CARRIERS OF SPACE PATTERNS AND CONSTRUCTION TYPES

German Migration and Architecture in Chile, 1850-1875

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Winter Semester Seminar 2009 at TU-Berlin
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

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Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
CARRIERS OF SPACE PATTERNS AND CONSTRUCTION TYPES
German Migration and Architecture in Chile, 1852-1875

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Seminar in Winter Semester 2009 at TU-Berlin
Revised as of October 9th, 2009

The Seminar will attempt the identification of the German influences in the architecture of the first German immigrants in Chile, as a contribution towards a comparative analysis of the building types and construction systems in Chile and in Germany by means of the definition of relevant elements in the influence and its evolution as they were implemented in Chile. This will be done by studying the architecture types in the immigrants’ regions of origin and destination, and the relevant materials and construction methods to be explored directly in the field and in manuals, maps and other documents, for the period corresponding to the emigration and settling in Chile.

Das Seminar beschäftigt sich mit der Entschlüsselung deutscher Bautradition in der Bauweise erster deutscher Einwanderer in Chile zwischen 1850 und 1890. In der Literaturrecherche als auch der Feldforschung wird sich das Seminar zunächst mit den ursprünglichen Heimatregionen der Einwanderer wie Hessen, Hamburg und Hannover beschäftigen als auch mit den ersten Orten der Einwanderung in Chile wie Osorno, Valdivia und Llanquihue. Durch ein parallel laufendes Seminar an der Partnerhochschule in Chile (Prof. Francisco Prado) angeboten, ist reger Austausch von Forschungsergebnissen zwischen beiden Ländern geplant.

1. TOPIC

Chile has been subjected to a series of economic and social influences at various stages of its history as an independent nation. These have had -of course- an influence on the country’s cultural life, and have consolidated to the point that today many of them are recognized as part of the country’s heritage.

Migration has been one of the vehicles for such influences: Spanish, Italian, German, English, French, among others immigrants, arrived in Chile for different reasons and at various times, and have left marks in the country’s history, which are still valued as distinctive contributions, integrated to the culture of the nation. The architecture associated with these influences is one of the most enduring legacies and bear special presence, as they are a tangible witness and available to the public on a daily basis. For all Chileans, the architecture of British immigrants in Valparaiso, the Germans in the South, the Americans in many mining camps, are clearly recognizable as valuable traces of the past.

At the same time, it is noteworthy that influences on Chilean architecture associated with migration are not confined to the early years of the Republic, but extend for many years and continue to be a mechanism to maintain culture up to date and connected with the current architectural trends in the international scene. In previous works we have studied this trend, especially for the case of German influence, at different times and with different scopes: In the first quarter of the twentieth century, the Freitag brothers, sons of immigrants from the South travelled from Chile to Germany to receive training at a time that while the Weimar Republic was a major forum for artistic renewal that developed in an interesting work on their return(1). In the last decade of the twentieth century, the ideas of efficient or sustainable buildings are beginning to be implemented in cases constructed of much interest(2).

In spite of the changes in a broader context, i.e. socio-economic, communications, technology and international trade, the presence of these practices seems to recall the origins of European immigration. This brings us to the oldest of the German influence in architecture in Chile that of the first immigrants arrived from the 1855 to 1874, in groups organized by the Government to populate the areas of Valdivia, Osorno, Los Lagos and Puerto Montt.

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The Architecture of the German Immigration

The early German colonization of southern Chile led to the construction of a vast architectural heritage, which Chileans recognize today as “German architecture.” Families stemming to areas like Hessen, Württemberg, Brandenburg, Hannover, Oberschlesien and Böhmen, emigrated to settle in the areas of Osorno, Valdivia and Llanquihue, carrying their culture and architecture with them. However, it is not really clear to what extent the Architecture of the German Colonization of southern Chile is actually influenced by the import of German architectural models, or how this influence took place.

The literature and original records about the history of the colonization is abundant from the social sciences point of view, and there is extensive documentation of built heritage as well. There is a tacit understanding in the research dealing with these issues that the houses built by the settlers correspond to what they knew before travelling to Chile. However, a specific relationship has not yet established to identify and understand this influence in depth, or to disprove it. A specific study of specific architectural elements to appraise the real influence of German Architecture remains to be done.

The question that this research attempts to answer is: what are the specific influences of German architecture in the architecture developed by German immigrants in southern Chile? Our preliminary answer is that such influences can be identified in three levels: the social (given the form of living and customs), the space patterns (identifiable space and uses associated to them) and the construction types (building methods, preferred materials, technical solutions). In this work we will focus on the last two, which have been less discussed in the existing research on the subject: the development of the issue specifically through the recognition and documentation of spatial patterns or types; and through the construction systems that recognize the continuities look beyond the design features of buildings, on construction solutions that characterize them.

Towards the end of the nineteenth century, other influences appear to be clear, the French for example, a general model at the time, and it is necessary to define very specifically the time in which to identify the German influences. Thus, the study has limited to the period between the 1852 to the 1875, the period in which immigrant groups arrived, promoted by the Chilean Government. The Seminar will focus on examining the architecture and spatial patterns of regional areas of origin of immigrants, and on the building systems and techniques for the period of immigration and building houses in Chile.

2. OBJECTIVES

The general objective of the project is to establish the influence of space patterns and construction systems brought by German immigrants in the architecture of the colonization of southern Chile.

The specific objectives of the Seminar are:

i. To establish the relevant cases in this influence as of regions or time periods,
ii. To document the cases and building systems in both Germany and Chile,
iii. To discuss the means by which this transferral process developed, based on the documentation retrieved and relevant references.

3. CONTENTS

The Seminar contents can be described under four main headings that will be specifically discussed during the semester, and are also to be a permanent reference along the work, namely:

Construction of Identities through Migration

Architectural Identity is heralded as a way of approaching architecture by emphasizing local, cultural specificities as a critical core for theory and design, as opposed to global uniformity. Even if peripheral (other than euro-north-american) cultures are seen as fitting best such approach, it has been mostly developed in western Europe, and few sound examples of such an architecture or criticism stem to the “situated knowledge” of the so-called underdeveloped world. The dialectic models of centre v/s peripheries, local v/s global, and persistence v/s change seem no to be enough to embrace the problematic complexity the idea of Architectural Identities conveys.

In discussing the north-south influence to support a dialogue between architecture and identity, Herrle uses the model of Packages and Carriers as articulated by Berger/Berger/Kellner, to support that “there are packages containing technologies, symbols and icons that have been produced in cultural contexts mostly from countries of the northern hemisphere” that will eventually be carried to other cultural contexts. In his discussion, Herrle emphasises media and global communci-tion, a rather abstract means of transferral. In response to this, we propose a more literal migration of influences; that, indi-viduals, academics or practicing architects are carriers of technological change and that packages of innovation built on their individual expertise, education, professional networks and influences, which are consequently spread by specialised and mass media, discussed in professional societies, promoted in the Universities, or developed by individual practitioners.

This idea is not unprecedented in Chile. During the first decades of independent life technical expertise was not locally available and needed to be imported. This took different forms: direct import of prefabricated buildings -affordable be-cause

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the transportation costs were reduced nearly to zero in freighters needing a dead load after being emptied in Europe of raw materials; contracting of architects and engineers, which were invited by the Government to promote innovation and reinforce -or construct- references for national values and identity in many fields; or study travels of talented young Chileans to acquire an international class education. Migration was a privileged medium conveying these influences.

German Migration and Architecture in Chile

Southern Chile, in the regions around Valdivia and Puerto Montt, is well known because of the big influence of the German immigration. The settlers began arriving consistently since the mid-19th century promoted by the government through designated agents, like Bernhard Philippi, and populated economically developed an area of difficult access due to its climate and geography. Technical and technological advances used by the settlers to fill the fields, raise livestock and develop industries are known through various publications and documents of the time. Along with this they had the mission to found and re-found cities that were formerly lost in the war of Arauco, many of them still under the sway of the Mapuche people. In occupying their new homeland, they built residential buildings, churches, schools, factories, stables, etc., with the material most available, timber.

Currently, we find examples of those constructions in many cities and towns of the area, in spite of time and general lack of conservation measures. Some of these buildings are currently designated as National Monuments; some have been simply studied, drawn and documented by research studies in schools of architecture. Traditional timber architecture is a legacy of German settlers, known to Chileans as “German” architecture. But an uncertainty persists: is it actually German architecture, imported to model and likeness, vernacular development or simply a mutation of the model for national lands?

Traditional German Architecture

Germany holds a wide historical record and multitude studies of houses in pre-industrial villages. Hundreds of publications, drawings, studies of building systems, evolution and influences in the traditional country houses, suggest that the traces of the architecture developed by the Germans in Chile, may still be followed can be found in the country of origin.

The text “Mauer- und Gewölbekonstruktionen in der Mark Brandenburg während des 18. und frühen 19. Jahrhunderts” (Walls and vaults in Brandenburg during the eighteenth and early nineteenth century), developed by Professor Udo Bode, is a clear example of the literature to be used for case studies and comparisons with the constructions developed by settlers in the south of our country. This text focuses on the technical-constructive aspects of the homes built during the eighteenth and nineteenth specifically in the region of Brandenburg (Berlin and its vicinity), Germany. The thesis makes a thorough historical review of construction for the characteristics developed over the centuries above which are precisely those that correspond temporarily influences German settlers might have brought to Chile. This opens the door to begin a study region by region according to the provenance of the settlers, which is registered in the documents collected by Emilio Held Winckler[4].

Technology in a Social and Cultural Context

The idea that technology and architecture belong to separate realms is relatively new. Starting the second half of the eighteenth century, according to Banham[5], Architecture is conceived as separate from building technology. The generalization of this concept has had enormous impact on the theory, criticism and practice of architecture. This separation is based on an explosive development of new technologies from the industrial revolution, which has resulted in a progressive techni-cal expertise and a complexity that requires new disciplines in the compartmentalization of fields that were previously under the eaves of Architecture, or simply did not exist. In this Seminar, technology is examined as a cultural arena, and the as-sumption of technology to be neutral or autonomous is questioned. We draw on the history of construction as a methodo-logical approach for a better understanding of technological development in a social and cultural context.

Technology is a prevailing feature in contemporary society, yet its role has been poorly located with a critical eye. However, a well settled, commonsensical notion of technology prevails, that of technology as equivalent to progress, driving society supported by and autonomous, natural development which univocally impacts on society. At the same time, Architecture is a discipline that -with the aim of providing shelter for men- notoriously articulates technologies and social context. Several of the properly technological aspects of architecture, under the influence of this simplified, deterministic tone are neglected in the professional practice and assumed not to have academic relevance and are thus often excluded from our critical agenda. Although the production process of Architecture has been traditionally considered as a parameter in the develop-opment of the architectural project, it has rarely been in the conceptual and critical core of the trade.

4. METHODOLOGY

The work will involve comprehensive and accurate documentation on the basis of literature review and field research in Germany, in the regions of Hessen, Württemberg, Brandenburg, Hannover, Oberschlesien and Böhmen, by the TU-Berlin Seminar; and in Osorno, Valdivia and Llanquihue, by the PUC Seminar.

[4] Emilio Held, Documentos sobre la colonización del sur de Chile: de la colección histórica de Emilio Held: bosquejo histórico: nómina de barcos y personas que llegaron entre los años 1840 -1875 [Santiago de Chile: Claus von Plate, 1965].
The work will be organized along two parallel lines: Case Study work and Reading / Writing Work. The assignments of both lines will alternate, as to have specific topics under discussion in the Seminar at any given point of the Case Study work. Thus, the critical positions developed by reading the literature of the semester should substantially feed the Case Study.

Consequently, students are expected to:

i. Read and write a substantive summary on the topics assigned,
ii. Research, elaborate and present relevant, original documentation based on both relevant sources and field research,
iii. Take an analytical position about the material compiled, and discuss in a documented manner their relevance to the topics of the semester.

Specific work includes:

**Readings, Writings and Discussions**

Reading of assigned articles and writing of a Brief Reading Report (ca. 150 words) to be discussed in Class and completed by individual readings outside the list. These need to be properly referenced and/or quoted. Reading Reports need to be submitted to dalencon@daad-alumni.de the night before deadline, by 12:00 PM the latest.

**Case Studies**

The work will involve comprehensive and accurate documentation on the basis of literature review, archive work and field research. The teams will research on the relevant materials and construction methods in each case, by field documentation and literature research in manuals, maps and other documents of the time.

The case study work will involve the following activities:

**Basic Bibliographic Documentation:** Sources are Libraries, Archives, Site Museums, both in Chile and Germany, such as the Emilio Held Archive maintained by the Liga Chileno-Alemana de Santiago, the Library of Iberoamericansches Institut in Berlin, etc.

**Comprehensive documentation based on field surveys:** The field works involves rigorous plan documentation of the cases at scales of 1:50, to 1:5, sketches, photographs, etc., and specific description of the construction system and building materials employed in the cases considered the most relevant typologies of the regions being studied.

**Analysis of the types and construction methods found to be significant:** Both through newly elaborated documents and those obtained from field and library research in manuals, maps and other documents of the time.

**Final Report**

The final Report (70% drawn, 30% written ca. 2000 words) should condensate the work and take a position in the relevance of the case for the topics examined along the semester, based on specific cases of study work and analyses. It will be first presented as a proposal and discussed in two preliminary appointments upon request and finally presented and submitted for evaluation.

**Research Context**

The seminars are simultaneously conducted by the Faculty team, with the financial aid of DAAD, through the existing cooperation agreement between TUB and PUC. The resources of the research will be available for the Seminar: Material and travel funding, access to archive and specific sources, communication tools (blog, webpage) and database.

The following scheme summarizes the stages of work of all three initiatives and their coordination:
Products
The expected results of the work of the semester are:
Brief written report discussing the existing sources (archives, books, magazines) on specific research topics to be distributed among the students.

General and specific architectural surveys of selected cases, as well as the solutions implemented in each, including Description and Data Sheets, summarizing typological characteristics of each, and a photographic survey of each of the cases and specific relevant elements.
Final report encompassing both the bibliographic discussion and the information collected and elaborated in the surveys.

5. REQUIREMENTS
- 4 Reading Reports (10%)
- Documentation Brochure of Study Cases (A3, Presentation 1, 20%)
- Analysis Brochure of Study Cases and References (A3, Presentation 2 30%)
- Final report (70% drawn, 30% written ca. 2000 words) and PPT Presentation (Final Presentation, 40%)
- Compilation P1, P2, P2 and FP to be delivered ex-post on PDF format in order to receive your grade certificate

6. REGISTRATION
There is two kinds of registration to attend the course: 1) as regular Architecture Diploma and Master Course of Study (including exchange students); and 2) Urban Design Master Students. All should register according to their program requirements. All students should confirm their attendance to the Seminar by submitting the Reading Report 1 by Monday, October 20th, the latest. With this submission, you agree the conditions in this Syllabus and will be officially enrolled and registered by the University administration.

The submission of this first Assignment will also serve the purpose of discriminating the students to be admitted, should there be more than 15 Reading Reports submitted. Preference will be given to students who signed up the list on due time. In addition, five places are reserved for Urban Design Master Students, and five for regular TU-Berlin Master – Diploma students.

7. SCHEDULE

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11. New Year’s Holiday

Reading Assignment 3.
Final Report Proposal 1st Appointment

13. RA Review
Field Trip to Hessen and Hamburg
Meeting with Chilean counterparts and specific local case study
Final Report Proposal 2nd Appointment

14. Field Trip return. Organization of documentation synthesis

15. Research Assignment Presentation [P3], Documentation Brochure of Study Cases [A1].


17. Independent Work. Individual discussion upon request

18. Final Presentation (FP)

8. BIBLIOGRAPHY

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**“German” Architecture in southern Chile**


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**Writing and Research Methods in Architecture**


Building Identities through Renovation
Learning from the case of Ruprechtice 185

Ding Chengjie
Berlin University of Technology, Berlin, Germany

ABSTRACT: Timber house is one important building typology in Germany. But it needs renovation regularly due to deteriorating conditions of the house. The question is how the renovation contributes to or damages the identity of old timber houses? Through studying the case of Reprechtice 185 in three dimensions: plan, façade, and section, I have found renovation and identities have relevance and interact with each other, but in a complicated way, and are often combined with people’s lifestyles.

KEYWORDS: Folk German residence, Renovation, Identity, Timer house

1. GENERAL INTRODUCTION
Timber building, with its warm and natural, easy processing and expressive, is widely used in residential construction and development. In Germany, timber house is one of the most important buildings during the 19th century, and it has many different constructions and typologies. As is indicated in the picture below, the timber houses are very wide-spread and common throughout Germany and its peripheries. It’s located not only in cities, but in villages as well. In our fieldtrip and case study, we study the timber house in Bohemia (now in Czech Republic), which is located south-east of Germany. When we look deep into the research, we concentrate on the massive-timber houses.

Fig 1.1: Ausbreitung der Holzbauskunst in Europa, Phleps, Hermann, 1942. Holzbauskunst, der Blockbau
2. ARCHITECTURE AND IDENTITY

The essential purpose of architecture is defined accordingly:
“The basic act of architecture is therefore to understand the ‘vocation’ of the place. In this way we protect the earth and become ourselves part of a comprehensive totality. What is advocated here is not some kind of environmental determinism. We only recognize that man is an integral part of the environment, and that it can only lead to human alienation and environmental disruption if he forgets that. To belong to a place means to have an existential foothold, in a concrete everyday sense”. (Norberg- Schult, C. 1980, Genius Loci, Rizzoli p.23)

The function and purpose of architecture mean that it is the combined result of the local geography, tradition, culture and technology, etc. And it is different from political and ideological aspects in that it is more real and virtual, which reflects the real meaning of function and applicability. In other words, it provides the basic background information of the particular area, which more or less can explain the identity of the place.

And styles of architecture tend to be conceived ad either the result of cultural and social ‘forces’, or else ad something which is applied to architecture. Alternatively, architectural style may be looked at as a distinctive structure of human action (M. Herzfeld and M. Lenhart; 1980). As a matter of fact, sometimes architecture functions as way of being, just as science, art, and other major culture-forms are ways of being.

As for the case of Reprechtcie 185, it is a typical traditional residential building dating back to 1852. It is a perfect model to embody the local building typologies, people’s way of living, local materials and technologies, etc.

3. CASE OF REPRECHTICE 185

3.1 Bohemia

Bohemia is located in central Europe. Geographically it is embraced by mountains: the Boemenwald in the south-west, the Erzgebirge in the West and the Sudeten/Riesengebirge in the North, Bohemia shared borders with Germany in the East, Silesia in the North, Moravia in the west and Austria in the South.

![Bohemia Diagram](http://de.academic.ru/dic.nsf/dewiki/1415956)

3.2 Climate

I use the data of Klidosko to describe that of Reprechtcie, as they are of similar condition and I don’t find that of Reprechtcie. We can see from the diagram that the weather is too cold and humid in that area, which makes it really uncomfortable. And therefore timber becomes the ideal material to build houses due to its accessibility and natural characteristics.
3.3 Ruprechtice 185

Ruprechtice (Ruppersdorf) is located in the north-east of Bohemia (Czech Republic), which is 8 km north-west of Bromov. The house of Ruprechtice 185 located at the north edge of the village, which is surrounded by a range of farmland and forest. It is a two-floor building with a typical “Umgebinde” in front, which was first built in 1852 with half timber and half stone. In the following years, it had been renovated several times and still been kept in good condition. It was originally owned by a German family in the 19th century. After the owner went to Chile, M. Srailova bought the house and has been living in it from then on.

4. RENOVATION OF THE HOUSE AND ITS IDENTITY

Local vernacular buildings represent some of the identities of the place. But local identity and tradition are not shaped solely by form and space, time defines it as well. As a matter of fact, identity changes and evolves as time goes by, in the way of renovation. And renovation affects the identities of architecture in a range of ways:

Firstly, some parts of buildings need to be replaced due to deterioration throughout the time. These ‘new’ parts can partially change the outlook or even the whole system of building, depending on the extent of substitution. And the contrast between the new and old has the potential to produce ‘new’ ideas and also identities. It has even become a popular method of design strategies, not only in the area of building renovation, but in other species of design as well.

Secondly, new material and technologies are continuing applied to the old buildings to make the buildings more stable and beautiful, which may not be local any more due to globalization. And sometimes they really affect the building in a number of ways such as design and usage. But normally the material and technologies are progressed from the original ones and has the characteristic of continuity.

Finally, new facilities and equipment are used to accommodate the modern and comfortable lifestyle. Accordingly, people’s lifestyle has changed a lot, even if it is in remote areas. Take Ruprechtice as an example, almost every family used to raise animals, and usually indoors; but now nobody is willing to do that anymore because it is not so profitable and necessary as before. Most villagers used to be farmers, not nowadays many of them are normal workers.

As for the case of Ruprechtice 185, it has been renovated several times throughout the years, which is very interesting to its identities because of the changes. The materials are relatively new, some new and more reliable technologies are applied to the house, and new facilities and equipment are used to make the room more livable and comfortable. In the following section, I will discuss deep into the building identities in three dimensions: plan, façade and section, and its influence on people as well, in order to the influence and relationship between renovation and identities.
4.1 Plan

The plan of the house changed since the usage is changed, some rooms are transformed and some additions are made to it. The identity of the building will be changed or improved a little during the process.

4.1.1 Functional adaption

Firstly, the original stables are transformed, since there is nobody raising animals indoors anymore. This is a significant change during the process, which makes the indoor space more human-oriented and comfortable. There is no disgusting smell, indoor space becomes bigger, and the life becomes more comfortable.

Then, the functions of some rooms are changed. The cattle’s room, for example, is transformed into a chamber. And the kitchen is extended by the owner, too. Furthermore, the Toilet and bathroom in former Stables is renovated.

4.1.2 Addition

The owner did some additions to the house in 1970s after she bought it. The kitchen and the chamber at the left back of the house were additions done by the original German owner, and the store room and the garage were added by the M. Straiatrova, the current owner.
4.2 Façade

The façade always deteriorates as the materials become old, sometimes the degeneration of materials could endanger the safety of the structure and that’s why the façade needs renovation. In the case of Ruprechtice 185, the condition is comparatively good. The structure is mainly original and most of the façade materials are kept the same.

4.2.1 Roof-covering

The original roof-covering is some kind of straw, as we can see from the Figure 3.1. But straw is not a durable and reliable material. As time flows, it will become softer and sheds away, sometimes it leave space for soaking and drainage. So the roof-covering was replaced by tiles in grid during 1852 and 1945. What’s more, the original joint of straw was made by wood and iron wire, which is not stable and reliable. The new joints which are made of by new water-proof materials and technology can greatly reduce the risk of drainage.

After the renovation and replacement of the roof-covering with tiles, it looks more stable and beautiful, and functions better. And we can see the outlook of the house doesn’t change a lot even though the whole roof-coverings have been changed, which created an ‘identity’ of continuity.

So as far as I’m concerned, it is very necessary and successful to do the replacement of roof-covering, as it not only promotes the function of the house, but it follows the original context of the house and makes the identity of the house more stable and reliable.

4.2.2 Face-covering

The face-covering is also an important part of buildings that needs renovation or replacement regularly, especially for such old buildings. In the case of Ruprechtice 185, the original face-covering material maybe clay or something like that, as we can guess from the Figure 3.1.

Today the face-covering is reprinted again, which makes the building looks more tide and durable.

4.3. Section

The adoption of section is really very minor, as it will not affect the structure system of the house. Actually the owner only moves one beam, from the living room to the roof. In doing so they can achieve two goals: one is to obtain higher space in the living room; the other is to reuse the beam to undertake such structural functions as weight and side thrust of the building.

5. CONCLUSION

After looking carefully at the question of whether or not renovations affect the identities of historic rural German buildings, I have found that they have relevance and interact with each other. But the relationship between them is not necessarily the same. Sometimes the process of renovation helps to maintain the building identities; sometimes the identities just change and disappear; sometimes the old identities shed away and the new identities emerge throughout, which is a process of evolution of building identities.

And the process of renovation is often combined with the change of people’s lifestyle and habits. Basically it has transformed from the rural farming custom to more modern and comfortable lifestyle.
Apart from that, there are still some interesting aspects that deserve attention.

**What's the role of vernacular aspects in terms of identity?**

Vernacular aspects are the combined results of the local geography, tradition, culture and technology, etc. It is different from political and ideological aspects in that it is more real and virtual, which reflects the real meaning of function and applicability. In this sense, vernacular plays a fundamental role in the field of identity. In other words, it provides the basic background information of the particular area, which more or less can explain the identity of the place.

**Is time a crucial criterion in the process of identity making?**

Time plays an important role in history and tradition of a particular place or area. Prompted by the historical perspective, tradition found its way to development and evolution.

On the one hand, the increasing awareness of history as being a philosophical category and, on the other hand, a rationalization of thinking on a scientific basis inevitably led to the development of a progressive perspective and a taxonomical approach. Comprehensive classification and historical narrative opened the path in architecture to the creation of various forms of buildings. (Hentle, Peter : 2008)

Apart from that, time can test the reason of being and improve it, and renovation is the process to supplement adaption to the original situation, in which the real identity may emerge.

**What's the relationship between space and identity?**

Tradition is not shaped solely by time, space defines it as well. In fact, tradition is the conjunction between time and space. After taming (more or less) time, the construction of identity tended to assimilate space too. Together, time and space appeared to better embody a community than when taken separately. The interest in space developed, and the various expression of vernacular, whether language, crafts, or architecture, seemed rather to be conditioned by geography. (Hentle, Peter : 2008)

In a word, space constructs part of the identity, and identity influence the making of space, in a various way. In the process of renovation, “new” spaces are created, which helps to construct some “new” identities.

6. REFERENCES


Tradition and Regulation. The impact of fire and forest regulations on the nineteenth century bohemian country house

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ABSTRACT: In the beginning of the nineteenth century timber was the predominant construction material in Northern Bohemia. The rural mountainous region was determined by a cold climate and agricultural society. During the middle of the eighteenth century industrialization increased and the Austro-Hungarian administration began to introduce regulations to the rural areas. “Traditional” building styles were put into question by building codes, fire and forest regulations. The laws sought to increase fireproof constructions and to reduce the use of timber and straw, which were at that time the common and most available materials. This work elaborates impacts of those regulations which can be de-terminated in build examples in northern Bohemia. Although between 1750 and 1875 e.g. fire and forest regulations were repeatedly released with an emphasis on fireproof materials, country houses remained to be build in timber. Without a main turn of material and typology, still there are constructional details, which can be referred to the regulation, like adaption of stone chimneys, a certain distance between buildings, or the reduction of timber elements.

KEYWORDS: Bohemia, Timber, Country-house, Fire regulation, Forest regulation

1. INTRODUCTION

Between 1871 and 1875 around 450 Germans emigrated from the area of Broumov (Braunau) in Northern Bohemia to the south of Chile. The catholic farmer and craft families settled around Lake Llanquihue and a part of them founded the village Nueva Braunau.

The build environment they knew from Bohemia has developed over centuries and was shaped by various factors like climate, tradition, material availability, user needs, economy and regulations. In the eighteenth and nineteenth century this built environment was challenged and changed through industrialization processes and new regulations, introduced by the austro-hungarian monarchial administration.

Gruner states 1893 in Beiträge zur Erforschung völkstümlicher Bauweise im Königreich Sachsen und in Nord-Böhmen that “folk architecture” (volkstümliche Bauweise) is the appropriate architectural and constructional answer to the needs and habits of a society, the local climate and available material. It is the appropriate answer in a certain time and space without an import of styles from different times or spaces. Referring to this thesis, the introduction of regulations must evoke a new constructional answer, which would become a common construction type or element. The settlers took packages of construction knowledge overseas and introduced them in a new context.

Which were the impacts of fire and forest regulation in these packages?
2. BIBLIOGRAPHY DISCUSSION

After a general research on typology and construction types of the Bohemian country house, two representative cases of study were identified. They were first hand documented in addition to secondary sources. In order to elaborate influences, regulations concerning buildings for the countryside were researched through archives and libraries. The time frame is 1750 to 1875. Therfor the Fire Regulations of 1755, 1782 and 1785, the forest regulation of 1753 and 1754 and the building codes of 1816 and 1864 were investigated. The impacts of fire insurances, which were introduced about the same time and had an effect on the costs of timber constructions are not considered.

3. CARRIERS OF SPACE PATTERNS / BOHEMIA

The group from Broumov (Braunau) appears to be a quite homogenous group. All 456 people left within the same time (1871–1874) from the same place. As indicated in Fig.2, the emigrants originated from the following villages in the area of Broumov:

- Bozanov (Barzdorf, Batsdorf, Batzdorf)
- Broumov (Braunau)
- Hejtmánkove (Hauptmannsdorf)
- Hermankovice (Hermsdorf)
- Jetrichov (Dittersbach)
- Knice (Wiekersdorf)
- Martinkovice (Maerzdorf/Merzdorf)
- Otovice (Ottendorf)
- Rozmital (Rosenfeld/Rosenthal)
- Ruprechtice (Ruppersdorf/Rupersdorf)
- Šonov (Schoenau)
- Birkicht, Deschkadof, Gruenborn, Wiesen, Oedendorf, Lechau, Hynice (Heinzendorf)
- Grunwald, Kladern, Schoemberg, Velkoves u Broumová (Grossdorf)

They were farmers, bricklayers, carpenters, blacksmiths, cobbler and so forth.

Armin Opitz writes that 23 out of the hundred families from Broumov founded Nueva Braunau and describes the amount of land, tools and material they received by the Chilean government (www.opitzarmin.de).

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Figure 1: Influences on Bohemian country house typology; (Author 2009)

Fig.2: Origins (left, Author 2009) and Chilean settlements Lake Llanquihue of bohemian emigrants (right, A.Opitz)
4. CLIMATE AND TYPOLOGY IN NORTHERN BOHEMIA

Bohemia is located in central Europe (Fig.3) and surrounded by mountains with the Giant Mountains (Sudenten/Riesengebirge) to the North. The climate is a temperate climate, with precipitation during the whole year. In winter the mountainous areas experiences snow and cold wet winds from the south. Average Temperatures range between -1°C in the coldest months (December, February) and 16°C in the hottest months (July, August) according to current climate data of Klodzko (Glatz) by the US Departement of Energy.

In the preindustrial eighteenth century buildings in the countryside were predominantly constructed by timber. The country houses were mainly massive timber constructions or in combination with sand stone. The systematic of construction in Fig.4 distinguishes simple massive construction and combined massive/framework construction (Umgebinde). Single country houses situated on high altitudes in the Giant Mountains outside a village context are “Bauden”.

![Figure 3: Bohemia with German areas (dark grey), Austro-Hungarian Empire (grey), German Empire, Location of Cases of Study (Author 2009)](image)

![Figure 4: Systematic construction types (Author 2010)](image)

The general plan layout was a three zonal so-called Wohnstallhaus. The house has a central eaves-sided entrance with a residential and stable part on either side. The building vary in details like number of rooms, usage as stable, barn or similar. An important architectural element of northern Bohemia and Silesia are the Lauben (alcove) of different kinds, which extended residential or storage spaces and protected entrances, gables or walls. Like gables they were often places of decoration.

5. NEW REGULATIONS IN A TRADITIONAL LANDSCAPE

Until 1914 Bohemia was part of the austro-hungarian empire with wide areas mainly inhabited by Germans (Fig.3). Sommer describes 1836 in Das Königreich Böhmen; statistisch-topographisch dargestellt how the area of Broumov (Braunauer Land) was – until the industrialization in the eighteenth century – determined by farmers and craft. Broumov with it’s monastery was the administrative and economic centre of the region.

The first regulations concerning building construction for the countryside of Bohemia were introduced in the middle of the eighteenth century.

At the same time the industrialization with mining, glass and fabric production started to alter the economic and labour system of the region. The availability of construction material shifted. Next to timber and sandstone, bricks (even if expensive) or adobe started to be used for walls and roof covering. The massive usage and export of timber for industry, construction or as heating material led to decimated forests.

Forest regulation were introduced and sought to reduce timber as a material of construction. Fire regulations imposed certain construction styles and rules on urban layout, whereas building codes gave regulations among others on building styles and construction from the point of e.g... material availability and tradition.
6. CASES OF STUDY

Two cases of study are representatives of the type Wohnstallhäuser within a village context. The first was constructed after the introduction of the first regulations for the countryside. The second was constructed twenty years before the first families emigrated to Chile. Which changes of the typology can be identified? Do they show any impact in the build elements, which can be connected to the regulations? Are there developments of the typos.

Case 1 (Salduv Farm, in Jilemnice (Starkenbach)) is massive timber house with a additional stone stable. It was constructed before 1732, possibly destroyed by a fire in 1788 and reconstucted in 1790s. In 1997 the building was renovated and relocated to the adjacent plot. The building is analysed based on the material of 1997, shown in Fig.5.

![Figure 5: Salduv Farm: Site (left), Plan (middle), Picture (right); (Sucharda 1997)](image)

Case 2 (Ruprechtice 185) was constructed in 1852 – see Fig.6. Reliable Photos and plans are available after 1977, when the building was renovated and documented by the current owner. The ground floor was a combination of sandstone and timber walls, which were replaced by bricks in the 1970s.

![Figure 6: Ruprechtice 185: Picture (left); Author 2009), Plan (middle) and Facade (right); (Ding 2009)](image)

7. IMPACTS OF FIRE AND FOREST REGULATIONS ON THE BOHEMIAN COUNTRY HOUSE FROM 1750 TO 1875

The considered fire and forest regulations issue different architectural elements, which are compared with the two cases of study. These are distance rule, the construction of chimneys, the material for roof covering and the use of timber as a material for construction.

Distance rules

The distance between buildings is addressed in the fire regulations of 1755 (Kayserl. Königl. Patent, Die Feuer–Lösch–Ordnung Auf Dem Land Betreffend) by Empress Maria Theresia and 1782 (Feuerordnung für das Land) by Emperor Joseph II (Fig.7). They order a detached roofs and a minimum distance of 178com (Klaf ter) between buildings.

In Jilemnice, the street „Zvedava Ullica „, was reconstructed after the fire in 1788. The distance rule of 178cm between building was respected, except on four points – see Fig. 8.

Ruprechtice is a typical Waldhufendorf, which developed along the local river and street. Connected to the land layout every farm stands alone and in distance to the next one. The plan shows that the majority of farms realized a distance between buildings, but a also several did not.

Based on the given material, it remains unclear, how much these village layouts were actually determined by the regulations or other factors like plot layouts.
Fireplace and Chimney

The most central issue in fire regulation, which both cases of studies adapted, is the stone chimney. In 1755, 1782 and 1782 several paragraphs address the necessity of stone chimneys and imposed the need to keep flammable material away – see Fig.9–11.

Open and unprotected fire places seem to be the main reasons of fires and the destruction of early timber buildings, and were therefor repeatedly issued. What strikes is the mentioning of timber chimneys, which shall not be used anymore, but could not be found in any documentation of timber buildings in Bohemia.

Loewe documents in Schlesische Holzbauten two timber buildings from the sixteenth century, with the chimney and fire place already in stone. The publication Volksarchitektur des Riesengebirges describes the general adaption of the fire place from an open fireplace (Schwarze Küche) in the hallway (Diele) towards a smaller cooking oven inside the residential room (Stube).

Figure 7: Distance rules in fire regulation 1755 (left) and 1782 (right); (M.Theresia 1755, Joseph II. 1782)

Figure 8: Chimneys and fire places in fire regulation (Joseph II 1782)

Figure 9: Chimneys in fire regulation (M.Theresia 1755)

Figure 10: Chimneys and fire places in fire regulation (Joseph II 1782)
Die Rauchfänge sind von Ziegeln, oder Steinen zu bauen. Die Dachhäuser haben sich die Feuerlöscherquartier, und die Kriegsminister auf ihren Dachern darauf zu sehen, ob es befeftigt wird —

Figure 11: Chimneys and fire places in fire regulation (Joseph II 1785)

In Salduv Farm the two chimneys in the center of the house are made of stone, although all the residential walls are completely made of timber. They appear to be out of place, and the questions rises, if they were already constructed in the eighteenth century, or if they were added in a later phase. This appears to be an adaption due to fire experiences and regulations. In comparison the chimney of Ruprechtice Nr.185 was already constructed with a closed fire place. The chimney is integrated in the massive sandstone wall of the hall. Within sixty years the chimney and fireplace are adapted and introduced to the building.

Figure 12: Chimneys and fire places in Cases of study. (left, JAK 1997), Ruprechtice (right, Author 2009)

Roof covering

Loewe in Schlesische Holzbauten and Carstensen in Die Holzschindel identify straw and timber as the predominant bohemian roof covering in the nineteenth century in northern Bohemia and Silesia. The fire regulations of 1782 and 1785 issue the cover material of roofs – see Fig.13. They are advising, if straw and timber can not be avoided, to construct increased fire proof.

The regulations indicated, but do not openly forbid thatched or shingle covered roofs. This is reflected in the cases of study. According to pictures and descriptions of Jilemnice in the end of the 19th century, buildings in Zvedava Ulicka including Salduv Farm were covered with shingles. Case 2 was – according to a drawing from 1923 the building– covered by the local traditional combination of straw and shingles – see Fig.14.

Shingles were the central material in northern Bohemia to cover roofs and walls, to protect from rain and decorate the country house. Above that they were available and cheapest until the end of the nineteenth century. Carstensen describes in detail the tradition, construction and advantages of shingles in the cold climate of Bohemia.

Figure 13: Roof covering in fire regulation 1782 (left) and 1785 (right); (Joseph II 1782 &1785)
The general use of timber – timber dissipation

The massive usage and export of timber for industry, construction or as heating material opened a German wide discourse on the dissipation on timber. The local forests were rapidly exploited. Throughout the German and Austrian territories officials, technicians and academics raised this issue as Radkau describes in Holzverknappung und Krisenbewustsein im 18. Jahrhundert.

This development led to the introduction of forest regulation. The central point was a protection of the status quo and the necessary Re-cultivation of the erased forests, with the effect that spruce became the prevalent tree in the region. The traditional construction in timber was put into question:

The forest regulation of 1753 says, that country houses shall be constructed with stone, and 1754 that building shall not be completely constructed in timber – see Fig.15. The Gubernialverordnung of 1816 dictates the requirement of permission through the local authorities for new timber constructions or the renovation of timber constructions.

These regulation show small reflection in the built environment. Salduv Farm was fully timber with an added stone stable. Ruprechtice 185 is a combination of sandstone and timber. This is striking, as Sommer describes the local availability of bricks and stones in the region. The reasons for such a fairly slight changes in use of material are probably various. Tradition, climate-adapted constructions, material attributes like the low thermal conductivity or frost resistance, local availability or costs influence the applied material.

8. CONCLUSION

The regulations for the bohemian countryside were written with the experience of cities or other regions. The prevailing construction types and methods in northern Bohemia were developed over centuries. Therefor regulations did not lead to a major shift in the typology or material, but rather details and elements were integrated. Elements which fitted within the typology, material availability and the construction knowledge.

Apart from timber as “region responsive” material, probably economic reasons prevented a major change concerning the usage of material.

An impact of regulations on the Bohemian country house can be determined with the adaption from the open fire to a closed fire place, the integration of stone chimneys and the realisation of distance rules in a village context.
The settlers from Broumov left Bohemia at a time, when industrialisation and regulations for the countryside were introduced for around one hundred years. They left with knowledge of fire regulations, building codes and the limit of resources. Probably less as a knowledge of regulations, but rather as part of their tradition of construction.

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JAK Projektni Atelier, www.jak-cz.cz


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Climate and Material Effects on Space Patterns
Analysis on 4 case studies in Broumov region

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ABSTRACT: The houses in Broumov region experienced several renovations during periods of time. Timber was limited from 1753 to be used in the whole house so that the houses in Broumov region were mostly constructed in timber, stone and brick. However, there are few literatures of how people use different materials or why these materials are chosen. The aim of this paper is to analyze how climate and materials affect space.

KEY WORDS: Climate, Material, Combination, Space

1. BACKGROUND INFORMATION

1.1 Location
Broumov is a town in the Czech Republic, in the Náchod District of the Hradec Králové Region near the Polish border. The municipality at the small St. nava River is the centre of the Broumovsko area, together with the adjacent Adršpach-Teplice Rocks a protected area popular with mountaineers.

1.2 History of Broumov
The town was established in 1236 by the Benedictine abbey of B. evnov in Prague, to which King Ottokar I of Bohemia had granted the area. The settlement arose around a former provostry and became a principal site of textile manufacture. After a fire in 1306 it was largely rebuilt, including the monastery and city walls finished in 1380. The medieval church of Panne Marie (the Virgin Mary), however, survived the fire, and is the oldest extant wooden church in the Czech Republic, dating back to the 12th century; the building is still in use. Pursuant to the Beneš decrees, the German-speaking population was expelled, including the abbey’s monks, who reestablished the Braunau in Rohr Abbey in Bavaria.

1.3 Different materials used in Broumov
Timber is the most common material in Broumov. Oak was used in the early times, while conifer is the most common species of timber used now. The most widely used tree species in Czech Republic is spruce, then fir, pine and larch. The reason that tree species was changed is that usually it takes 150 years for oak to grow while it only takes 80 years for conifer. Meanwhile, oak grows in plain. As a mountainous area, stone is also the basic material for foundations and walls.
2. CLIMATE EFFECTS AND EVALUATIONS

2.1 Climate in Broumov

The local climate is temperate with warm summers and cold, cloudy, humid winters, typified by a mixture of maritime and continental influences. It is mildly temperate but mostly very wet or wet. Average annual air temperature of this area ranges between 6 and 7 °C, average annual sum of precipitation is from 700 to 900 mm. The comfortable time in a year is only 386 hours.

Fig. 1: Differently classified forest area in Czech Republic as percentage of the national forest area (values given in % of the national forest area) Source: Köble, R and Seufert, G: Novel Maps for Forest Tree Species in Europe http://www.iiasa.ac.at/Research/FOR/downloads/europe/tree_species_maps.pdf Tree Species in Europe

Fig. 2: psychrometric chart; Source: Climate Consultant
2.2 Special features

Because there is no available detail data of climate in Broumov, the author takes the data of Kłodsko in Poland, which is in the similar geographical position (Broumov: latitude 50.35oN, longitude 16.19oE, elevation 395m; Kłodsko: latitude 50.43oN, longitude 16.65oE, elevation 375m), for special features study. From the wind wheel, we can find that the wind speed is 13m/s, which is the maximum value in a year, from south side. Southwest and northeast are the warmest orientations in Broumov. South has the longest daylight time in winter, while west has it in summer. Therefore, there is a contradiction that people should prevent the fast wind in south, in meanwhile, let the daylight come into rooms from south.

![Wind Wheel Diagrams](image)

Fig. 3: wind wheel in a year
Source: Climate Consultant

Fig 4: wind wheel in Feb.

Fig 5: wind wheel in July

Diagram form

2.3 Analysis and evaluation of three cases

![Floor Plans](image)

NIEDER SCHWEDEL DORF
Source: Loewe, L: Schlesische Holzbauten
Fig. 6: Analysis of space, drawn by the author

OBERT KLEIN AUPA
Source: Loewe, L: Schlesische Holzbauten

RUPRECHTICE No.185
Source: author

Through the analysis above, we can find that living rooms locate in the south part of the houses, while storages in the north part. According to the climate features, living rooms are exposed to the fast wind in winter, though people can enjoy more daylight in living rooms.
3. MATERIAL EFFECTS ON SPACE

3.1 Traditional houses in Broumov

A special architectonic feature of the Broumov region is the classicist yard farmstead. The village classicist house was created under the influence of classicist construction and reconstruction of the town of Broumov. In the country, this type of house was constructed as early as the 1820s, but especially in 1850 - 1870. The dominant of Ruprechtice is the Baroque church of St. Jacob Longer, built in year 1721 by the project of K. I. Dienzenhofer in timber.

3.2 Hierarchy of material use

According to the construction regulation in 1753 and timber-forest regulation in 1754, buildings in the countryside shall not be completely constructed by timber. So that the most parts of the walls in first floor are made by stones. However, people were still used to build houses in timber, so that they had to choose the part. In these three cases, timber was used in living rooms and bedrooms, which are the most important spaces. If there was only one place used timber, it would be living room.

After the change of construction regulation, the adaption and the renovation are mostly constructed by timber.
There was also hierarchy in facade. Timber was mostly used in main gable, which facing the road, and was most decorated.

In Braumov region, decorations of facades do not distinguish between residential and farm buildings. Details are created in stuccoes, and they complete the basic segmentation of facades, defined by vertical bands, mouldings, blind arcades, and pilasters. On the gables oriented towards the road, there are plaques commemorating the establishing of the farmstead, stone relief works depicting saints, and niche statues of popular saints. Classicist pilasters in the gable are usually ended by heads.

The upper floor is mostly used as storage. The original ostensible material of upper floor was straw, because people didn’t often use it. Now that brick is used.
4. CONCLUSION

<table>
<thead>
<tr>
<th>Cases</th>
<th>Orientation of main space</th>
<th>Timber used in first floor plan</th>
<th>Timber used in facade</th>
<th>Timber used in floor and ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIEDER SCHWEDELDRF</td>
<td>Face southwest</td>
<td>In living room and bedroom</td>
<td>In main gable which was mostly decorated</td>
<td>Unknown</td>
</tr>
<tr>
<td>OBER KLEIN AUPA</td>
<td>Face southwest</td>
<td>In living room and storage</td>
<td>Mostly in gable</td>
<td>In floor and ceiling in living room and bedrooms</td>
</tr>
<tr>
<td>RUPECHTICE No.185</td>
<td>Face south</td>
<td>Only in living room</td>
<td>In main gable which was mostly decorated, while less in main facade</td>
<td>In floor and ceiling in living room and bedrooms, not in storage or kitchen</td>
</tr>
</tbody>
</table>
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

... 
Naturbaustoff Lehm, moderne Lehmbautechnik in der Praxis ; Bauen und Sanieren mit Naturmaterialien, Aarau, AT-Verl.

From Fig. 12, we can conclude that the main spaces, which could be living rooms or bedrooms, mostly face south. According to the wind wheel, the direction of longest time of sunshine is south, so the main spaces provide a relatively warmer place for people to live in such a humid and cold climate. However, compared to other directions, the speed of the wind from south is the fattest. In addition, the high relative humidity makes the living condition even worse in winter.

Timber was still used in these four cases, even that was limited by the regulation in that period of time. Under that situation, timber was chosen to be used in the most important parts. Timber, as in plans, was used in living rooms in all the four cases. If there was only one space which could be built by timber, it would be the living room, which was proved by the case in RUPRECHTICE No.185. In facades, timber was chosen to be used in the main gable, which was facing the direction that people entered the village, rather than the main facade with the main entrance. From the author’s point of view, that is because timber was used in the living room, which always located in the side part of a house.

From the analysis of these four cases, we can conclude that the space pattern of timber house in Broumov region in 19th century has been affected by the climate and material, however, tradition contributes more to the space pattern of those areas in that period of time.

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The role of the fireplace in the „Hamburger Hallenhaus“ - it’s evolution and changes during the centuries

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1. INTRODUCTION

The „Hamburger Hallenhaus“ was constructed in the northern part of Germany, specially around Hamburg since the 15. Century until the beginning of the 20. Century. The inhabitants that lived in this building were almost always farmers or people who worked in other agrarian sectors like fishing or something else. At the beginning the „Hamburger Hallenhaus“ was organized like a „one room building“, which means that the typology of the building was one big multifunctional area, where all the different activities of the inhabitants happened.

In the middle of this area was the fireplace. The fireplace connected the working and storage area with the living area and formed so the most important place in the house, the „Flett“. The function of the „Flett“ with the fireplace was it to give the inhabitants a place to cooke, eat, heat and light. This was also the place where the social life and festivals happened and had so a representative task.

The role of the fireplace changed with the time. Changes in the society, changes in the pattern of family life, new fire regulations and later the industrialization made that this „place to be“ disappears and was changed in a less important place, the kitchen which had a different role it was just a cooking and eating room.

The biggest changes were during the 19. Century. In this time economic trends in the agrarian sector, the housing estate situation, a trend to selfindividualisation of every family and governmental interferences gave the building a new request and so the building gets a new floor plan. Former multifunctional areas were divided in special living areas with a special typology.

Fig. 01: Kagel, Niels. Wandel des ländlichen Wohnens und Wirtschaftens im 19. Jh. Kiekeberg Museum

2. CHANGES IN THE SOCIETY

The changes in the agriculture during the 19. Century can be divided in three steps. The first is from 1800 – 1830 embossed of economic and political stagnation. Reasons for the stagnation were low prices for grain which provoked a agrarian crisis.
In the time from 1830 – 1860 new structures in the agricultural sector indicated, that was caused by the agrarian reform from the government. Since 1860 agriculture was embossed by a modernization. The agricultural sector prospered. The prices for agrarian products increased highly. A reason was the growing of the society the peasants began to produce to sell and to export their products. The market changed from a regional self sufficient to a national and international commerce. The farmers began to intensify the agriculture and to increase productivity to get higher profits. One of the main reasons for the change in the agriculture to modern working methods was the industrialization. The improvement of the machines gave the precondition to the change. New inventions like the steam engine or the use of fertilizer made it possible to increase productivity. The bigger and more effective steel machines made it possible to intensify the agriculture with less servants. The requirement of work capacity diminished and changed the pattern of family life. The family who lived and worked in one building reduced to the heart of the family. The housing density on the rural areas diminished and so the problem of living space was reduced but in the urban areas the requirement of work capacity in the industry increased which caused a living space problem in the cities. The proximity to Hamburg was a big influence to the living and housing standards of the farmers. The economic recovery of the agriculture allowed to increase the luxury of the buildings and to adjust to bourgeois norms from the cities. The extension of the infrastructure like the railway to the rural areas changed the working situation. More business enterprises established in areas that earlier offered just possibilities in the agriculture. The contribution of people who worked in other sectors than the agriculture increased and changed the working market.

3. Changes in the House

The social and economic changes in the society had a big influence to the building. The initial „one room organization” of the building fulfilled the needs of the inhabitant, the social life happened in the „FLEIT” because the central fireplace gave the people heat, light and a place to work, to eat or to celebrate. The biggest problem of the floor plan was that the openness of the building the dirt and smell from the working and storage area were part of the life and the living area was impossible to leave it in a clean condition. Another big problem was the delicateness for brand. The open fire in the middle of the building was a big risk to set the building on fire. The flames and sparks moved around because the construction of the building wasn’t very dense. The risk of a brand wasn’t only a risk for the own building but for the whole village.

![Fig. 02: Kagel, Niels. Wandel des ländlichen Wohnens und Wirtschaftens im 19. Jh. Kiekeberg Museum](image)

So in the year 1589 the prince established new fire regulations. The new laws stipulated for example that the building had to be constructed with a hard roof material and not anymore with reed. Later the fire regulations stipulated a vault and a wall to surround the fire to stop the movement of the flames and sparks inside the building. The next evolution of the fireplace was the „Diggert”. It was a closed oven that was connected to the wall of the living room. It was also put next to the sleeping rooms, with the effect of heating them. The „Diggert” was the first adaption to the urban standards and was a big progress in the comfort for the inhabitants. A next evolution was the use of an exhaust.
The change from a smokehouse to a building without soot inside the building gave the possibility to paint the living area and made it easier to keep the building clean. With the change of the family to its heart the building changed to. The requests to the building with less servants were different. The floor plan changed from the „one room organization“ to a division between the working and the living area by a wall. The typology of the building changed from a open to a closed system organization. The new organization disintegrated the rooms for different typologies. The division gave the inhabitants more privacy, which was another adjustment to bourgeois living norms. The initial fireplace became a part of the kitchen and the heating function took a heater. The new organization of the building with many little and low rooms simplified the heating of the inhabited rooms. The economic recovery allowed the farmers to get higher living and housing standards. With the industrialization it was possible to get think that were produced serial, like furniture’s, tiles or saving oven that needed less burning material. With the use of tiles in the kitchen it was much easier to keep the kitchen clean, which was a new evolution of the hygiene standards.

4. CONCLUSION

The interim of the „Hallenhaus“ from a opened to a closed organization with separated living and working areas was necessary because the requisitions changed. The first changes had the idea of increasing the living comfort. The higher housing and living standards made it inconceivable to live next to the animals and to have their dirt and smell in the living rooms. The same that happened to the organization of the building happened to the fireplace. Once it was the needed midpoint of the building, where the social family life happened. With the change of the pattern of family life to the heart of the family it was outmoded to share with the servants and the trend adjusted to bourgeois living norms and more privacy. Besides the higher technical equipment of the building made the fireplace as heart of the building became useless. One example is the evolution of the light. First the fireplace was used to light the building, later the candle made it possible to surround the fire, the last evolution was the electrical light that made the need of light from fire disappear. With the social, economic and political changes in the 19. Century the organization of one unit that fits every function didn’t made sense any more. A modern type of building was necessary. The machines and the harvest became to big for the building. The increase of the number of people who worked in industrial or business enterprises was another important fact for the change to modern buildings because the people didn’t needed a working area any more. The new requisitions which confronted the „Hallenhaus“ made, that this type of building was replaced by modern buildings that fitted one typology.
Fig. 05: Kagel, Niels. Wandel des ländlichen Wohnens und Wirtschaftens im 19. Jh. Kiekeberg Museum

5. REFERENCES


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Structure Evolution of Hallenhäuse in Hamburg Countryside (1600 - 1900)

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Berlin University of Technology, Berlin, Germany

ABSTRACT: The structure of Hallenhäuse in Hamburg countryside is famous for its post-and-beam construction which connects the living part to working part. A typical space pattern of this area is the big roof and the human lives with their livestock. The big roof does not support by the exterior walls, but by internal structure, which will start at the same time the load of the harvest. It was developing from its appearance around 1500s to the end of 1900s. The evolution of social condition, way of living and technology caused the evolution of structure of Hallenhäuse. The emigrants from Germany to Chile took the patterns which are convenient, rational and accommodate to the climate and environment. From the documentations and cases study we can see the trends of the evolution.

KEY WORDS: evolution, Hallenhäuse, structure, trends, typology, hierarchy

1. GENERAL INSTRUCTIONS

The most important feature of the Hallenhäuse is its internal, wooden, post-and-beam construction which supports the entire building. "The frame was originally made of oak, which was very durable, but from the 18th century it was also made from cheaper pinewood. To protect it from damp, the wooden posts rest on a stone foundation about 50 cm high, often made of fieldstone. The non weight-bearing external walls were built as timber frames, the panels of which were originally filled in with willow wickerwork and clay (wattle and daub) and, later, with brick. "[Kirchner-Radestorf, 2002)

That means: migrations from this area in the years around 1850s, could take any of these typologies to Chile, based on the concomitant condition of the different structure. So what determine which typology they take with them? What are the trends of structural evolution in Hallenhäuse? What is the advantage or disadvantage of the structure in different periods?

Structure of research: 1. Case study. 2. Generalize into typologies; predigesting each case from one period, remove the elements not relevant or not always attendant in the structure. 3. Analysis: analyze on the typologies generalize from the cases in different fields, including hierarchy of structure, number of elements and force analysis.

2. CASE STUDY

In order to find out the regularity of structure revolution of Hallenhäuse, some cases were chosen to support the analysis. Case were chosen according to two approaches: 1. Learn from the field trip in Freilichtmuseum am Kiekeberg and document them, there are different houses constructed in different periods, which shows the evolution of the structure. 2. books contain some of the relevant materials such as documentations of Hallenhäuse. Here only shows the cases documented by the author. Not including those from other books or literature.

Case 1. Silberhof: “originally Built in 1612” [Giesela Wiese, Rolf Wiese, 2002] The data is from the investigations of the field trip to Freilichtmuseum am Kiekeberg. Repaired and maintained around the year 1988, this house lost some of the components in the original pattern. But the main part does not change and we can easily easily distinguish the old from the new by condition of the surface.
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

The structure, the using of reinforced slabs, and the separation of living and working part became popular in that time.

Figure 1: section and facade of Silberhof (left top) (draw by author), Photos of Silberhof (right) (from author) site of Silberhof (left below) (draw by author)

**Case 2. Helferhaus:** This house is defined as the shelter of the helper. It is provided by the rich family, who is in need of the helper live near to them. This house is not far away from the host’s. Although small, it is integral and represents the living condition of the helper.

Figure 2: Section and facade of Helferhaus (left top) (draw by author), Photos of Helferhaus (right) (from author), Site of Helferhaus (left below) (draw by author)

**Case 3. House Pannecke:** This house is simply structured in 1824, without any decoration or folder on the gable. But this house represents the typical pattern called viersländershaus. The technology and culture were mature during this period. Facade shows the structure, the using of reinforced slabs, and the separation of living and working part became popular in that time.
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

3. FROM CASE TO TYPOLOGY

After the collection of these cases, in order to make the structure clear, cases are generalized as typologies. There are already some classifications, if we judge this Hallenhäuser with the structure, it could be sorted as a zwei-, drei- or
Vierständerhaus or commonly known as “scaffolding”, because the high roof does not supported by the exterior walls, but by internal structure, which will start at the same time the load of the harvest. But in the countryside of Hamburg, seldom can we see the dreiständerhaus, so I sorted it in another way: Predigesting each case from one period, remove the elements not relevant or not always attendant in the structure. The elements including in the typology should be: without these elements, this structure is not established or falls down.

1. Chronology: The frame of chronology is based on the literature review and case study, but it is not a one-to-one correspondence between each typology and each period. The structure of Hallenhäuse in Hamburg countryside is changing slowly. The boundary of timer shaft is not so vivid. Some structure, for example “zweiständerhaus, emerged from the year of 1500, but could still be seen in a house of 1800s which was newly built, although in that period the vierständerhaus was newborn and prevalent.” (Carl Ingwer Johannsen 1979, P.55) So in different research fields, different chronology is constructed.

2. Typology:

<table>
<thead>
<tr>
<th>Case 1</th>
<th>1550-1800</th>
<th>1600-1800</th>
<th>After 1750</th>
</tr>
</thead>
<tbody>
<tr>
<td>House from Curstal, 1550</td>
<td>Silberhof, 1612</td>
<td>Vierlanden house 1852</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case 2</th>
<th>1550-1800</th>
<th>1600-1800</th>
<th>After 1750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hufnerhaus, 1550</td>
<td>Neuengamme,</td>
<td>Vierlanden house 1774</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case 3</th>
<th>1550-1800</th>
<th>1600-1800</th>
<th>After 1750</th>
</tr>
</thead>
<tbody>
<tr>
<td>House of Peter Eggers,</td>
<td>House from Damnatz, 1690</td>
<td>Vierlanden house 1801</td>
<td></td>
</tr>
</tbody>
</table>

Typology* |  |
*Draw by author

Using the same procedure, the typologies of the longitudinal section and structural longitudinal section are showed in table 2 and 3.
4. ANALYSIS ON TYPOLOGIES

Table 4: Whole system; transverse cross section

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1550-1800</th>
<th>1600-1800</th>
<th>After 1750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complicated hierarchy, at least 3 rating, primary, secondary, subsidiary</td>
<td>Clear structured primary and secondary.</td>
<td>Regard as a whole system. Like a pack.</td>
<td></td>
</tr>
</tbody>
</table>

Typology*

Hierarchy *

Clear hierarchy, 3 rates. The light color represents the elements attach to the main part which is in dark color. The roof beams and purlins are attached to the central beam.

Clear hierarchy, 2 rates. The small columns under the purlin bear little weight of the roof. So it is the secondary system.

No hierarchy. No sequence of priority. All the main elements worked together, without attachment.

Number of nodes *

Use the most elements to contribute. A lot of nodes.

Use the least elements. Each node afford more.
Moments distribution
n**

The biggest moments distribution of all. But each element affords a similar force.
Small moments distribution. But the beam between the purlin and the main column afford too much.
Moderate to all the elements.

Normal forces distribution
n**

Aligned in vertical system. Easy to conduct load from the roof.

Shear forces distribution
n**

Well distribute of mean load. But big.
Small, but not well distribute.
Moderate.

*Draw by author
**Calculated with software "Framework" by author

Table 5: Whole system: longitudinal section

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Before 1600</th>
<th>1600-1750</th>
<th>After 1750</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typology*</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Holistic*</td>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
<tr>
<td>aligning*</td>
<td><img src="image7.png" alt="Diagram" /></td>
<td><img src="image8.png" alt="Diagram" /></td>
<td><img src="image9.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

*Draw by author

The living area and the working area are historically separated. Simplify in conduction but complication in function.
### Table 6: Elevation: living part

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1600-1650</th>
<th>1600-1750</th>
<th>After 1750</th>
</tr>
</thead>
</table>

- **1600-1650**: Use a small beam as cantilever, not aligned with the main beam.
- **1600-1750**: The main beam overhangs for the column.
- **After 1750**: The column itself overhangs for the upper loads.

- **Moments distribution n**
  - So big distribution for the cantilever.
  - Rational distribution for the column.
  - Some parts afford too much.

- **Normal forces distribution n**
  - Well distribute of mean load. But big.
  - Small, but not well distribute.
  - Moderate.
5. CONCLUSION

The trends of evolution:
1) Directly: The direction of pressure conduction became more directly all through the years. In the early ages, pressure tend to conduct through more than two elements while in the same nodes in later years, it tend to be less than two elements. Direction makes the whole structure more rationale.
2) Simple: Fewer components participate in composition, in order not to weaken the nodes. From the table 4, 5 and 6 we can see to brace the roof, people use fewer elements in the Hallenhäuse, cantilevers were getting shorter, and in the end disappear, and useless attachments were vanishing.
But there was an exception, from table 5, the Holistic shows a converse trend of evolution. It was more complicated after the year 1600 than before. That is based on the social changing which lead to the diversification of life, finally influence the structure. People preferred living separated from animal and were able to do so during that time.
3) Align: More components are tending to align with relevant components. The analysis in table 5 shows the alignment. Before 1600, the beams and columns are not aligned vertically, but aligned horizontally. But after 1600, it tends to aligned vertically which is better for bracing.

6. REFERENCES

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Development and living conditions in Hamburg countryside at the 19th century

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ABSTRACT: The so called “Hallenhäuser” (or aisled houses) are big farm houses where animals and inhabitants live under the same roof. It is the same house structure from at least the 15th until the 19th century, when the organization of the society pushes for new living ways and standards. The result of this research shows how past knowledge get lost in the time because of many cultural facts for example population explosions or changes in the government system. With the costs of time and many lives, the big cities and the countryside learn again how to deal with health and hygiene, now with some new inventions of the 19/20th centuries.

1. INTRODUCTION

Before and after 1850, important historical facts took place in Germany: wars, invasions, flood, religious persecutions and agricultural crisis were reflected immediately on the countryside. All this social, cultural and geographical matters influenced here the history. The house discussed on this essay testified these changes and survived through the time.

The year of 1850 was a turnaround, because it was also a point on the history where better times arrived: new rooms like kitchen, sleeping room, and corridor were created. The furniture as a moving object appeared for the first time. The hygienic standards were higher demanded, but still insufficient until the beginning of the 20th century. But these changes didn’t happen at once. The countryside always reacted slowly in accepting new ways of living or technologies.

It’s assured that at this point, many inhabitants of those houses or neighborhoods left Germany, migrating to other countries. It is of interest to our Seminar to explain and be aware about the conditions in which this people lived. Some of them may have migrated to Chile, carrying all the learned lessons with them. Now, based on books, websites, newspaper and a visit to an open-air-museum it is possible to build a background for this discussion.
Figure 2: Freilichtmuseum Rieck Haus – Vielände, Hamburg. Source: Picture from the authors

Figure 3: Lepenski Vir (Serbia) 5000 b.C. Prehistory dwelling build with the fire place at the middle Source: Pfriemer[2001]

Figure 4: Down: Ingolstadt (Bavaria) 2000 b.C. 25m x 10m plans. Source: Pfriemer[2001]
2. ONE BIG HOUSE

Aisled houses are typical for the elected region in the north of Germany. It’s a big house sometimes 40 meters length and 16 meters wide on a rectangular straight floor plan. The structure of the older versions contains an internal framework and two column-arrays. The side walls haven’t got a structural function.

Its plan is mainly divided in two parts, the production area and the living area. The production area is accessed from the yard through a big gate. It’s used as central transit and working room with stalls in both sides and over it, on the roof, is the place to store the grains and cereals. The production area terminates with alcoves, designated as sleeping niches to the servants. The living area begins than in a transverse body with maximum 9 meters deep and no wall dividing this area at least until the middle of the 19th century. Here we find the so called Fleit, where between potato bags and other agricultural products the open fireplace was located. Bread, beer, and butter were also produced here. The smoke of the fire went up without any chimney and helped to conserve the meat, that was hanging over the cooking area. It also dried the grains, conserved the wood structure of the house and kept bugs away. In the other hand, eyes and lungs were affected with the smoke, and there was also a big risk of fire in the house. Like described on Grote (1984) it should have been difficult to maintain everything organized and clean there. The grime from the open fire made all stannous dishes or the strong ornamented cabinets dirty.

After the Fleit area, there are important family rooms to sleep, storage and work. In each case the rooms are divided in a different way. They could be use by a farmer couple, a married son or elderly parents, but normally no servants.

3. THE LIFE QUALITY OF THE DWELLERS

In terms of the health and life expectancy in the 19th century, according to Kagel (2006) the average age of the population was about 38 years. From all the newborn children, 20% died before the first year, and 30% would not reach the age of 20. A 50 or 60 year old person was considered as very old. In order to find the causes of this numbers we found: Surgeons, academic or fully qualified doctors were rare in the countryside. The roads in most of the region were in bad conditions, to reach a doctor or pharmacy it could take 3-4 hours. A medical visit would cost too much for a poor family, and most of the times healers or just some household remedies were applied. Together with the small life expectancy, the hygienic circumstances and an insufficient nutrition were also assumptions of the problem. Diseases like Typhus, Variola, Dysentry, Scarlet fever, Mange, Pertussis, Syphilis, Tuberculosis and Rheumatic disturbance were highly present.

To that point the background story for development and propagation of many diseases were not identified, because bacteriology-science was only at the beginning. Tuberculosis and Cholera, for example, were first discovered at 1882/83 by Max Pettenkofer (1818-1901) and Robert Koch (1843-1910).
But in the 18th century, scientist, doctors and civil servants were already conscious of this big problem in the countryside. In 1786 Dyke-reeve Nicolas Beckmann wrote in the Hannoverschen Magazine that even in the new farmhouses, if the hygiene was not taken serious there would be no increase of health.

The only kind of Doctors in the countryside were the Landphysici whose capacities were very limited. They were in charge of the basic services for the community health care. One of this Landphysici records[1872] includes that the construction of the houses in the north of Germany always failed because of having no chimney. The lack of it kept the dense smoke, released because of the use of turf as burning element, inside the house. Indeed, the houses did not include chimney until the second half of 19. century when the industrialization offers new and achievable construction materials like clay bricks and cement(invention of 1867). The paths on the barn were with almost 30cm mud(most of it dejections of animals and humans) that was brought constantly into the house on the shoes, situation that the farmer was used to since his childhood. Only Sundays as the farmer went to the town for church, they considered important to wash their faces. A toilet was rare on the countryside, they used each corner around to excrement.

With no insulation on the adobe walls or pavement on the ground, the humidity was very elevated, what explains the rheumatic problems mentioned on Kagel(2006). The ones that could afford to buy some expensive imported tiles from Holland had their kitchen or some walls leak-proof.

The bed was an alcove made of wood with a straw layer and than a mattress. The linen or sleeping clothes were seldom washed. A small overture didn’t help the fresh air to come inside, but at the contrary, kept the humidity of this breathed air, lot of dust and acarus.

Since the house was only some degrees warmer than outside, the sleeping alcoves were kept closed during the night to avoid loss of temperature. Also potatoes or vegetables were stored under the bed, because the temperatures wouldn’t reach the frost.

![Figure 7 Sleeping Alcove - Freilichtmuseum Kleeberg. Source: Pictures from the authors](image-url)

The methods of food conservation were only at the beginning. In 1626 the England philosopher and empiricist Francis Bacon (1561-1626) has done some experiments on this subject by observing aliments cooled with snow. In 1856 the American Alexander C. Twinning makes a cooling machine as a commercial product. After the second half of the 19th century, although the hygiene was slowly getting better still fungal attack on grains or the bad conservation method for food like meat represented always a danger of being poisoned.

Before closing this section, it is important to mention about the servants. A full farm could use approximately 6 servants [at the harvest season the whole family of the farmer was helping also]. They lived together in the ailed house under the hierarchy of the owner, slept in alcoves or over the animals in a platform, always far away from the privileged core of the house like fireside. They were mostly also good craftsmen and in the leisure time or between harvests they were allowed to make their own business and breed animals and food for subsistence. The common abilities were to fish, to sew, produce wooden articles or furniture.

After the agrarian reform of the middle of the 19th century the servants could earn more income and it has modified dramatically the relation among themselves on the countryside. They could marry and make them autonomous if they had enough savings for example. They could ask for permission to live with their family in a small house (ailed house down-sized) on the same ground plot and obligated to help for some daily hours and in harvest times. The hygiene in their houses is described as even worse as in the main ailed house. It could be one indication why the new social values at the second half of the 19th century builded some distance between servants and family members that has never returned.
4. THE WATER IN THE PAST

Now in order to consider a fundamental aspect of the life in the countryside, we will analyze the way that they used to handle with water supply and make some comparisons. One of the main mistakes done at the 19th century was made with the water supply of the house/city. With almost no toilet or canalization, all the sewage is thrown in the garden, street or rivers. The consequence of this fact is that the habitants did not have a clean water source. Certainly with the ground absorption or some rain that helped mix contaminated water with phreatic water, the quality in the springs (commonly used as source) was highly undesirable.

It will always be a question why did we forget the learned lessons of the past. So many nations that handled successfully with the water even before Christ, so many constructions wonders like huge canalizations, pools with circulating fresh water, cistern, rain water recovery, water/bathroom heater, and many others that brought to that time a basic hygiene level. With the crash of the Rome Empire the Occident did not take care of the infrastructure like aqueducts or canalizations while in the Orient it was the contrary. In the middle age, Europe was described overall from Paris to London to be insalubrious, and the pest, the so called “black-death” came greedy. Descriptions from the voyage of Marco-Polo at 13th century tells us about clean streets and watercourses in China. Even if its not a trusted source, at the course of the 15th century China has builded 300km of water supply and canalizations and a big water reservoir. In 1727 the German Doctor Engelbert Kaempfer was travelling in Nagasaki and noticed the folk used water from the river for drinking tée (boiled), otherwise only from a safe source like the water from the city pipelines or some deep spring. In other cultures like Aztec (14th till 16th century) or Inca (13th till 16th century) the hygiene was described as “unimaginable” for an European. Living rooms with kitchen, washing basin and bath house, servants responsible for the street cleaning and garbage disposal also.

In the German territory we have a good example of heritage to illustrate the potency and technical capacities of the Roman Empire in supplying water for the city of Cologne: The “Efel Water Pipeline”, a canalization of 95km that was built in the year of 80a.C. It’s an inverted “U” duct form made of stones, with the dimensions of 0.70m(w)X1m(h) and 1m buried in the ground to avoid the water from freezing. The most important fact in this example is that the city of Cologne has the Rhine River nearby, but just to be sure that the population had a good quality of water it was seen as necessary to be constructed bringing water from far away, from Nettesheim till there.

By the year of 1842 the city of Hamburg was surprised with a big fire that burned 1.750 houses and made 20,000 persons homeless. Promptly the England engineer William Lindley (1808-1900) brought plans and projects to build one of the first canalizations of continental Europe. Motivated by the pest and the chaotic hygiene circumstance, the city of Hamburg steps in this new solution. But some districts deny the use of sand-filters treatment just to cut some costs, and 40 years after the construction also a Cholera epidemic erupted, once that the fresh water from the river wasn’t that fresh as expected, having a closed cycle between sewage and sinking.

But for this case here studied, most important is that these pipes that were installed in the city of Hamburg reached the countryside for example Harburg, only at 1892 (water) and 1902 (sewage) according to Kagel (2006).

Figure 8: (left) Water reservoir from Emperor Justinian I with 8m high built in the year of 532. (right) Drawing from clay pipes found in the Agora in Athens 6th century B.C.

5. CONCLUSION

This all-in-one house proves to be a solution for the past where inhabitants, fire-place, animals and storage comes in a package that won’t be a model for the future anymore. As a technical achievement the construction is an effort given its bounteouness and very much developed with the time. But it would make no sense to build this big house if the servants live apart, the animals in barns, the cereal stocked in a repository and mostly, when better and achievable construction materials and fire-places with smoke-ducts(chimney) are afterwards at disposal. We can notice this evolution for example from the sleeping alcove, where occupants slept inside with the doors closed. As soon as the house isn’t that cold and humid
anymore, and with some influence of the big city’s style in vogue, the very known “bed” is taken as standard and the unhealthy alcove will disappear. New rooms like the bedroom will give the owner the privacy desired.

Together with the bad comfort and livable quality of the house already described, improperly nutrition, abusiveness consumption of alcohol, lacking of professional competence of doctors, insufficient healthcare and few assortment of hospitals will be a serious threat for the countryside residents on the 19th century.

In the distant past or other cultures the hygiene wasn’t that denied mostly. People could not know how the diseases were transmitted, but they knew hygiene could help avoiding it. There were solutions for innumerous problems without the know-how of our time. The population explosion in the middle-age and/or the absence of powerful emperors together with their advisors demanding the construction of big monumens, has brought the ignorance. After a long period of “darkness” comes the Renaissance and in the 19th century the last great ideas like the canalization of William Lindley, it shouldn’t be considered miraculous, but just a re-lecture of the conquest from our big intellectuals in the history. Many tracts like from Vitruvius[70b.C.-aprox.10b.C.] or Ludovico Comnaro(1452-1566), or the ingeniousness of Leonardo da Vinci(1452-1519) were long ago always at our disposal.

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http://www.guenter-lehnen-koeln.de/Koeln_roem.html

http://www.zeit.de/2008/52/P-Lindley
Call Attention to the “Grundschwellen” in Timber Structures
Illumination Derive from the 1739 Building Code

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ABSTRACT: Timber maintenance and preservation are more and more urgent today. The thesis, according to the research trip sources and historical regulation in Hessen, found a shortage in the conservation field that few words refer to how to deal with the part – “Grundschwellen”. However, this element was discussed in the historical Building Code specially. The assumption generated that in Hessen state the part – “Grundschwellen” is so vulnerable that authorities should called the people’s attention even in the law. With the assumption the article talks about the weather in Hessen to show the influence on the timber structure and discusses why the decay forms more easily happen in this special element. At last a case study of Hessen will show how to maintain the “Grundschwellen” and be the supporter of the argument as well.

1. GENERAL INTRODUCTION
The ancient regulation in Hessen in 1739 set about rules on how to build houses in the state. The article is derived from the rules and focus on the special part of the timber structure which is seemed more vulnerable to be decayed. Through the whole process the author supports the argument in order to call conservators’ more attention to this special part to maintain and preserve the whole timber structures.

2. DIE GREBENORDNUNG VON 1739
The ancient regulation introduction
The „Grebenordnung von 1739” was first reprint as a „public issue” by v. Dieter Carl in Yellmar 1998. The Grebe Rules - 1739 handed over to the headman of Hesse-Kassel as legally binding guideline for their official acts - is as original today, a rarity, which is also second-hand no longer offered. The book can be found practically only in large libraries, archives and museums, where it is subject to a strict prohibition on copying. The Grebe order is very important as it gave an insight into all areas of the village life, and intervened in the local administration as well. The book offers therefore not only for the academic specialist preformed a wealth, but also remains essential for all local historians who work on the chronicle of his/her place. The order of 1739, here the Grebe power, was provided over a significant period of time, as they had valid for all the villages and had to be made public even in the cities as well. [Carl 1998]
The content of the building code:

Translation of the code:

20. From the “Building Rules” shows that the former timber resources in our forests no longer existed.
   a) Any “Completion” shall depend on the minimum and necessary timbers, and it should not be waste of them.
   b) The basic thresholds of the new buildings must be supported and be at least 2-3 shoe placed upon the ground.
   c) “As far as it is practicable and only feasible that the lowest floor would be built mainly of stones.”
   d) The garden shall be enclosed with hedges, thereby reducing the “plank-wood” too.
   e) Thatched roofs of new buildings are banned and chimneys need to be guided through the roof.

Old laws’ analysis

Firstly, the regulation was defined mainly through the perspective of the general life the citizens. Although it is a building code, it did not talk about the specialist of building issues. Specific construct technology, standard of the timber structures and the design of the houses had not been mention in the code like today.

Second, a lot of details were discussed in the laws, such as “2-3 shoe higher than the ground”, how did chimney go through and the need of the hedge around the garden. It is not only the regulation but also a guidance of the house improvement.

Third, the building code was so short that it concentrated on the main issues happened in the 18th century in Hessen. Though short, it concluded the key subject and went deeper into the citizens’ life. Its influence on the contemporary both physical and social life was substantial. The low level should be built in stones even became the role actor in shaping the form of Hessen house.

Forth, the very important finding should be the “Grundschwellen”. Only 5 items, 2 of them talked more or less related to this part of the timber structure. So the questions quickly generated, Why the “Grundschwellen” should be defined a certain height? Why the ground floor is only feasible in stone? Why this element is the only one of the timber structure that had been mentioned in the building code? Is it so special that the authority needs his people paying more attention to the part? As the regulation is special for Hessen it is also manifested that this part is more or less especially vulnerable in Hessen.

3. CLIMATE CONDITION IN HESSEN

The information are shown in the diagrams. Humidity in Hessen is much higher than the comfortable range. It is the same with sun radiations which will do harm to the wood outside the weather. And temperature is always lower than the suitable one.

Figure 1: Die Grebenordnung von 1739 (left) [online] and the schwelle (right): field trip source

Figure 2: Temperature range (left) and Radiation range (right); climate consult
4. DECAY OF TIMBERS IN “GRUNDSCHWELLEN”

First moisture plays a key role in timber decay. There is a wood “fiber saturation point” which is generally about 30 percent moisture content. When the content drops below the range, physical and mechanical properties begin to change. (Freas 1982, pp. 92-93) (Fig. 4) shows that whatever the moisture content is higher or lower than the range, distortion in the wood will take place. The result would be the damage to the whole structure.

Second, in the weathering out door, the original faces of the smooth wood will become rough, as grain raise. The wood loses its surface coherence and becomes friable, fragmented, large cracks and boards cups grow up. (Freas 1982, p. 107) All these effects brought about may be rooted from the sun light, the wind, and the rain. And the “Grundschwellen” is exactly in the same situation.

Third is the fungi decay, (Fig. 5) which is easily to be attained in the position of “Grundschwellen”. On one hand, if the wood in contact with the ground, as the soil constitutes a major potential source of moisture, the decay hazard is greatly reach the wood without delay. On the other hand, even though the “Grundschwellen” is built above the very ground – soil, it is still the nearest to the earth.
Forth, many kinds of insects could be the enemy of the timber structures, such like termites, ants, beetles, and bees, etc. Huge disaster could be induced by these insects. (Freas, (1982), p.126) “Grundschwellen” is always the starting part that insects will attack, as this position is either nearest to the ground or at the corner or they stand in both situations.

5. CASE STUDY FROM FIELD TRIP

The case situates in the town Rotenburg an der Fulda. The simple history of the house and its owner is painted just above the door. It is a well preserved old house which is built around year 1824. First is the condition in “Grundschwellen”. As we have already discussed before, the weather in Rotenburg an der Fulda is as same as the state Hessen. Humidity in the air is always higher than the comfortable range. Sun radiation is also higher than the average level. As the cases in our site, Hessen, the ground floor is built by stone restrict to the 1739 building code, the vapour cannot that so easy come up to the “Grundschwellen”. However, vapour can always round its way through the transverse gap between individual stones and go up to the “Grundschwellen”, and attack them. Third, as the “Grundschwellen” linked with the base and always in Hessen another type of material, stone, and what is more is the stone base is as usual broader than the “Grundschwellen”. As a result, the flowages of rain over the roof edge, against and down vertical walls, although wandering its way through supporting structure frameworks, at last will assemble at the bases of walls and contribute to a significant decay in the structure components - “Grundschwellen”, which they wet. The (Fig.6) just show the process talked above.

Second, maintenance could be seen as the key step to preserve the timber houses. And some maintenance methods have already been used in this house. For instance the lower part of the house was built in stone as dictated in the old laws. The wood structures which are exposed to the outside weather are well painted. Another element we should notice is that the conservators plus an additional shelter on the outside surface of the “Grundschwellen”, the purpose of course to protect the “Grundschwellen” from being washed by the rain. (Fig.7)
Third, apart from these methods which have already been used in protecting the “Grundschwellen”, other senior methods are also required in treatment. For those methods are either fundamental or just pre-treatment. More professional ones should be taken into action as well in order to keep the timber in good condition for longer period. Two methods for maintenance of the “Grundschwellen” are recommended. One is the water repellent (WR) method, for water is one of woods’ worst enemies. Water repellent is a simple useful way to keep the wood structure from water penetrating. The composition of the material would usually be paraffin wax or related material. And this can help to protect wood surface against decay. (Freas, 1982, p.271) The other is to protect the wood surface from the natural weathering process. (Freas, 1982, p.277) It is also useful in the “Grundschwellen”. One of the method could be the penetration into the wood, (Freas, 1982, p.278) which could be partly solve the “Grundschwellen”’s problem that the under face is directly touch the ground.

6. CONCLUSION

Hesse is one of the German states with a great deal of historic wooden architecture, mostly half-timbered buildings. There is a special commitment called the State Conservation Office of Hessen (Landesamt für Denkmalpflege Hessen), has already take many actions to deal with this part, for example in the arising idea to exchange expert knowledge on the conservation of historic wooden architecture, they take the financial responsibility from 1996 with a bilateral scientific exchange by means of projects with Japan, (Henrichsen, 2003, pp. 5-9) It is really worthy to concentrate on the contract, as Long term preservation of historic timber structures largely depends on the availability of traditional craft techniques. Dating back to the history or more specifically to the “Grebenordnung von 1739”, which especially mentioned the maintain method of the special part – “Grundschwellen”, people had already notice the super importance of protect, maintain, and preservation of the wooden structure. And what we can also speculate is that the “Grundschwellen” was vulnerable since that time on as well as at present times. And it is manifested that the “Grundschwellen” is special vulnerable in such weather in Hessen, as it is compared the building typologies with other state of German. In the comparison, the characteristic is distinctive. The regulation of 1739 only put some restrict commands on the maintain of the timber, such like the size should be larger than the other counter-part, the “Grundschwellen” should be built on an one floor height stones instead of put directly on the ground outside on the level of government’s legislation to protect and maintain the timber nearest to the ground. However, when going through the literatures, I found that few authors mentioned about this part. Most of the writers put more concentrations on the reinforce of the roof trusses, the repair of the frame work of the wall and the floors, for example, as they are considered the main part of the whole timber structure. A special example of the modern way to protect timbers from decay is water repellents (Freas, 1982, pp. 271-277), in this case chemical protection can be used to each elements of the timber frame work. However for the “Grundschwellen” the face which directly in contact with the stone base is difficult to be provided protection through these techniques, but no more mentioned for how to deal with the part that is so vulnerable. (Freas, 1982, p.133) Even though they think of the part, it is not systematic or be taken as a serious point. Nevertheless we need to deal with the part of the frame work for it is really vulnerable to the conditions around as it is mentioned before.
7. REFERENCES


Ridout, B. 2000: Timber decay in buildings, London [u.a.]: Spon.


8. APPENDIX


International Council on monuments and sites (ICOMOS) is an international non-governmental organization of professionals, dedicated to the conservation of the world’s historic monuments and sites. Homepage: http://www.icomos.de/

9. ACKNOWLEDGEMENT

Thanks to Prof. Renato d’Alençon who directed me how to think of timber structure and develop an own perspective to understand it. Thanks to Jan who provided me the important information. At last the thanks will give to Mr. Haide Schreiber who is the president of the museum in Rotenburg an der Fulda. He searched for the old regulation about the building code which is the key source for this article.
Symbols of carpenters

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1. INTRODUCTION

Since a long time the construction of frame-workhouses is a big art for carpenters all over the world. A typical German two-storey frame work house from the 15th century consists of approximately 500 different timber pieces, which are stored separately during the construction process. To overview the storage and drying process of these timber pieces a classification system is used.

This text is a preliminary result of my research work during my course Carriers of Space Patterns and Construction Types - German Migration and Architecture in Chile, 1852-1875 at Technische Universität Berlin 2009/2010 in combination with an excursion to Chile.

Key research subject in this essay is the symbolism of German carpenters between the 15th and 19th century. As a conclusion to this work there is an exemplary documentation of the used symbols in 4 different German regions.

2. THEORY: SYMBOLS OF CARPENTERS

2.1 Type area

The construction process of timber frame houses starts with the selection of wood types. Therefore the master of the guild together with the forester in duty are looking for the correct timber to use for the intended construction. This research has to be done between December and February⁹, because during these months no resin is being produced. After the selection of the construction material the selected trees are being labelled. According to his guild the carpenter uses the corresponding symbols for labeling.

Figure 1: process diagram. Production process of framework houses
After the selecting and labeling process lumberjacks are being send out to fell the selected trees. Afterwards the logs are transported to the carpenter’s place.

Logs are supposed to dry for about 3 months. After this period the first steps has to be made to refine the wood.

Therefore timber is being classified in different quality categories and is being cut for further refinement. To determine the timber’s "Bundseite" the wood is being aligned and ordered with the more representative side up. This side is marked with a "Abbondmarke" - see Fig. 2. At first this label usually is applied gently by red chalk or pencil.**

Figure 2: symbols of Abbundmarken

Carpenters follow their believe “from draft to detail” and refine each timber beam until the construction, including all joints, can be laid out for test purposes on the carpenter’s place. When all pieces fit properly the "Abbondzeichen" will be applied firmly and the layout will be dismantled again for transportation to their final destination. To avoid the mix up of the different timber pieces the “Abbondzeichen” is helpful to reconstruct the definite timber frame house.***

*** Großmann, Georg Ulrich: Fachwerkbau, DuMont, Köln 1986

2.2 Chronology

Evidences are given that multi-storey timber frame buildings exist for more than about 1000 years. Even in Jakata Tales, the doctrine of buddha, symbols on timber frame construction is reported and even the profession of a carpenter is mentioned - see fig. 3.*

Once upon a time, when Brahmadatta was king of Benares, there was a village of carpenters not far from the city, in which five hundred carpenters lived. They would go up the river in a vessel, and enter the forest, where they would shape beams and planks for housebuilding, and put together the framework of one-storey or two-storey houses, numbering all the pieces from the mainpost onwards; these then they brought down to the river bank, and put them all aboard; then rowing down stream again, they would build houses to order as it was required of them; after which, when they received their wage, they went back again for more materials for the building, and in this way they made their livelihood.

Figure 3: Jakat tales: No. 156. ALINACITTA-JATAKA.

* Von Hinüber, Oskar: Jatakas Wiedergeburtsgeschichten. Enstehung und Aufbau der Jataka-Sammlung; Stuttgart 1998

2.3 Four different systems

On closer examination of the chronology of carpenters’ symbols in the researched German area there are four outstanding labeling systems.*

illogical character string***

Figure 4: illogical character string. (left): symbols documented in Friedenskirche of Scwiednitz**. (right): symbols illogical character string
This system was used until the 14th century and consists of individual symbols. Its appearance depends on tools. There was often a high expenditure of energy because of its special details. Foreign carpenters could not decode this symbols.

addition of lines or symbols**

![Image of addition of lines or symbols]

Figure 5: addition of lines or symbols. (left): symbols documented in Russia**. (right): symbols of addition system

This system was used until the 16th century. It is precursor of Roman numerals system. It is very comprehensible to understand but has also problems: symbols can become very high and confusing for a framework house which consists of more than 500 elements.

Roman numerals**

![Image of Roman numerals]

Figure 6: Roman numerals. (left): symbols documented in Halberstedt**. (right): symbols of Roman numerals

This system was since the 15 century the common system. Roman numerals are modified by the carpenters. The system could be also read upside down and is very comprehensible.

Arabian numerals**

![Image of Arabian numerals]

Figure 7: Roman numerals. (left): symbols documented in Hungary***. (right): symbols of Arabian numerals

This system was occasional used before Thirty Years’ War by some guilds. During the 18th & 19th century it develops in the region around northern Westphalia and area between Minden and Cloppenburg to the common system. It is very comprehensible to read because it only consist of Arabian numerals but more complicated to mark in the wood, because of the numerals’ curve.

* Großmann, Georg Ulrich: Fachwerkbau, DuMont, Köln 1986
*** Gerner, Manfred: Abbundzeichen, Dt. Zentrum für Handwerk und Denkmalpflege, Fulda 1996
2.4 Tools

Figure 8: tools of the carpenters. (from left to right): crowbar, pushaxe, snatch hook, red chalk

The crowbar* /Stemmeisen
The crowbar is a tool for hard drawing symbols, to integrate them directly in the wood. It is necessary especially for wedge symbols tight.

pushaxe* /Stossax
The pushaxe is also a tool for hard drawing symbols. Because of its rough character it is used for fine lines. Carpenters work with this tool primarily for Roman numerals.

snatch hook* /Reishaken
The snatch hook is also a tool for hard drawing. With the snatch hook it was possible to draw small lines. Carpenters used this tool also to draw about two elements of timber.

red chalk* /Rötel
Red chalk is a soft drawing tool. It used for symbols which are only applied on the timber surface. It is very transient. With the red chalk the carpenters mark primarily the “bundmarken”.

How to read a carpenter symbol of the roman numeral system

Since the 15th century the most frequently system is ther the system of the Roman numerals. However these system is modi- fied in its way of counting. Therefore the system follows the principle of addition. This is necessary because the carpenter turn often their position when they work in upper height.*

<table>
<thead>
<tr>
<th>Roman Numeral</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>3</td>
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<td>IIII</td>
<td>4</td>
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<td>V</td>
<td>5</td>
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<td>VI</td>
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<tr>
<td>VII</td>
<td>7</td>
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<tr>
<td>VIII</td>
<td>8</td>
</tr>
<tr>
<td>VIII</td>
<td>9</td>
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<td>X</td>
<td>10</td>
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<tr>
<td>XI</td>
<td>11</td>
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<td>XII</td>
<td>12</td>
</tr>
<tr>
<td>XIII</td>
<td>13</td>
</tr>
<tr>
<td>Xlll</td>
<td>14</td>
</tr>
<tr>
<td>XV</td>
<td>15</td>
</tr>
<tr>
<td>XXlll</td>
<td>24</td>
</tr>
<tr>
<td>XL</td>
<td>40</td>
</tr>
<tr>
<td>XC</td>
<td>90</td>
</tr>
<tr>
<td>CD</td>
<td>400</td>
</tr>
<tr>
<td>CM</td>
<td>900</td>
</tr>
</tbody>
</table>

A symbol of carpenter has to transport different information for the identification of the specific element. For the assignment of the different timber elements the carpenter needs peculiar information which has to be transported by the symbol. For this data about the wall, the position in the wall and floor are indispensable. To put all this information together the carpenter use a revised system of Roman numerals.**

Figure 10: information of symbols. (from left to right): Ruten, Ausstiche, Stockzeichen, Roman numerals
2.5 Example of the Roman numerals’ system

In this example you see a typical symbol of carpenter found in the region around Kassel. The symbol includes all the three important information.

![Example Roman numerals](image)

The first arbor stands for the first wall diagonally. The three stripes produce two interdigitate Roman X which stands for the number twenty. The Roman V stands for the number five and the the individual standing stripe which stands for the number 1. Because of that there is no specific information about the floor, the reader could be sure that the elements a part of the ground-floor. Furthermore you can see the caption of different information could interdigitate. Adding all number together you receive the exactly position of element. Here: number 26 of 1st line wall, ground floor.

** Vaupel, Wilhelm: Fachwerkhäuser der Kasseler Altstadt, Beschreibung Kasseler Häuser 1973

3. INVESTIGATION PART

Region of Hessen

Case study:

Gutsherrenklaue
Rotenburg an der Fulda / Hessen
Build in 1824

- used system: system of Roman numerals
- used tools: pushaxe + crowbar
- special quality: follows a strict sture, use of ausstiche, rutem and stockzeichen stockzeichn are often abbreviated to an diagonally line
Region around Hamburg

Case study:

Silberhof in Scharmbeck
build in 1612

Meybohmsche Kleinhaus in Kakenstorf
build in 17

used system: Roman numerals
used tools: pushaxe + crowbar
special quality: own counting system influenced
by junction of pillar
Region of Westphalia

Case study:
Haus Ostermann build in 1845
Haus Heimann build in 1829

used system: system of Roman numerals
system of Arabian numerals

used tools: pushaxe + crowbar + snatch hook
special quality: combination of two individual systems
arabian numerals replace number of position the wall

Haus Ostermann build in 1845
Haus Heimann build in 1829
Region of Bohemia and Silesia

Case study:

used system: system of Roman numerals
used tools: pushaxe + crowbar
special quality: information of position are marked on original peace of timber and on the adjoining peace

4. REFERENCES


Revitalisation of the umgebinde houses by private investors in the Zgorzelecki District in Lower Silesia, Poland

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ABSTRACT: The article discusses the unique umgebinde house construction typical to the Region of Lower Silesia in the Zgorzelecki District, Poland. German term umgebinde is used in Poland interchangeably with przysπw or konstrukcja przysπpowa, therefore umgebinde will be used also in this article to address this particular type of structure. The typology of umgebinde house will be presented on the bases of the case study of Chata Kołabczyjka, successfully relocated from Wyganiec Ziętrawkie (Weigsdorf) to Zgorzelec (Goerlitz). The article will focus on the private owners of such houses and their activities aiming at preservation of this architectural heritage. Some legal, financial and technical problems connected with renovation of umgebinde houses in Zgorzelecki District will be highlighted in order to point out the direction for further research.

1. INTRODUCTION

Basing on the list of German migrants to Chile compiled by Emilio Held (Held 1965, pp. 7-214) a list of Silesian towns and cities (from which the migrants had emigrated to Chile) was created. Consequently, it allowed mapping the original settlements of the carriers and enabled restricting the focus of study to the Lower Silesia.

Figure 1: A map created on the bases of the lists of German migrants to Chile (Held 1965, pp.7-214)
2. STATUS OF PRESERVATION OF TIMBER HOUSES IN ZGORZELECKI DISTRICT

A research excursion with the aim of deepening the knowledge of constructions used in timber housing from the nineteenth century in Silesia has proven, that the matter of if the houses were preserved so that one could learn from them was no longer as important as how they were preserved. As it turned out, despite being unique examples of traditional timber construction, many represented very bad status of preservation.

Figure 2: Selected pictures of the houses in the Region of Bogatynia and Jelenia Góra illustrating the poor status of conservation of selected houses [Author’s photographs].

2.1. Preservation of timber structures by state-owned institutions

Some of the houses, however, have been well preserved. Their life has been extended by relocating to open-air museums. There are a lot of such museums to be found in the region of Silesia. Fig. 3 illustrates the localisation of the most popular of them.

Figure 3: A map of Silesia open-air museums created by the author on the bases of the internet sources.

2.2. Preservation of timber houses by private owners

Some buildings have been partially preserved via historical documents that now may be found in the local Archives. For instance in Wroclaw (Breslau) Archives, or its’ local filial in Jelenia Góra (Hirschberg). Those, however, are mainly incomplete or not up-dated, therefore they do not provide sufficient information concerning the buildings (Many of the documents had been destroyed during and after the II World War).

It is impossible to relocate all the historical timber houses from the region of Lower Silesia to open-air museums. Allowing the private investors to save the houses is, however, an alternative. More and more private owners in Germany or Czech Republic appreciate the historical value of these unique wooden constructions (idea of Umgebinde as a means of promoting the process of revitalization of the old houses [3]). Looking at both German and Czech examples of numerous revitalized umgebinde houses one may see that in order to preserve this precious architectural heritage also in Poland, future (and present) owners of such houses need to be aware of, not only accessible means and methods that can be used when revitalizing such buildings, but also of the historical value of those buildings. Getting to know the probable technological and legal difficulties would certainly enable finding the renovation methods that would respect the traditional timber structures of those historical buildings.
When investigating examples of umgebinde houses during the field trip, it turned out, that there are examples of the private-owned houses that have been successfully revitalized. In order to take a closer look at the typology of the umgebinde house, but also at the factors, that lead to successful preservation of such houses (as opposition to many examples on the verge of collapsing due to neglect), Chata Kołodzieja (This present name for the house was given by the last owner, and may be translated as “The Wheelwright’s House”) was used as a case study.

3. EXAMPLE OF A SUCCESSFUL CONSERVATION – CASE STUDY OF CHATA KOŁODZIEJA

The said house was originally situated in Wigancice Żytawskie (Weigsdorf), a place that has been erased from the map due to the fact, that neighbouring area had turned out to be rich in coal and has consequently been turned into a coal mine (KWB Turów)[1]. This house was the only one saved from destruction, resulting from coal mining politics in this region, thanks to a successful relocation to Zgorzelec (Goerlitz) by Ms. Elżbieta Lech-Gothardt (2005) [1]. Consequently, the aforementioned house stands for many more that were not spared (see Fig. 6 representing former Wigancice Żytawskie with its traditional urban structure).
3.1 Characteristics of the umgebinde construction on the bases of the case study

Destroyed Umgebinde houses from Wygnancice Żytawskie, as well as over 250 still existing in the region of Lower Silesia are examples of an unique type of construction that can be encountered only between the Region of Saxon Switzerland (pol. Szwajcaria Saksońska, ger. Sächsische Schweiz) and Karkonosze (Riesengebirge) in Euroregion Nysa (ERN).

This type of construction was most probably born as a result of the clash of two distant cultures. When the settlers from Western Europe came across Slavic Peoples (pol. Słowianie, ger. Slawen) (who had been using their massive-wood construction to build houses covered with hay and straw). They have upgraded their methods of construction by using vertical beams to support the roof and upper floors (making the construction of the house independent of the walls). The beginnings of this construction can be traced back to as far as Middle Ages, therefore the construction itself may be definitely labelled a regional, if not national, architectural heritage. This technique of building houses was popular even after introducing in the eighteenth century legal obligation of avoiding wood-only constructions (issued by Prussian administration)|[1]. Now, there are over 17000 of those houses ERN (when counting not only Poland, but also Germany and Czech Republic)|[3]. The structure of an umgebinde house consists of three basic parts illustrated by the Fig. 7

![Figure 7: Components of the Umgebindehaus (Bennett, 1988).](image)

In Chata Klobdzieja one also finds other typical features of umgebinde: the ground floor with kitchen, bread-fireplace and workshop separated by a small entrance chamber (now ground floor is used as restaurant and exhibition room) and upper floors (former bedrooms and storage, now guest-rooms). The whole Chata was topped by a mansard roof covered with slates (after relocation used for paving the floor). The only change has been introduced to the ground floor where the fragment of a former wall is now a pillar. All the wooden construction, including the roof structure is original. Fig.8 below illustrates the structure of the building.
Figure 8: Plans of the house (from the top): Cellar, Ground Floor (before and after the relocation) with the change in plan, Upper Floors and Roof [drawn by the author on the bases of the sketches made accessible by the owner of the house].

When it comes to the exterior, it is worth pointing out that as much as 80% of the original wooden windows were preserved and used in the relocated object, others were reconstructed in order to keep the outlook of the facades that would as much as possible approximate the original house (According to the owner - Elżbieta Lech-Gotthardt) [See Fig. 9]

Figure 9: The facades: West and East, drawn by the author on the bases of the sketches made accessible by the owner of the house.
Not only is this building a specific monument of the umgebnde construction, but also serves as an unquestionable source of knowledge of timber constructions used in the eighteenth and nineteenth century in the region. By taking a closer look at certain details of wooden connections a whole array of various methods of connecting wooden elements that had been typical for Silesia at that time is to be found (see Fig. 10 below).

3.2 Problems with the relocation

The very fact that the house had definitely been worth saving from the coal mining-triggered destruction had not been sufficient. Since no institution took care of the houses from Wigancice Żytawskie, it required a lot of strong will and financial resources to carry out the relocation of Chata Kołodzieja (As the owner admitted in the interview carried out during the field trip in November 2009) (V).

It took as long as five years to get a permission for placing the relocated house on a new lot and three years to apply for ministerial Founding. The petition for founding was supported by signatures of such renown people as: architects, conservator of monuments, the mayor of Gryfów Śląski, representatives of the German community from Budziszyn. Despite that, the founding has not been as high as expected and covered only the cost of window-renovation (approximately 200 000zł, which amounts to approximately 50 000 Euro). It was only a part of the whole cost of relocation (approximately 500 000zł, 125 000Euro) (V).

The process of relocation itself took only twenty-six days (three days of taking the building into pieces, fourteen days of wood conservation, nine days of constructing all the pieces back together at their new destination) it was proceeded by extended process of preparation. It included numbering and marking of all the elements of the construction, cleaning and proper treating of the wood (some larch logs were as long as seventeen meters and required special treatment) (V).

In the carefully reconstructed interiors of the Chata Kołodzieja one may see many remnants from the past, such as some everyday-use objects, old toys, tools. The walls metaphorically as well as literally tell the story of the house since they are covered with paintings illustrating the history of the house (see Fig. 11).

The present owner got in touch with the ancestors of the past owners and the last owner Mr. Ernst Stephan (who is still alive). The key that he used to lock the door of the house for the last time in 1947 is now hanging next to the entrance. It was handed to the new owner by Mr. Stephan as an act of gratitude for saving the building (see Fig. 11).

The historical atmosphere attracts the customers of the restaurant and hotel (as this is the present function of the building). Not only makes it Chata Kołodzieja a busy meeting place, but also helps to popularize the uniqueness of this type of wooden construction and puts it in the minds of all the visitors for good.
In 2006 UmgebindeLand foundation rewarded the owner for this successful relocation (1). As mentioned before, this process did cost the owner a lot more time, money and effort than anticipated. Fund raising process is long and exhausting, especially in Poland. Theoretically one may apply for founding from the Interreg III (Part of EU Structural Funds Program), but Polish law admits only foundations and societies, not private owners to benefit from the Program. Moreover, Polish societies can only plan expenses for education, therefore it is so hard to get any help when it comes to the finds for renovating such houses (1).

Technical condition of those houses, especially in the Polish part of ERN is not good. By definition, those houses are more exposed to the deteriorating influence of the weather conditions than any other buildings (wood, clay as basic materials). They are very prone to destruction due to lack of renovation. Additionally, the renovations that are carried out without necessary knowledge and skills may become even worse.

For this reason, getting to know the examples of professional revitalizations may serve as a source of precious knowledge. It would facilitate the work and cost estimates and therefore hasten the process of revitalization for future owners of such houses. The lessons ought to be learned from both successful and unsuccessful revitalizations of such buildings. Consequently, a lot of research needs to be done in the field of documenting them. Both, well-preserved and improperly revitalized houses should be carefully investigated and described in order to serve as a guideline for future (and present) owners.

4. CONCLUSION

It seems that only the private owners of umgebinde houses are responding to the need of preserving this architectural heritage (in contrast to the State-owned institutions). They are the ones, who allow groups of children to visit their houses during trips, in this way introducing the awareness of historical values of such buildings (5). They are the ones who set up blogs, where they passionately describe the minutest details of those houses (6) and run societies for preservation of umgebinde houses (7). Many ambitious initiatives are being undertaken by Bogatyteckie Stowarzyszenie Rozwoju Regionalnego (Association for Regional Development) such as revitalizations of whole streets (1-go Maja street and Armii Czerwonej Street in Bogatynia) or the Day of Open Houses (i.e. 25.05.2008, 31.05.2009, and planned for 30.05.2010) (7), as well as Fundacja Kultury Ekologicznej Dwór Czarnie that organizes revitalization workshops for the owners of historical buildings (8).

It is worth pointing out, that the majority of those umgebindeactivists are not professionally connected with architecture or building-preservation. Consequently, there is an urgent need of directing the attention of architects and engineers to this problem.

The very fact that this timber heritage is precious source of knowledge from the field of history of architecture, not only for Poland, or Europe, but also for such distant countries as Chile, should strengthen the motivation for further studies of the problem of preservation of the historical wooden constructions in the Zgorzelecki District of Lower Silesia. Private investors are the alternative to low-subsidized open-air museums. Their passion and financial resources are irreplaceable foundation to build awareness of the value of this architectural heritage. Despite (oftentimes) lack of professional training, they serve as irreplaceable source of knowledge of the history and the structure of the houses.

It does not, however, mean that they should be left on their own. This potential ought to be supported by professional studies. Consequently, a lot of research is yet to be done in the field of investigating the tools for help that may be provided by professionals from various fields to the private owners. Placing the activities of the private investors in the broader than local (UmgebindeLand) context (as, for example, Timber constructions of the Lower Silesia as a set of architectural patterns taken by the emigrants to as far countries as Chile) undoubtedly adds importance to the efforts the private investors undertake in order to preserve umgebinde houses and may be interpreted as yet another reason for further research.

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Catalysts of Space Patterns
The migration of the Tyrolean style to Silesia

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ABSTRACT: When in 1837 a group of 427 Protestants from the Austrian Zillertal left their country and settled in the vicinity of Erdmannsdorf in Silesia, they built a colony of around 60 houses in traditional Tyrolean style that are apparently 1:1 copies of their Austrian archetypes. While it is obvious that the migrants as carriers of their architectural heritage brought ideas to Prussia, this paper attempts to show how the Prussian state worked as a catalyst to materialize those ideas by giving all the financial, professional and jurisdictional support that was needed to turn ideas into reality. The work draws on the study of the genesis of the colony and thereby the identification of the aforementioned Prussian input and concludes with an outlook on the situation in Chile, were at around 50 of the Tyroleans migrated in the 1850s.

KEYWORDS: Tyrol, Silesia, Chile, Migration

1. FROM AUSTRIA TO SILESIA

The Zillertal in the Austrian state Tyrol had been facing protestant influence since the 16th century. Although the 1781 Edict of Tolerance should have guaranteed free religious practice with equal rights, a group of around 600 protestants that planned to found a congregation and practice their faith was rejected by the Tyrolean government in Innsbruck. Additionally “acatholic people” were exposed to repressions that affected both their parochial and secular life: they were no longer allowed to buy property, their books were confiscated, they were no longer allowed to marry and they were not buried on the cemetery. (Heim et al. 2006, p. 4 ff)

Consequently the Tyrolean protestants were given the choice either to stay and rejoin the catholic church, to relocate to a protestant area within the Austrian empire (which would have been Siebenbürgen in what is today Romania) or to leave the country. (Ibid.)

As 100 years ago Prussia had granted asylum to protestants from Salzburg, the leader of the Tyroleans, Johann Fleidl, went to Berlin in Mai 1837 and officially asked Frederick William III of Prussia for asylum. In this context he also mentioned the wish of the Tyrolean community to be settled in a landscape that shows similarities with the Alps. (Beheim-Schwarzach 1875) After a preliminary approval in June, the final official covenant was made in July. The reasons for this decision can be found in pure christian love and charity: the low number of around 400, the level of education of the Tyroleans – many were illiterates – and their profession – most were farmers – make it unlikely that Frederick William III of Prussia was pursuing economic interests. (Beheim-Schwarzach 1875 and Donat 1887)

Between August and September 1837 a total number of 416 people from the villages of Brandberg, Finkenberg, Hippach, Mayrhofen, Ramsau im Zillertal and Schwendau left their home and headed to Prussia where they arrived in the village of Schmiedeberg (Kowary) 3-4 weeks later after a trip of around 700km. (Heim et al. 2006)

Meanwhile Prussia had decided to settle them in the Hirschberger Tal (Jelenia Góra valley) at the foot of the Riesengebirge – the highest Prussian mountains thus following their wish to live in a mountainous area. (Wende 1898) Schmiedeberg remained their home for almost one year. Nonetheless as it was more of a refuge – the Tyroleans lived in rooms that the people of Schmiedeberg had offered to them – than a home and although a committee was formed that took care of the most important things like education this interim solution had to end the sooner the better. (Beheim-Schwarzach 1875)
2. A NEW OLD HOME

In the years of 1838 and 1839 the Tyrolean colony was finally erected, the first house was moved into at the beginning of November 1838. Around 100 of the Tyroleans were agricultural workers and as such occupied and hosted by Silesian farmers which left a number 297 people that needed a house. (Donat 1887)

According to their financial background they could be distinguished into three categories:
1 – wealthy farmers: 37 families, 201 persons with a fortune of 100,000 Gulden, 9 servants and 34 horses
2 – owners of small houses: 11 families, 55 persons with a fortune of 15,652 Gulden + 7000 to come from Austria
3 – tenants: 5 families, 30 persons, 10,100 Taler (Beheim-Schwarzach 1875)

Of the required 56 plots, 35 were bought with the money that came from the sales of the Austrian farms, the poorer families had to lease their plots. An overall amount of 1646 morgen (420ha) was required. As it was rather difficult to find a coherent area of this size the decision fell to the village of Erdmannsdorf (Myslakowice) where Frederick William III owned plenty of land that he was willing to give away.

Finally three villages were built: Hohenzillertal with 10 houses and 58 inhabitants, Mittelzillertal and Niederzillertal with 41 houses and 184 inhabitants. An additional 15 houses with 55 inhabitants were built in the old village of Erdmannsdorf. (Donat 1887)

The newly built houses show a large resemblance to their Austrian archetypes, thus following the wish of the Tyroleans who had asked for this - more expensive - type of house. Given their financial and professional background the question arises how it was possible that their ideas came true. To find an answer to this question it is useful to recall the idea of packages and carriers that was first introduced by Berger/Kellner/Berger in their publication Homeless Mind: Modernization and Consciousness (Berger et al. 1974) and revisited by Peter Herle. (Herle 2008) This concept subsumes the content of the stream of influence, an unlimited supply of raw materials that is waiting to be distributed - under the term packages which is then broadcasted to every part of the planet using the means of our network society as carriers. Obviously in the pre-globalized world it was the brains of human beings migrating to foreign countries that played this role of the carrier.

By applying this concept to the situation in Silesia it is obvious that the Tyroleans worked as carriers of the mentioned architectural patterns. At this point is helpful to upgrade the previously explained concept by introducing the idea of the catalysts who sustain the carriers and help to materialize their packages i.e. ideas.

3. THE TYROLEAN COLONY – A CLOSER LOOK AT THE CATALYSTS

The aforementioned resemblance between the houses in the Zillertal and the ones in Erdmannsdorf (Myslakowice) results from several parameters. In general these parameters can be distinguished into the knowledge and the idea of identity that the Tyroleans brought to their new home as carriers on the one side and to the support by the Prussian protagonists that worked as catalysts which finally made it possible to finance and thus materialize this knowledge and these wishes. By taking an in-depth look at the process under which the colony emerged, these carriers and catalysts and their interaction will be identified.

Prussia’s instruments

Immediately after the migration was approved, two provisional agencies with the aim to deal with the organization of the migration were founded: The “Königliche Immediat-Commission zur Regulierung der Zillerthaler Angelegenheiten” that

Figure 1: Exodus from Austria (Bzdziach et al. 2002)
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

consisted of court chaplain Strauss. Geh. Oberregierungsrat Jakobi and Staatsminister von Loftum. This agency was situated in Berlin and served as the highest authority, however it did not have any direct contact with the Tyroleans. The second agency, the “Comité für die Angelegenheiten der Zillerthalner Untertanen” served as a mediation authority between the one in Berlin and the Tyroleans. Consisting of Friederike Gräfin von Reden, Graf Matuschka (Kreislandrat) and Hauptmann Flügel (mayor of Schmiedeberg) it was located close to the Tyroleans. Amongst others it organized the accommodation in Schmiedeberg, did all the necessary correspondence and distributed the money that was provided by the Prussian state. Later on it was this committee that provided the Tyroleans with a school a church and finally the houses. (Beheim-Schwarzach 1875)

Friederike Gräfin von Reden – the “mother” of the Tyroleans

Friederike von Reden was the president of the second agency. Besides her work in the commission, she was personally involved, always listening to the Tyroleans and being their direct contact for any kind of problems. (Wende 1898) Additionally she especially helped the Tyrolean women by teaching them how to spin, by providing them with wool and by cooking for celibates. (Beheim-Schwarzach 1875)

Purchase of Land

As previously mentioned, the colony required a total amount of around 1600 morgen (408ha). As it seemed nearly impossible to gather this amount of coherent land, Frederick William III of Prussia decided to provide the missing land by giving away his property.

10 families settled in the Vogtsches Vorwerk in Seidorf, 7 in Rustikalstellen in Erdmannsdorf, together covering 350 morgen, The remaining 1250 morgen were provided by the Prussian King who thereby supplied 75% of the whole colony. (Wende 1898)

Those that were able to pay immediately became owners, the rest was given the sites using the system of emphyteusis allowing them to change it into property whenever they were able to afford it. Additionally the Tyroleans were exempted of any duties that were usually linked with the possession of property. (Wende 1898)

33 families with 120 persons were able to buy the sites immediately and therefore requested a total of 755-922 morgen, 42 families with 121 persons were dependent on subsidies and requested 573-680 morgen, another 8 families with 44 people had no fortune and applied for a total of 70-88 morgen which they planned to lease. (Beheim-Schwarzach 1875) As the money of Tyroleans did not suffice, another 18.500 Taler that were originally planned to be used for the houses were provided by the government. (Ibid.)

Planning, Organisation & Finance: The Role of Kaiser’s Administration

As much as the Tyrolean style was requested by the Tyroleans, it is important to mention that it was Frederick William III who explicitly preferred the more expensive but according to his eyes more stylish Tyrolean way of building the houses. (Wende 1898) As a consequence a total of 263,400M was estimated for the construction of the houses.

Again one can distinguish three groups that requested a total of 64 houses (Beheim-Schwarzach 1875)

1 – 25 houses, 9 small ones, 11 medium ones 5 double
2 – 32 houses, 15 small ones, 8 medium ones, 9 double
3 – 7 houses, 6 ordinary ones and one medium one

As the whole operation was facing a lack of time, it was the king who wrote to the Oberpräsident of Silesia and asked to him to provide any available support to make it possible that the houses were completed before the end of autumn 1838. (Wende 1898)

 Builders and technicians were asked to work out a budget and to create plans that were then checked and approved by the high commission. (Beheim-Schwarzach 1875) All labour on site was announced in the local papers. (Ibid.)

A total of 86.400 Taler was needed for the first houses. As the budget was 98.000, another 12 houses were built during the winter. In contrast to the land that had to be bought by the Tyroleans, for the cases of housing all expenses were covered by the Prussian state which leads us to an overall gift of 141.500 Taler. Consequently the whole operation was much more expensive than expected: While it was planned to spend 400 Taler per family, 350 per capita was the actual cost. (Wende 1898)

Opening the debate: Building a model house

Not only did the Prussian state organize and finance the erection of colony, it also created a model house which was used as a built example to discuss the houses to come. This house was 74 ½ foot long, 34 ½ wide, had a balcony on two sides in the upper floor and a brick-wall between dwelling and stable. It was covered with shingles and 10-14 Bohlenstangen, finally covered with stones. The ground floor was made of rubble stone, the upper floor of timber framework that was later filled with bricks. The Tyrolean leader Johann Fleidl was asked to visit this house and find out if it is appropriate for his people. (Beheim-Schwarzach 1875) Despite some minor differences concerning size and individual finishing, the house was approved. (Bzdziach et al. 2002)

Construction Phase: Expectations Fulfilled

The plans for the houses were made by Baumeister Frey, the supervisor of the whole operation was the Regierungsbaurmeister Oeltze. The actual construction site was guided by two Prussian conductors that were coordinating a total of 421 carpenters
and 187 bricklayers. Although it is said that some Tyroleans assisted in the actual construction, their role was mostly that of a controller that told the conductors as soon as they considered something to be not appropriate. (Beheim-Schwarzach 1875) One example for this role can be found in the question of the fireplace: The conductors planned to build regular Prussian ovens while the Tyroleans asked for their traditional Tyrolean-style ovens. Not only were those more expensive (15 Silbergroschen) they – according to the Prussians – were also less performant than the Prussian ones. Although the Comité preferred the cheaper ones, the Tyroleans threatened to ask the king directly. As a result of this, the Tyrolean ovens were built and a consequence of this, benches around the ovens had to be built as well, again raising the price. (Beheim-Schwarzach 1875)

**Equipment**

As an addition to the actual houses the Tyroleans were also given the required equipment: blacksmith Hechenleitner was given a whole forge and most of the Tyroleans were provided with furniture. (ibid.)

![Carriers and catalysts system](image)

Figure 2: system of carriers and catalysts (created by the author)

### 4. RIESER HOF, ALTER DORFWEG 14

The previously described houses of this colony break ranks as they at the one side have nothing to do with the prevailing types in Silesia and at the other appear to be a 1:1 copies of the austrian archetypes. The following chapter will elaborate on this using one example.

**History**

The case of study is the Rieser-Hof, Alter Dorfweg 14 (Starowiejska 14) in Erdmannsdorf. Its first owner Balthasar Rieser was one of the previously addressed rich farmers: In Austria he had owned a house with kitchen and living room as well as 10 chambers, 2 basements, 13 stables, an alp for 36 cows, 150 centners of hay, 28 morgen cropland, 12 morgen grassland, 40 morgen forest and 104 Morgen pasture land plus a fortune of 3649 Taler. (Beheim-Schwarzach 1875) In 1841 he gave away his property to his niece Theressia Rahm, born Rieser who sold it to Silesians in 1863. (Feishauer, unpubl.) Although this house – as well as the other Tyrolian houses – was declared a monument as soon as 1979 (Nasz 1981) it was continuously deteriorating until it was bought and renovated by a group of Austrian investors in the 1990s.

**Typology**

The house combines dwelling, barn and stable under one roof, following the austrian typology of the Streckhof. As such it is relatively long (around 24m), 9m wide and 9m high.
Construction

The whole building stands on a mason base that also functions as a leveling of topography. The 2-story dwelling part is built in massive timber (Schrottholz) which – depending on the orientation of the facade - is cladded with wooden planks whose gaps are finally sealed with wooden slats. Compared to this the stable in the middle of the house is completely built in mason. Finally the barn and the hayloft which is situated above the stable are built in a timber framework that is today cladded from both the inside and outside. Older photos show the inside without the the complete cladding, making the structure visible nevertheless the infill is cladded as well, making it impossible to clearly come to a conclusion. The previously mentioned model house used brick as an infill. Although it is possible that it was done the same way here as well, photos from the renovation phase with the cladding partially removed raise the idea that no infill existed at all. This idea is stressed by the fact that the adjacent space was not for dwelling purpose and thus needed no heating at all.
Several special characteristics separate the house from the typical Silesian farmhouse. Amongst others these are:

- roof pitch of only 25-30 degrees which is typical for the alpine region as it prevents snow from falling down, creating an additional insulation layer, but not for the Silesian region were steep roofs are prevailing.
- purlin roof (Pfettendach) which is typical for region of southern germany. As a more sophisticated construction method it allows larger trusses than the prevailing couple roof.
- all-side overhang of the roof of approximately 1m to assure protection of facades and access.
- Continuous access balcony in the first floor on three sides of the building, often used for drying the laundry.
- two-story massive timber construction which can be found on the bohemian side of the Riesengebirge but not on Silesian one were the Umgebindehaus with an upper floor that is structurally independent from the ground floor prevails.
- Massive use of decorative elements such as the balustrade of the balcony, the beam heads and the purlins.

**Archetype**

The Zillertaler Regionalmuseum in Zell am Ziller is a farmhouse that was relocated from its origin in Schwendau. Although it dates from 1713 it is a sound example for the archetype of the Tyrolean houses in Silesia. A comparison of the overall appearance as well as of some details shows strongest resemblance between the copy and the archetype where we find all the above mentioned characteristics.

![Figure 4: Hof Ental, Zell a. Ziller (www.gemeinde-zell.at)](image)

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**5. CONCLUSION: CATALYSTS OF SPACE PATTERNS**

The previous chapter was meant to take a closer look a the emergence of the colony and thereby identifying the relevant actors. The process of the foundation of the colony was to a large extent dependent on the input of finances and resources by the Prussian state; it organized the foundation and construction, it designed the houses, organized the actual construction and covered the expenses. By this it clearly stressed the important role of the prussian state as a catalyst, be it the king itself or its servants. Additionally it showed the role of the Tyroleans that were in any scale seeking for a replication of their origin: be it the landscape, be it the house or be it the oven. However as they were lacking professional and – in many cases – financial background, it can clearly be seen that this wish could only be made possible through the help of the external catalysts, reducing their role to that of a consultant. Consequently the question whether or not something like architectural heritage outlasts the process of migration cannot be generally answered. It appears to be not a decision the migrants make themselves although they’d wish to. Instead it is to a large extent defined by the circumstance they face when they arrive.
6. OUTLOOK: CATALYSTS IN CHILE?

This system of carriers and catalysts becomes most important when one continues to follow the traces of the Tyroleans: For unknown reasons (some say that it was due to the landscape which was too different from the original Zillertal, which seems odd as a first letter after the arrival was talking about the large similarity with their origin [Beheim-Schwarzach 1875]) plenty of the Tyroleans left Silesia very soon. Amongst other places, Chile was one of the main targets of their second migration that took place in the 1850s. By the year of 1860, 55 Tyroleans (the families Brugger, Fleidl, Hechenleitern, Heim, Klocker, Kröll, Schönheir, Fankhauser, Heim and Winkler [website: zillertaler Auswanderer von 1837] had left Erdmannsdorf for Chile, one last Tyrolean followed in 1889.

There they settled at the shores of lake Llanquihe, most of them in what is today Los Bajos, some in Frutillar, some in Totoral and some in Puerto Varas. One of them – Bartholomäus Kröll – even went 500km north to Humán close to Los Angeles. At least two houses from this early time (Hechenleitern, built around 1860 in Línea Pantanosca and Klocker, built around 1900 in Los Bajos) are still existing. However they show no resemblance to the Tyrolean tradition thus it seems as if everything got lost during the second migration. Given the impetus the Tyroleans showed in Silesia, the short time of only 20 years they stayed there and fact that they continued to cultivate their traditions in Chile it is likely that the carriers were still holding their information but lacking the catalysts – a thesis that could be proofed by a yet to come repetition of this investigation in Chile.

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Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
The analysis of degradation of selected half-timbered inns of Lower Silesia.

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ABSTRACT: The aim of this essay is to indicate the issue of wrong usage and maintenance of antique timber buildings of Lower Silesia as well as presenting its consequences – degradation and deprivation of these buildings. Three sample inns from the given area, which have the typical half-timbered structure, are depicted in this work. Furthermore, it has been made an attempt to investigate the function of these objects through the ages, pointing out the multiculturalism of Lower Silesia and an influence of Poland, the Czech Republic, Austria and Germany. General function of an inn in Poland was discussed, indicating the functional difference of the inn on Lower Silesia. What is more, historical documentation of three chosen inns was presented enabling comparison between original and current condition. The current condition could be evaluated thanks to materials, which were gathered during the visit. It has also been made an attempt to explain the reason why they were degraded. Moreover, positive trend towards renovation of regional architecture on terrain of Lower Silesia has been shown, giving the transposition of “Wheelwright’s cottage” as an example.

1. HISTORICAL OUTLINE OF SILESIA

Silesia has a very complex history. It is a place, where through the ages there have been crossing influences of four different countries: Poland, the Czech Republic, Austria and Germany. This land is historically linked with the Slavic Peoples, who have been the residents there in 8th and 9th century. In about 990, Lower Silesia, after the period of Czech regime, went under the reign of Piast dynasty – founders of Poland. The region was becoming one of the richest provinces of Poland, thanks to the development of settlement, mining industry, trade and craftsmanship. At the same time, political disintegration was taking

Figure1: Silesia in 19th century (left map) and location of historic area in modern Poland (right map)
2. AN INN IN THE COUNTRYSIDE

The description of an inn was chosen as a subject of this essay because it has played a vital role in the countryside as well as in an awareness of its residents. In the light of the above, it can be concluded that people immigrating to Chile between 1850 and 1890 could have taken along a custom of building such constructions. Another reason was that inns, regarding their functions, enable to investigate the changes of usage of these buildings. Three sample inns were chosen from the region of Jelenia Góra, precisely from: Bukowiec, Gruszków and Miskowice. These buildings are placed in the close neighbourhood of towns of origin of some Chile’s emigrants (based on Emilio Held’s book Documentos sobre la Colonizacion del Sur de Chile).

2.1 Historical outline of an inn in Poland

The history of an inn in Poland dates back to early medieval times. The first record on this subject appeared in Gall Anonymus’ “Chronicle of Poland” in the first half of the 12th century. Initially, inns were the lord’s personal properties who granted privilege of running them to orders, knightage, and in times of German colonization, local government. They were responsible for bringing colonists. From 1494, function of an inn was directly related to “propilation” laws (privilege granted to the owner of a land to produce bear, alcohol and honey and to import these articles and profit from it).

Since time immemorial, an inn was inseparable element of polish country’s life. A building had many functions: e.g. restaurant and accommodation for travellers. Duties collectors often worked there. It was not only a meeting place for people and a place for folk plays but also a kind of shop where one could buy alcohol drinks or agricultural and craft’s products. The closer to today’s times the more an inn was fusing with everyday’s country’s social life. Christening parties, weddings and wakes have been organized there. In inns people did business, and on Sunday’s evenings went on dancing. It is a good moment to point out a bit wider function of an inn on Silesia. The name itself indicates that so called „Gerichtskretscha“ (a court inn) was not only a place described in the previous paragraph but also a kind of a town hall or commune’s building. It was a meeting place of the elders and country’s self-government. A hall of an inn was at the same time a place of local residents’ meeting, who have been gathering for minor trials – so called minor court law, i.e. local government’s privilege.

At the beginning, inns were built by the main routes or at the main crossroads. Later, when inns started to specialize in selling alcohol, they were built in villages to gain profits. If a village had a more regular shape, the inn was one of the main elements located in the middle of it, by the marketplace. Otherwise, in places where the building site had less crystallized structure, the inn was located nearby church or manor house, which were the landmarks of a village [see Fig.3-5]. One of the main reasons to locate inns nearby churches was that formerly there were less of them. Because of that, all the people from the nearby villages arrived in the holidays to take part in a holy mass. The role of inns was therefore to provide those people with accommodation.
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

Figure 3: Map of Bukowiec village

- House
- Inn
- Church
- Local road
- Dirt track
- Lake

Legend
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875

Figure 5: Map of Miedzowice village
2.2 Bukowiec – A court inn

The history of Bukowiec put its name down on history of Silesia’s towns. In 14th century, in times of German colonisation, Bukowiec became property and headquarters at the same time of von Zedlitz Prussian family. Afterwards, till the end of 16th century it belonged to Reibnitz family. Finally, in 1785, the village was inherited by Fryderyk Wilhelm von Reden. He was a minister of mining – an enlightened and educated person with artistic aspirations. From his initiative a court inn of half-timbered structure was built in the village in 17th century. The building was then rebuilt in 19th and 20th century. This inn is one of a few examples of buildings that have preserved its original function – nowadays there is a bar.

![Figure 7: Court inn in Bukowiec between 1900 and 1936](image)

2.3 Gruszków – A court inn

The origins of a Gruszków village date back to the turn of 14th and 15th century. At that time however, it was not an independent settlement but a part of a nearby city – Kowary. The village was originally the property of earl Schaffgotsch. In 1635, the property was took over by then ruler of Silesia, Austrian emperor Ferdinand II, who then sold all the property, together with Kowary, to earl Hans von Tsherin in Czech Republic. For over one hundred years Gruszków remained a property of von Tsherin family. Finally, in 1747, the village became the property of Kowary city.

In 1786 in Gruszków there was a school, two water mills and lived 16 serfs, 51 crofters and 53 cottagers. The settlement was famous for its very tasty beer. The building of a half-timbered court inn was constructed at the end of 18th century, and then rebuilt in 19th century. Until the beginning of the Second World War, the inn was the only beannery in the village. At present, it is a private property and slowly falls into ruin.

![Figure 7: Court inn in Gruszków between 1900 and 1936](image)
2.4 Miszkowice – A ducal inn

A ducal inn in Miszkowice is the oldest one among the described and best documented at the same time. In medieval times the village was probably a part of monastic estates. Later, it was property of von Stauffgotsch family. J. S. von Vagten owned the village between 1634 and 1670. Then, it belonged to von Czernin lords. Finally, Miszkowice became the property of Kowary city.

The inn was constructed in 16th century in a place where, as legend announces, in 11th century was a hunting manor of Czech prince Michael. First documented evidence about rebuilding the inn appeared in 1624 and 1664. In 17th century it was extended. It was probably the time when a part of log cabin construction was created. This extension was continuation of an original building structure into the west direction. In 1772 the whole manor was bought by Johann Gottlieb Bönsch, which was documented by the inscription “1772 JGB” on the joist in the main chamber. The new owner did another reconstruction of an inn and probably built the highest storey of wattle-and-daub structure, which was supported by timber frames.

![Figure 8: Ducal inn in Miszkowice between 1920 and 1936](image)

This place went down into German history as a secret meeting place of leading Prussian politicians and reformers. In 1810, a minister, baron Karl von Stein and minister of foreign affairs, prince Karl August von Hardenberg, who was at that time an expatriate, met in this inn to create a reformation plan. It happened after the victorious campaign of Napoleon. A special monument was built on the hillside of “Kościę Kostka” in memory of this event. The inn itself earned then the sobriquet ‘ducal’. After the Second World War a family, who have not been overhauling it, inhabited the inn. As a consequence, it faded into oblivion. The northwestern part of the building collapsed during the gale in May of 1996. While describing the presented inns, it is worth mentioning that they have something in common. They all have quite the same history. They were created either as a gastronomic or administrative facility. Along with the development of public infrastructure, they remained its function up till the Second World War. Afterwards, the continuity of the function has been lost under the influence of many factors. The subsequent degradation of the buildings leads to decline of local identity.

3. THE ANALYSIS OF PRESENT CONDITION OF DESCRIBED INNS

In order to analyse the changes in condition of presented inns there has been done a research based on the historic documentation. The main purpose of the analysis was to compare the present condition with the condition form the interwar period, which was when the continuity of the inn’s function has been lost. The historic documentation (old photos, sketches, descriptions) has been compared with the author’s own observations and materials, gathered during the local vision (28.11.2009 – 30.11.2009). As a result, the following conclusions has been reached:

First of all, all the presented buildings are in a very poor condition. They are neglected and slowly fall into ruin.

3.1 Bukowiec (Fig.9)

1. – The change of roofing: partial covering of a roof with an asbestos-cement roofing material, which is improper. Traditional materials used for covering roofs in half-timbered houses are ceramic tiles, slate tiles and shingles.
- Plastering of a wattle-and-daub construction and applying modern insulation systems (e.g. polystyrene) leads to dampness in the building. Antique buildings should be insulated using mineral wool, i.e. insulating plates or granulated cellulose fibres. Despite thermo insulating properties, insulating plates have also capillary and pervious features, which prevent vapour form liquefying and mould form spreading.

- Change in composition of elevation – which disturbed arrangement of windows. The old window opening was bricked up and a new one, in a different place and having different proportions, was created instead.

- The half-timbered construction has been bricked up, which lowered the value of a building and damaged it. Consequences are quite the same as previously – possibility of dampness in a building.

2. Neglect of wooden elements, which started to fall into decay. The most popular ways of protecting timber from harmful influence of atmospheric conditions in 19th century were natural methods such as linseed oil and wooden tar. More affluent owners used special paints, which protected the building and were decorative elements at the same time. Traditional paints, mainly lime and oil paints based on varnish, were made out of natural ingredients. They were enriched with coarse-grained pigments, which prevented from evaporation. Modern substitute is silica dispersion paint. All the synthetic paints should be avoided because they are too thick and limit, or even disable, circulation of the air. It can lead to decaying of wood.

3. Bricking up the door, which disturbed the composition.

4. Change of windows - incorrect installation of windows without muntins made of improper material (plastic instead of wooden windows were installed). Furthermore, windows should be equipped with ventilators that enable circulation of the air, otherwise moisture can occur in the building.

3.2 Gruszków (Fig. 10)

1. The change of roofing – partial covering of a roof with a sheet metal, which is an improper material.

2. Neglect of structural timber elements – lack of proper conservation led to rotting of wood. As a consequence, holes have been created in places where formerly there were planks.

3. Filling cavities in the wall with red bricks, which, in this case, is also an improper material.

4. Falling-off plaster. A traditional way of putting clay is as follows. Firstly, netting made of sticks is fixed to the wooden surface of a wall, which prevented the clay from sliding down. Then, wet clay is placed. After drying, a thin layer of fresh plaster, made of lime and fine-grained sand, is put on. Five layers of lime paint are then put on still fresh plaster. As a result, an indelible surface is created. However, polluted atmosphere and acid rains can lead to gradual degradation of this surface.

5. Partial rebuilding of an inn using bricks, which has no relation with the rest of the building, and an installation of windows without muntins.

3.3 Miszkowice (Fig. 11)

1. Improper material used for filling the walls. Installing additional doors and windows, which disturbed the composition.

2. Bricking up and changing the proportions of a few window openings.

3. The overall neglect of a building. The remains from 1996’s collapse of the building have not been ordered yet.

4. Filling cavities in the wall with red bricks, which is an improper material.

Two important issues should be mentioned while talking about Miszkowice. This building is on the list of heritage registers and is under the custody of conservator of the buildings from Jelenia Góra. After the gate and partial collapse of structure of a building in 1996, an architect company carried out renovation of the whole building. It included consolidation, partial reconstruction and protecting the structure of a building. It is not known however, if the improper choice of materials used for rebuilding the broken wall was a matter of mistake of design, shoddy workmanship or willfulness of residents. It has been found out that there is a conflict between the local council and the conservator of a building. (Fig.11/1)
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Figure 9. Bukowice (Buchwald) - Analysis

1. [Diagram showing architectural details of the Bukowice building with Annotations]
2. [Close-up image of the building's roof structure]
3. [Another angle highlighting the roof's construction]
4. [Enlarged view focusing on the roof's beam structure]
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
There are a few reasons why it happened:

- **Breaking of administrative and cultural continuity after the Second World War.**
  As it was mentioned in part I, after the Second World War, people from the eastern part of Poland were forced to settle Silesia. The eastern part of Poland was then controlled by Russia. At the same time, former inhabitants of Silesia, German people who had been creating the identity of this region, were displaced. The architecture and culture were outlandish, and even hostile to some extent, for the new residents. It has to be remembered that people from Poland, and other conquered countries, had anti-German attitude, which was caused by the war cruelty. After-German estate was treated as war booty. The emigrants, who had lost all their properties in eastern Poland, were forced to adapt as a home any given building, even if it was destroyed by the war. They had to fulfill their basic needs in a makeshift way, sometimes up till now.

- **Inadequate knowledge about renovation of timber buildings and possibility of adopting them for the current use.**
  The owners of these buildings are often not aware that they are part of a local landscape. It is because they are spread across separate locations in a city or village. After the war, all the educational and media action was concentrated on promoting Piast dynasty culture (i.e. typical polish culture) and polish roots of Silesia. Since only a couple of years, along with the unification of Europe, local and regional identity has been widely promoted and treated as a ‘homeland’.

- **Incorrect decisions form the past – wrong administration**
  Disastrous decisions made in the past include demolition, reconstruction and change in elevation of timber buildings. It was caused by ignorance about the region and lack of financial funds for the proper renovation. During the Second World War, an enormous damage has been done in Poland. Some of historic and architectural monuments were completely destroyed. That is why all the efforts and funds were allocated for reconstruction of essential polish monuments. Reconstruction of complexes of buildings or event the whole cities (e.g. Warsaw) are definitely worth mentioning. Unfortunately, the possibility of renovation of Silesia’s monuments was therefore limited.

- **Impeded access to financial help – red tape**
  Nowadays, the main problem is that private owners do not have the access to financial help. In order to get some money, every single building has to be on the list of heritage registers. This means that every, even the smallest change in the building, has to be made under the restrictive regulations and with the conservator’s knowledge. Moreover, the owner of a building is obliged to collect all the documentation about the building, which can take sometimes several years. The law, an act from 23 July 2003 about historic preservation, restricts it. It is very specific and private owners are often not able to meet the demands of it, so that they simply do nothing. Another obstacle for householders is impeded access to European Union’s funds, such as “Kraina domów przys. upowyczy” (The land of half-timbered buildings). These are assigned for unions, associations etc, which do not exist due to the history of Silesia. Lack of precise inventory and often-unregulated property law are also issues. The local authorities neglected them after the Second World War. At that time, in communist countries, and Poland was a Russian colony, all the goods had to be common and public so that private property was not protected. This kind of attitude has unfortunately lasted up till now in some places.

4. **SUMMARY**

Despite perennial neglect of protection, renovation and proper usage of timber buildings on Lower Silesia, there have occurred some positive changes in the approach to the regional Silesia’s heritage in recent years (related to Poland’s accession to the European Union).

![Figure 12: Building after the renovation and relocation to Zgorzelec](image-url)
During the visit on Lower Silesia, for instance, I met Mrs El bieta Lech-Gotthardt, who rescued a few half-timbered houses from degradation. One of them is a house in Wigancice. In 1996 the village was liquidated and all the houses demolished. A concept of moving the house to Zgorzelec occurred at that time. The whole process lasted for many years (1996 to 2003). After a long period of collecting the necessary documentation and permissions, the house was finally relocated. It was then renovated, applying the recommendations of conservator. Almost 80% of original elements were preserved during the renovation. Currently, there is a restaurant and a hotel there. It is a well-prospering and willingly visited object both for tourists and fans of regional architecture (Fig. 12).

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Oral tradition from Mrs El bieta Lech – Gotthardt (Zgorzelec) and Mr Marcina Pliszaka (Bogatynia)
Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
Mechanism of selected joints and the correspondence to the structure
a study on the joints and structure in Westphalia

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Berlin University of Technology, Berlin, Germany

Author Shan, Chen, Author Nils Rogel Carmona, Co-Authors of the Group Field Research
Berlin University of Technology, Berlin, Germany

ABSTRACT: The joint, as the basic component in the timber structure, plays an essential role in the stability and integrality of
the entire system. Different location of the joint determines the force it endures in that very point. However, the selection of
the joint is always influenced by various factors, and whether it meets the requirement of the structure is doubtable. By analy-
izing the structure and the mechanism of the joints which are widely used in Westphalia, the author concludes the appro-
priate joints and the shared characteristics on several nodes. Furthermore, the study about the specific cases in Westphalia
reveals the usage of the joints and whether their selections correspond with the required force endure mechanism.

1. INTRODUCTION: LOCATION OF THE STUDY

1.1 Brief Introduction

This study is based on the topic of Carriers of Space Patterns and Construction types – German Migration and Architecture in
Chile, 1850 – 1875. In the previous work, we investigated the spatial, cultural and technological backgrounds and origins of
Germans, who emigrated to Chile in the named period. The work of our field trip group concentrates on the region of
Westphalia in the Northwest of Germany.
As shown in Figure 1, between 1850 and 1875, the immigrants came from several locations, which are the rural outskirts of the cities of Werl, Delmold, Bielefeld, Brilon, and so on. What's more, a high concentration of people is found in the rural area of Werl, Soest according to our findings in the list of Germans who arrived in southern Chile made by Emilio Heldt as well as a similar list made by Ingeborg Schwarzebeck de Schmalz. So I choose the countryside of Werl, Lemgo and Detmold as the objectives, because nearly two thirds of the people came from there in all.

In the first part of our literature research, we concluded the houses in Westphalia into four typologies. However, our field trip and the interviews with Mr. Joachim Heine of the Technical School for Preservation of Construction Monuments and Renovation of Old Buildings (Fachschule für Baudenkmalspflege und Altbaume neuung Detmold) and Dr. Hubertus Michels, head of Department Historic Construction of the LWL-Open Air Museum Detmold (LWL-Freilichtmuseum Detmold) and further literature research in the specialized library of the Open Air Museum Detmold, showed that in reality houses of different construction types, of different material usage and of different ornamental detailing can be found in all parts of Westphalia and a high variety of different typologies can be found in a relatively small area.

That is to say, in Westphalia, the four typologies coexist. Therefore, it is much more practical to concentrate the houses in the specific locations rather than the typological research. By analyzing the cases, much more information may be found.

1.2 Climate and its impact on the structure

There are several climate elements that have a profound impact on the structure. Snow is the most important one. As shown in the following table, in Westphalia, the snow is about 0.8 KN/m². [Robert von Halasz, Scheer, 1996, p.233]

![Snow force in Westphalia](image)

Figure 2: Snow force in Westphalia (Robert von Halasz, Scheer, 1996, p.233)

2. CORRESPONDENCE OF THE JOINTS TO THE STRUCTURE

2.1 Explanation of selected houses and structure overview

Although we analyzed four structure typologies in the literature research and found all of them in the field, this essay would focus on one of them by studying eight cases from the field trip. All of them share the same structure frame, "the box frame". These eight timber houses are located in either Werl or Lemgo or Detmold, as shown in figure 3. Some of the houses were reconstructed during the last two centuries, but the structures are preserved well and kept the originality.

![Location of the eight houses](image)

Figure 3: Location of the eight houses [made by author]
Though vary in scale and area, the plans and spaces of the houses are similar with each other, which can be concluded into the following aspects:

First of all, all of the houses are two-floor high and originally used as the housings for the farmers. The space in the center is two-floor high and used as dining and living room. The cooking area is at the end of the central space. The areas surrounding it are used for sleeping and other activities and are all one-floor high. Figure 4 shows house 2 in Lemgo, which we studied elaborately in the last section of the seminar.

Secondly, few ornaments are found on the walls, except the words on the gate which are curved in the timber. No colourful ornament is decorated and only small and a few windows are found on the external walls.

Furthermore, the materials of the structure are timbers, while the roofing is made of tiles. The material of wall is a little bit more various. House 1, 4, 6, 7 and 8 used calcareousness and timber, while house 3 used brick and timber and house 2 used all of these three materials.

Although the numbers of bents and other timber elements are different, to study the structure and the joints, I simplify the structures of these 8 houses into one typology, which is based on the structure of house 2 and analyze this basic structure typology to clarify the mechanism on selected connecting points.

I would not analyze in detail about the structure. To the contrast, the study on the structure would focus on its connecting points and how these points connecting different elements. Thus, the forces on the very points and mechanism of the joints are both essential to study the correspondence of the joints.

### 2.2 Basic structure typology

The basic structure frame of these eight cases can be concluded as the sketch in figure 5. To disassemble it, the most important component is the bay, which is consisted by two bents and several connect wares. To be more specific, the vertical and horizontal pieces are used as the main structure frame, while the toeing ones are found occasionally which act as the stabilization components. As for the roof structure, purlins are short ones between the bents, no vertical supporting components are used. The stability is confirmed by the collar ties. What’s more, the base is composed of the green sand stones. The typical structure system is as shown below. (The number of wares is just schematic, so is the location of the collar ties and knee brace)
2.3 Force-carrying analysis of the structure

In order to identify different joints on different connections, the structure model that is concluded and simplified from the cases is taken as the typical one to be analyzed about the load-carrying capability to show the mechanism of the structure. In addition, the analysis has taken the wind and show force into account. (see figure 6)

![Figure 6: force bearing analysis of the basic typology structure](image)

2.3 Force mechanism on the connecting points

Although the force is various at the every point, the basic structure knowledge reduces them into four categories: moments, shear force, compression and tension. As shown in the pictures, every joint is suffering from all of these four forces. However, further study reveals that the detailed diversity and the categories can be summed up. In this article, I would select several nodes to analyze which are typical and representative. And then verify the joints used in Westphalia. Following is the load-carrying analysis (according to the software “Framework”). In order to make the analysis in the further step with a much clearer objective, I omit the forces that are little enough and conclude them to show the most important force that they are enduring:

<table>
<thead>
<tr>
<th>Position of the joint</th>
<th>moments</th>
<th>shear forces</th>
<th>compression</th>
<th>tension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
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</tbody>
</table>

It can be concluded that all of these five joints are enduring the shear forces and the moments that it caused. And the joint at rafter feet and the one at the connection of rafter and collar tie are bearing compression, while others with two timbers are bearing compression and tension at the same time. To be more specific, we can category them into four varieties: First one is the joint that mainly endures the moments and shear forces, which includes the knee-brace joint; the second one is the joint that bears the moments and shear forces, as well as the compression, which includes the joint at rafter feet and the post-beam joint; while the third category is the joint that primarily bears the compression, which includes the post-sill joint; the last one, however, is the joint that endures all of these forces, which includes the rafter–girt-post joint.

2.4 Correspondence of the joints to the structure

To study about whether the joints are suitable for that very point, the interpretation about necessary components to resist these four forces is essential. Generally speaking, to resist the tension and the compression, the area of the bearing surface is of most importance, while the timber behind the mortice is mainly to resist the moments and shear forces (see Figure 7). [Yeomans 2003, pp.85-91]

What’s more, tenons on the ends of joists or beams are shallower than the members they are supporting and this will limit the shear that can be transmitted by the member. In order to solve this problem, two methods would be effective. First of all, it is useful to form a notched end support, so that the rules given in the code of practice for this condition might be applied to the load-carrying capacity. For a notch cut above the bearing a higher shear stress may be allowed on the tenon. However, the notch must be no greater than half depth of the beam. Secondly, in the joints where the shear load is loaded on the narrow face of the tenon, the notch could be used to increase the capacity of mortice and tenon loaded at right angles to the grain. These joints include the ones where the main transverse floor beam is tenoned into the rear post of the frame, or where a collar is tenoned into principal rafters, or where posts tenon into principal rafters or tie and have an inclined brace bearing against them.
Two pictures on the right of figure 7 are the application of these two methods on the typical location.

Figure 7: area to resist the tension and compression: bearing surfaces to take the horizontal and vertical components of the rafter thrust (left 1), area to resist the moments and shear forces: The area behind the mortise loaded in shear parallel to the grain (left 2), floor joist joint and joint between beam and transverse beam (right 2), joint between the post and the beam (right 1). (Yeomans 2003, pp.85,87,90)

In addition, on the joints that are bearing the tension, special attention should be placed to the connection to the tie bar. For example, on the connecting point of the rafter and the wall plate, it is possible there has to be an appropriate connection between them and the tie beam. Possible solutions include using the lap dovetail. Given the angle of the dovetail, rather high compressive stresses can be produced.

In our trip to the open museum in Detmold, we found documentation about the joints used in Westphalia. Concerning the joints on those five specific positions, various mortices and tenons are documented. Nevertheless, they can be summarized into several varieties and their correspondences to the structure are as the following.

<table>
<thead>
<tr>
<th>Table 2.1: Mechanism of the documented joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force bearing</td>
</tr>
<tr>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>joint at rafter feet</td>
</tr>
<tr>
<td>Position of the joint</td>
</tr>
<tr>
<td>Typical documented joint</td>
</tr>
<tr>
<td>Assessment</td>
</tr>
<tr>
<td>Other documented joints</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2.2: Mechanism of the documented joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force bearing</td>
</tr>
<tr>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>rafter-girl-post joint</td>
</tr>
<tr>
<td>Position of the joint</td>
</tr>
</tbody>
</table>
To conclude, most of the joints are well correspondent to the structure; while some of them need to be improved, especially the rafter-girl-post joints.

### 3. CORRESPONDENCE OF THE CASE TO THE REQUIRED MECHANISM

However, after the field trip, I found that the usage of the joints in the timber houses is much simpler and similar to each other. This article would choose 8 cases the study the correspondence of them to the required mechanism.

#### 3.1 Joints documentation

Based on the analysis of the joints in Westphalia, joints documentation of these houses would focus on the five specific positions correspondingly. However, because of the limitation of field trip, some of the data are failed to be collected.

<table>
<thead>
<tr>
<th>Force bearing</th>
<th>Position of the joint</th>
<th>House 1</th>
<th>House 2</th>
<th>House 3</th>
<th>House 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moments, shear, force, compression</td>
<td>joint at rafter feet</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
</tr>
</tbody>
</table>

post-beam joint

<table>
<thead>
<tr>
<th>Moments, shear, force, compression, tension</th>
<th>rafter-girl-post joint</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>House 1</td>
<td>unknown</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3.2: Mechanism of the joints from field trip

<table>
<thead>
<tr>
<th>Force bearing</th>
<th>Position of the joint</th>
<th>House 5</th>
<th>House 6</th>
<th>House 7</th>
<th>House 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moments, shear force, compression</td>
<td>joint at rafter feet</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
</tr>
<tr>
<td>compression</td>
<td>post-beam joint</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td></td>
</tr>
<tr>
<td>Moments, shear force, compression, tension</td>
<td>rafter-girt-post joint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moments, shear force</td>
<td>knee-brace joint</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td></td>
</tr>
<tr>
<td>compression</td>
<td>post-sill joint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.2 Joints analysis

The joints in these 8 cases share lots of similarities. Thus, I induce the similar ones and make analysis on them.

<table>
<thead>
<tr>
<th>Force bearing</th>
<th>Position of the joint</th>
<th>Joint</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moments, shear force, compression</td>
<td>rafter feet</td>
<td>The shear load is loaded on the narrow face of the tenon. The rivet is used to stabilize the joint. Good to resist the moments and shear forces. Insufficient area as the bearing surface, bad to resist the compression. However, the tenon is on one side, which might lead to torsional moment and had better be improved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The shear load is loaded on the narrow face of the tenon. The rivet is used to stabilize the joint. Good to resist the moments and shear forces. Sufficient area as the bearing surface, good to resist the compression.</td>
<td></td>
</tr>
<tr>
<td>post-beam join</td>
<td></td>
<td>The notch is of proper length, while the shear load is loaded on the narrow face of the tenon. The rivet is used to stabilize the joint. Good to resist the moments and shear force. The shoulder increases the area of the bearing face, good to resist the compression.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The notch is of proper length, while the shear load is loaded on the narrow face of the tenon. The rivet is used to stabilize the joint. Good to resist the moments and shear force. The area of the bearing face is a little small, bad to resist the compression.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The notch is of proper length, while the shear load is loaded on the narrow face of the tenon, good to resist the moments and shear force. The shoulder increases the area of the bearing face, good to resist the compression.</td>
<td></td>
</tr>
<tr>
<td>Moments, shear force, compression, tension</td>
<td>rafter-girt-post joint</td>
<td>The angle of the tenon can produce rather high compressive stresses, good to resist the tension of the beam.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The angle of the tenon cannot produce rather high compressive stresses, bad to resist the tension of the beam.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The angle of the lap dovetail can produce rather high compressive stresses, good to resist the tension of the beam.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No effective way to resist the moments and shear force. Sufficient area as the bearing surface, good to resist the compression.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The shape of the tenon is effective to resist the moments and shear force. Insufficient area as the bearing surface, bad to resist the compression.</td>
<td></td>
</tr>
<tr>
<td>Moments, shear force</td>
<td>knee-brace joint</td>
<td>The notch is well shaped, and the shear load is loaded on the narrow face of the tenon. The rivet is used to stabilize the joint. Good to resist the moments and shear force.</td>
<td></td>
</tr>
</tbody>
</table>
3.3 Summary of case study

To indicate the correspondence of the joints of the cases, the table below is used for assessment.

<table>
<thead>
<tr>
<th>Table 5: Summary of the joint assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Joint at rafter feet</td>
</tr>
<tr>
<td>House 1</td>
</tr>
<tr>
<td>House 2</td>
</tr>
<tr>
<td>House 3</td>
</tr>
<tr>
<td>House 4</td>
</tr>
<tr>
<td>House 5</td>
</tr>
<tr>
<td>House 6</td>
</tr>
<tr>
<td>House 7</td>
</tr>
<tr>
<td>House 8</td>
</tr>
<tr>
<td>Shear force, compression</td>
</tr>
<tr>
<td>Rafter-raft joint</td>
</tr>
<tr>
<td>Knee-brace joint</td>
</tr>
<tr>
<td>Compression</td>
</tr>
</tbody>
</table>

As shown in the table, the knee-brace joints to endure moments and shear force and the post-sill joints to resist compression are most satisfied. However, the rafter-raft joints which are used to bear moments, shear force, compression and tension are most ideal. The reason is that the joints between the beam and rafter don’t response to the moments and shear forces quite well. What’s more, the rivets used widely in the cases are effective for the stability of the joints.

4. CONCLUSION

To conclude, most of the recorded joints correspond to the structure quite well. The selection of them fits to the variety and force characteristic on that very point. However, in the field, less correspondence is achieved. First of all, most of the joints have sufficient areas to resist the compression except some of the joints at the connecting points of rafter and beam whose compression faces are small as a result of the need to endure moments and shear force and some used to connect the posts and beams without shoulders to increase the area of bearing face. Secondly, the mechanism of the joints to resist the tension works variously, which is decided by the shape of the tenons. The ones with angels and more complicated shapes are much more effective. What’s more, the mechanism of the joints to endure the moments and shear force is of more complexity, which is closely related to the position. To be specific, the joints at rafter, post-beam joints and knee-brace joints are usually with proper notch, enough areas and the narrow faces of the tenons are in the direction of the force, which are essential to resist the moments and shear force. While the rafter-raft joints tend to be lack of efficiency, because there are no such areas or faces. Last but not least, the rivets are useful to keep the stability of the joints and structure. To improve the existing joints, the following aspects should be elaborated, especially the ones that resist several kinds of forces. Firstly, the joints to endure the compression should have enough bearing area, especially when the timber elements that resist forces are vertical ones. In that case, shoulder is most important to transfer the force. Secondly, angels and cusps on the top should be arranged at the connecting point with tension. Furthermore, the notch should be neither too long nor too short to confirm both the area to endure the moments and the shear forces and transfer them.

As part of the construction heritage in Westphalia, the technology of joints would be immigrant to Chile. As the correspondence of the joints to the structure is not that satisfied how the Chilean used the joints would be a question. What’s more, it is also questionable whether they would correct the unfitness or whether they would transit them to be suitable for the local climate and living habits. In the next phase of the research in Chile, more attention could be paid to these questions.

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6. ACKNOWLEDGEMENT

First of all, I would like to thank Prof. Renato d’Alençon who not only directs me to develop my idea but also elaborate my thesis. I learned how to develop a topic and do research and how to study in a context that is unfamiliar for me. In addition, I also want to give thanks to Mr. Joaheim Heine who provided much information and showed us his timber house which is very important for our research. Also, I would like to thank Dr. Hubertus Michels, who afforded much information from the museum in Detmold. Without them, this essay would never be completed.
Physical Property of Construction Materials in Westfalen

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ABSTRACT: The material perspective of the representative wooden house in Lemgo, Westfalen, is one of the research directions, as the traditional structure, the traditional use of space, and the traditional techniques. There were some personal reasons of house owners of choosing construction materials. For example, the former owner replaced the planks in the gable by bricks, because of showing off his fortune. The current owner used brick and stone as wall materials, instead of parts of clay, because he wants the wall to have better stability. Besides, the decision of choosing materials were rather rational and scientific. There were three original materials that were used in the house: oak wood, clay, and sandstone. Most of them have the best physical property compared to other materials can be easily found in Westfalen. For instance, oak wood has the best mechanical duration among others, while sandstone, used as foundation, has excellent absorbent ability.

INTRODUCTION

The bulk of Westfalen migrants, 1852-1875, mainly came from three cities: Werl, Detmold, and Lemgo (related to the group field research). Wooden houses in Werl are neither original nor representative enough after decades of reconstruction. Instead, suitable cases can be found in Lemgo and Detmold. Finally an original wooden house in Lemgo, owned by Mr. Heine, used as a dormitory of carpenter students, was chosen as the object of the research.

Figure 1 specific house in Lemgo (Field trip resource)
1. RESEARCH QUESTIONS

1.1 Research questions
As stated, the former house owner chose oak wood, clay, and sandstone from other materials when constructing the house originally. The key question is, do the materials have any advanced natural properties than others? Why did they choose oak wood as structure, clay as wall, sandstone as house foundation in physical perspective?

1.2 Working field
The objective of this research is to find out the convincing reason of choosing materials from comparison of physical properties of available materials in Lemgo, Westfalen. Some arguments from others, in technical points of view are related. Historical or cultural arguments are not within the scope of this research. It could be next aim of further research, for it is a scientific way to researchers to relate their arguments to the perspective of culture and history to go deeper in their researches.

1.3 Aim and hypothesis
The aim of the research is to compare the natural properties of available materials in Lemgo, Westfalen. And the hypothesis will be: The materials they used in the house were rational choice in that region, for they have advanced properties, in according to scientific analyses and comparisons.

2. INTRODUCTION AND COMPARISON OF MATERIALS

In fact, those construction materials used in the specific house, are not the only available materials in Westfalen. For example, beside oak, other trees as beech and pine are also productive in German forests, especially in Nord-Rhein. In the meantime, adobe and burnt brick are also no less than straw clay, which was used as wall material in the specific house. Because of the uncertainty of decision making when choosing materials, a comparison of all available materials is needed. The comparison shows physical properties of materials, which could explain the rationality of choosing materials.

2.1 Comparison of structure materials (timber)

2.1.1 Introduction of timbers in Westfalen
a) Oak wood
Oak tree is prevalent in almost all of Europe, from Norway, Russia to central Spain, Sicily and Crete in latitude. It accounts for 10% of the total number of trees in Germany. Oak can achieve 50 meter height in its growth, with a diameter up to 2 meters. It is considered as one of the woods have highest densities and was widely used in ship industry. Oak stock is consistently well-grown, which is suitable to be a construction material, for it could provide a straight stock up to 15 meters without any knots.

b) Beech
Compared to other native deciduous trees, beech provides a primary contribution to the German forestry and timber industry. Currently, the ratio grows up to just over 20% of the German forest. The hardness of beech wood is high, for the wood has a high density and hardness, but is not weatherproof. Beech is a self-clean wood. The amount of beech has been rapidly declined. Beech has an excellent attribute in absorbing moisture, but in the meantime, it is flammable. And beech dust may cause skin irritation, asthma, and even cancer.

c) Pine
There are over 120 species of pines, which can be divided into two groups according to their density, or its specific gravity: Soft Pines to about 0.45 g / cm³, hard Pines over 0.45 cm³. The wood of the pine is soft, pliable and easily to split. Pine editable good, rotate, and shrinks slightly. Wood dust can also cause irritation of skin.

2.1.2 Comparison of physical properties of timbers

<table>
<thead>
<tr>
<th>Table 1 technical data (<a href="http://www.holzwurm.de">www.holzwurm.de</a>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density g/cm³</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>Oak</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Beech</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pine</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

2.1.3 Outcome
The introduction and the table illustrate that both oak and beech have excellent mechanical properties and considerable output, which represents good accessibility. But the flammability of beech wood is a fatal defect as structure material. The natural hardness and hydroscopicity makes oak an excellent structure material.

### 2.2 Comparison of roof materials

#### 2.2.1 Introduction of roof materials

In westfalen it is desirable to protect the room from harsh weather in the winter time, as rain and snow, and to function as insulation, which demands the roof material a lighter load and better compressive duration, to deal with the load of snow, and absorbent ability and tightness in arrangement, to prevent the rainwater from entering the house. Based on the data collected from the field trip (Werl, Detmold, Lemgo, Münster), there are 4 possibilities of roof materials: burnt clay (mostly), stabilized soil tiles (seldom), earth roof and thatch roofing (only as roofs of secondary structures).

#### 2.2.2 Comparison of roof materials

<table>
<thead>
<tr>
<th>Material Characteristics</th>
<th>Earth roof</th>
<th>Stabilized soil tiles</th>
<th>Burnt clay tiles</th>
<th>Thatch roofing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Cheap.</td>
<td>-Cheap.</td>
<td>-Medium cost.</td>
<td>-Cheap.</td>
<td>-Cold.</td>
</tr>
<tr>
<td>-Good thermal qualities.</td>
<td>-Easy handling.</td>
<td>-Easy handling.</td>
<td>-Easy handling.</td>
<td>-Easy deteriorating.</td>
</tr>
<tr>
<td>-For earth houses in dry climates only.</td>
<td>-Local production of tiles.</td>
<td>-Good resistance to rain.</td>
<td>-Presents fire hazard.</td>
<td></td>
</tr>
<tr>
<td>-Not to use in earthquake areas.</td>
<td>-Medium resistance to rain and hurricanes.</td>
<td>-Burning of tiles needs much energy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2.2.3 Outcome

The table shows that burnt clay can easily reach the requirement of a roof in westfalen. Other materials, on one hand, fall in some crucial properties, such as mechanical duration; on the other hand, the life span of them is not so long as burnt clay, for which few original evidence can be found in the research.

### 2.3 Comparison of wall materials

#### 2.3.1 Introduction of wall materials

The massive wall construction in westfalen in the middle of 19 century, could be rubble stones, burnt bricks, adobe bricks, and stabilized soil. Massive walls are advisable in areas of high seasonal or diurnal temperature differences and cold nights and seasons because a massive wall has usually good insulation and heat storage capacities.

The walls also function as protection from rain and wind, heat and cold. Rainfall strikes the wall directly and by splashing up from ground surface. Some wind-borne rain has an inclination to the vertical of 30°-40°. Rising capillary water from the ground may saturate the low part of wall and timber poles and damage them. The wall must be allowed to evaporate the water. A wall construction can also insulate or conduct: absorb or reflect, and store the heat. The insulation, absorption and heat storage capacities depend on the materials used for wall construction. In addition, massive wall should be the protection against insects and animals as well.

#### 2.3.2 Comparison of wall materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Density g/cm³</th>
<th>Conduction W/mK</th>
<th>Porosity %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandstone</td>
<td>2.0-2.6</td>
<td>1.05</td>
<td>5.0-25.0</td>
</tr>
<tr>
<td>Brick</td>
<td>1.8</td>
<td>0.81</td>
<td>No data</td>
</tr>
<tr>
<td>Straw clay</td>
<td>1.4-1.6</td>
<td>0.59-0.73</td>
<td>No data</td>
</tr>
<tr>
<td>Adobe</td>
<td>1.0-2.2</td>
<td>No data</td>
<td>31.0-34.6</td>
</tr>
<tr>
<td>Wood</td>
<td>0.34-0.95</td>
<td>0.12-0.16</td>
<td>No data</td>
</tr>
</tbody>
</table>

#### 2.3.3 Outcome

Figure 3 Wall materials (Klaus Schillberg, Heinz Krieler, 1993, pp. 67; Kurt Schönburg, 2008, pp. 134; Paul Graham McHenry Jr. 1984, pp. 110; Winkler, 1994, pp. 209)
The chosen material, clay, has a medium property based on this comparison. There is still some data missing so far. Whatever, there is no convincing evidence by now that can prove clay has any prior property compared to others. The reason they chose clay as wall material might be the uncomplex technique and the lower cost. However, it is difficult to explain in the perspective of physical property.

2.4 Comparison of foundation materials

2.4.1 Introduction of foundation materials

A good house must have a good foundation, which is a most important part of the house. The foundation must have a good bending and torsion strength to keep the house from natural damage. As Germany is not located in any earthquake belt, the protection is mostly due to the strong wind, rain, frost, and moisture.

Based on the data collected from the field trip (Werl, Detmold, Lemgo), the original foundation materials generally have 4 possible options: natural stone (mostly, the bulk are sandstone), burnt brick, rammed earth (seldom), and wood (only 1 case). Foundations made of cement can be found in a few cases, but they cannot be representative if included in the research because they have been newly renovated.

2.4.2 Comparison of foundation materials

Figure 4 Foundations (Roland Stutz, 1981, pp.160)

<table>
<thead>
<tr>
<th>FOUNDATION POSSIBILITIES</th>
<th>Natural stone</th>
<th>Burnt brick</th>
<th>Rammed earth</th>
<th>Wooden post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economical aspects</td>
<td>Low cost</td>
<td>Low cost</td>
<td>Truly low cost</td>
<td>Low cost</td>
</tr>
<tr>
<td>Stability</td>
<td>Good</td>
<td>Medium to good</td>
<td>Poor to medium</td>
<td>Low to good</td>
</tr>
<tr>
<td>Skills required</td>
<td>Skilled construction workers</td>
<td>Experienced mason</td>
<td>Masonry worker</td>
<td>Experienced mason of carpenter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Carpentry and masonry equipment</td>
</tr>
<tr>
<td>Equipment required</td>
<td>Masonry equipment</td>
<td>Masonry equipment</td>
<td>Masonry equipment</td>
<td></td>
</tr>
<tr>
<td>Resistance to earthquake</td>
<td>Medium to good</td>
<td>Medium to good</td>
<td>Low</td>
<td>Low to good</td>
</tr>
<tr>
<td>Resistance to hurricane</td>
<td>Good</td>
<td>Medium to good</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Resistance to rain</td>
<td>Good</td>
<td>Good if protected</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Resistance to insects</td>
<td>Very good</td>
<td>Good</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Climatic suitability</td>
<td>All climates</td>
<td>Dry climates</td>
<td>Dry climates</td>
<td>Arid climates</td>
</tr>
<tr>
<td>Stage of experience</td>
<td>Widely used</td>
<td>Widely used</td>
<td>Traditional method</td>
<td>Traditional methods</td>
</tr>
</tbody>
</table>

2.4.3 Outcome

In according to the table, stone can be the most efficient material compared to others. It has excellent mechanical stability and resistance to nature, and the technique is accessible as well. Furthermore, it can adapt to all climates, and only need a low cost. As North-German Basin is productive of sandstone, [Encyclopædia Britannica] it is a convenient, efficient and rational choice.

3. DISCUSSION

According to the comparison of physical properties of available construction materials, no simple conclusion can be easily drawn. Oak wood, burnt clay tiles, and sandstone turned out to be the most suitable materials from physical perspective. But clay has not been proved to be the best choice as wall material in this approach. The result may imply that physical property is not the only decisive factor in choosing materials. Some economic and accessible restriction may be also necessary.
4. CONCLUSION

In accordance to the analysis, comparison and discussion, we can draw the conclusion that most of the materials they used in the specific house were rational choice in perspective of physical properties, while others were limited by other reasons, such as economic validity and accessibility.

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Carriers of Space patterns and Construction Types: German Migration and Architecture in Chile 1852-1875
The importance of tools and manufacturing technologies for the construction of timbre frame houses (Fachwerkhausbau) in 19th century rural communities in Westphalia and their application in contemporary preservation lore

Nils Rogel Carmona
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1. INTRODUCTION
In the lecture “CARRIERS OF SPACE PATTERNS AND CONSTRUCTION TYPES” the areas of origin of German emigrants, who decided to leave the country in order to start a new life in southern Chile, have been investigated. The focus are on the construction-technological aspects of agrarian timbre houses of the mid 18th to 19th century. The bases for the present paper derive from two main sources: the findings in the area of eastern Westphalia, especially of the surroundings of the cities of Werl and Lemgo; and secondly from the literature, that examines tools and work processes in timbre construction, which is not necessarily bounded to the geographical context.

2. METHOD
With the focus on Westphalia, in the first step, the broader context of social situation, economic influence, landscape and technology time and life will be presented shortly, as a base of knowledge on the area. In the second step the work of carpenters in the 19th century and their most important tools will be presented to finally compare these to the work of contemporary monumental preservation workers.

3. WESTPHALIA
The Society of the 19th century was socially divided into the four stands of:
- noblemen,
- clergy
- citizens and agriculturist

The social affiliation depended more on birth and property than on effort and therefore was hard to change. The stands were strictly divided in terms of political rights, way of life and contact and their organization was accepted in the society.

Up until the mid of the 19th century the bigger part of the population of Westphalia and Prussia was working in the agriculture and can be subcategorized into a variety of groups (The groups are being named according to their stand with a variety of regional synonyms like Vollbauern, Schulte, Schulze, Meier, Kleinbauern, Brinkens, Markkötter and others; Moos, 1984 p. 24 f.). About 20 % were part of the higher and middle class, whilst around 80% were of the poorest. The biggest part of the lowest class is represented by the lower peasants (Kleinbauern, translation by author) – a group consisting of Families with few acres of own or rented land, which they were allowed to use during a two to five years period adherent to the obligation to contribute to the squire.
In the 1840s the repeated come-together of agrarian (crop failures in the years 1770/71, 1802-1805, 1816/17, 1846/47) (Gudermann p.101), and production crises led to an overall negative trend for the daily life of agrarian families. The farmers, who were unable to pay their bills for goods or additional food, got sued (Ditt p.65) and the mortality rate rose, caused by the hunger and diseases, that came along, like dysentery. Reactions to this difficult situation by the people were different and emigration was one of them.

Besides the private property and, for smaller farms, the rented property, shared resources were part of the economical system of agrarian communities until the early 19th century. These shared facilities were water ponds, forests for animal feeding or timbre production, turfgrounds, adobe holes, etc. In the mid century, the community land was sold and became private property, mainly inhabited by non-agricultural workers, as the land was not big enough to feed a family (Gudermann p.274), which is part of a development, that changed the landscape significantly. From 1856 – 1910 more than 5,000 ha swamp were dehydrated and cultivated (Gudermann p.273).

Finally, a development in the opposite direction can be found in the development of new agricultural technologies (cultivation strategies, machinery, artificial fertilizer) in the late 18th century and their introduction on the fields during the first half of the 19th century–the outcome of the crop and animal production grew constantly.

4. HYPOTHESIS

The tools and traditional techniques of timbre frame construction have come back to live in theory and practice with the development and promulgation of monumental preservation regulations.

The form, design and construction of a timbre frame house and its single parts is highly influenced by

- the tools, that are used to prepare them and
- the skills of the carpenter

With the beginning of industrial production methods, both aspects lost importance and practical knowledge decreased until the 1970s and early 1980s. When the first monumental preservation regulations were established in Germany (March 11th 1980 in North-Rhine Westphalia (bau-rat.de), September 5th 1986 in Hessen (hessenrecht.hessen.de), December 3rd 1973 Hamburg, th.juris.de) and a demand for practitioners with knowledge of traditional construction and material preparation methods rose.

5. ANALYSIS

5.1 Determination of the most important tools

In order to be able to compare the work of contemporary practitioners in monumental preservation with the work of 19th century carpenters, a base of comparable aspects of each has to be compiled.

When looking into the toolbox of 19th century carpenters a variety of highly differentiated tools can be found (Schindler p. 94, Suits p. 221-237, 253 – 258). Through the comparison of literature (Suits p. 221-237,253 – 258. Hansen 1980 p.11, Großmann p.12, Schindler p.98) the most essential tools, that kept on being in use with only minor alterations throughout time, have been determined to be:

- the axes (carpenter’s axe [fig.03], mortising axe[fig.04])
- the adze (fig. 05)
- the saws (handsaw, crosscut saw fig. 06)
- the drill (fig. 07)
- the hammer & the chisel (fig. 08, 09)

6. PURPOSE OF THE TOOLS

The carpenter’s axe is (fig03, 04) used to straighten the trunk of the oak tree with the aim to gain a rectangular piece [fig.01]. The first step is to cut notches in short intervals into the bark. A previously marked line of grime helps to cut it straight. The intersections are then cut off, which leaves a straight and plane surface.

According to Hansen the work with the carpenter’s axe makes the surface of the timbre more resistant to the weather, as it works with the natural fibre direction of the wood, in contrast to the saw, which leaves a smoother and more plain surface, but cuts the fibres rather unfortunately (Hansen 1980 p.111). Großmann on the other hand states, that the outward timbre is never axed but always sawn, because of the higher smoothness. (Großmann 1987 p.12)

The mortise axe (fig.05, 06) is used for fine- planing surfaces and for detailing tenons and mortises.
The adze (fig07, 08) is used to cut pre-sawn tenons and fine-plane smaller areas of axed surfaces.

There are a variety of saws, which have very differentiated uses, but in this examination will be considered only the handsaw and the crosscut saw (for two workers). The handsaw has already been mentioned in the previous descriptions: it is used to precut joints or shorten smaller beams or laths. The crosscut saw (fig.10) is used to cut lengthwise through the trunk, in order to gain a multitude of pieces of a smaller diameter.

The drill’s purpose is to drill wholes for the wooden nails, that keep together each frame and finally the whole structure. When the building is new, the nails stand out rather long and can be hammered in the timbre, that, influenced by temperature and humidity grows and shrinks (“works”), so that stability can be preserved (fig.02).

Finally, hammer and chisel are used to chop tenons for the mortises.
7. **NOW AND THEN - A VISUAL COMPARISON OF THE TOOLS**

What has changed, what kept on being the same? In this chapter a series of uncommented photographs shall give an overview of the tools from nowadays and from the old days. The reader’s discernment is requested to evaluate the question and the hypothesis the investigation is based on.

![Fig.03, 04 carpenter’s axes](image1)

![Fig.05, 06 mortise axes](image2)
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Fig.07, 08 adzes

Fig.09, 10 saws

Fig.11,12 handsaws
Fig. 13, 14 handsaws

Fig. 15, 16, 17 drills

Fig. 18, 19 hammers
8. NOW AND THEN – A TEXTUAL COMPARISON OF THE TECHNOLOGIES

What has changed, what kept on being the same? The question posed in the previous chapter is now being answered from the author’s point of view, taking into consideration the information on technological and methodological mode of operation.

As a preliminary statement, the work of the carpenters in the 19th century has to be put into contrast to the work of a contemporary carpenter, who works on the preservation of a timbreframe house. The preservation of timbre frame houses is mainly a work of replacing broken and/or decayed parts of the house; it is not anymore the task to construct a complete timbre frame house and all its individual parts from the raw material. The amount of work and the amplitude of worksteps is highly reduced compared to the work of a 19th century carpenter. Nevertheless is a comparison in the narrow frame of tools and their appliance is considered to be legitimate.

Two major and obvious changes in the development of tools and appliance technology have to be point out:
- the change from wooden to metallic tools and materials in general
- the switch from pure manual, manpowered to mechanical, motorpowered production

In the following each tools’ contemporary counterpart and it’s use is explained. The carpenter’s axe is still in use, but only for academic purposes. There is basically no practical use in the daily work of a carpenter, even for a carpenter with a specialization in historic timbreframe house preservation. Oak tree trunks are cut by computer operated saws in highly mechanized sawmills and afterwards delivered to the construction site.

The adze is still in its original use. The surfaces of precut beams, columns and other parts is being treated with the adze to provide it with the original look and structure, which lets the new parts fit in easily into the original structure (fig.21,22).

The principle of tenon preparation also kept on being the same: the outer cutting lines of mortises are sawn – today by electric saws (see next paragraph) – and subsequently chopped out with the adze (fig.23-26).
The traditional saws have lost nearly all their significance in contemporary construction timbre production. Hand saws have been replaced by a variety of mechanical saws:

- electric buzzsaws, hand driven or mounted on a working desk
- hand driven electric jigsaws
- electric bandsaws

Crosscut saws have been replaced with mechanized sawing facilities, where tree trunks are entering on a band conveyor and leave as planks.

The drill has kept its form but has been motorized and is powered by electricity.

Finally, hammer and chisel kept on existing very close to their original form in function and purpose.

9. CONCLUSION

The previous comparisons have shown the similarities and differences between the tools and their contemporary counterparts. In conclusion it showed, that some tools have not changed much throughout time, as the adze, hammer and chisel, some have been electrified (drill and saws), some have taken over the domain of others (saw – axe) whilst others have disappeared from the toolbox of today’s carpenters (carpenter’s axe), at least in the form they existed back then. What does that mean for the evaluation of the hypothesis?

10. THESIS REVIVAL

Do the tools and traditional techniques of timbre frame construction have come back to live in theory and practice with the development and promulgation of monumental preservation regulations?

Yes and no. The awareness of tools, that once have been in use, their purpose and their application techniques have become an inherent part of carpentry and even more in specialized carpentry, like the field of monumental preservation. But the usage of tools has been undergoing the most recognizable change through mechanization and the introduction of electricity. Some of the tools, such as hammer and mortise are not as bounded to a certain aim and therefore kept on playing a crucial role in the work of carpenters. But then, it has to be admitted, that hammer and mortise have never been out of use and therefore cannot be hold to be accountable in the context of this paper.

The carpenter’s axe has been replaced by the saw and therefore has not got back to practical life. It remains a museum piece, that once in a while will be taken out, shown and used in a project or workshop of historic construction technology. The mortise axe on the other hand is still in use in the field of preservation technology: for fine-planing sawn surfaces or elaborating tenons.

The adze is de facto a part of a contemporary monumental preserver’s tool box. In this case the narrow operational area of this tool saved it’s existence, as it could not be replaced by another tool.
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The saws have been established on a grand scale, through their rather save and precise handling and therefore replaced other cutting or chopping tools.

Finally, it has to be stated, that, even though some of the tools have run out of the use, their method of function has not disappeared but just switched location. Even in the most modern and highly developed saw, be it a huge computer operated and complex machine or a electrical handsaw, the principle of function has not changed.

11. OUTLOOK

What the present paper tried to achieve is to give an overview of the most essential tools in carpentry and correlate them and their modes of use with the present. Within the narrow frame of the chosen topic and the demands of the course it was the aim, to elaborate a comprehensive and contextoriented paper. The next step in the bigger context of the course this paper originates from, would be to counterpart the outcome of this paper with investigations still to be done in Chile. Which of the techniques and tools were taken over the Atlantic Ocean? How did the fast deployment of sawmills and mechanization in general in Chile influence the use of the carpenter’s axe? How did the different timbre and the abundance of wood influence the form and appliance of tools?

12. BIBLIOGRAPHY


