

KÄRNAN - Kings, Knights and the Common People

The everyday use and spatial organization of
the medieval castle with 3D visualization

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Abstract

This master thesis is about Kärnan, which is a medieval tower that is situated in Helsingborg. Kärnan was built during the beginning of the 14th century and was part of Helsingborg's castle that belonged to the Danish king. This thesis investigates how the tower was used and which people were living and running the castle and how the castle affected the surrounding landscape. Fief holders were running and living in the castles while the Danish court traveled around and stayed at different castles owned by the king.

The medieval appearance of the interior is also discussed, and digital methods are used to test how the space have been furnished and used during the 14th century. An acquisition was performed with 3D laser scanner and image based 3D modeling was used, in order to create a digital replica of the building to use as a reference. The digital replica was merged with virtual furniture which was reconstructed using software computer-based visualization.

Keywords: Kärnan, Medieval castles, Middle Ages, 3D laser scanner, Virtual reality, 3D Image based modeling

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1. Introduction

Helsingborg is a city, with medieval origin, situated in the northwest coast of Scania, Sweden. The city is located by the narrowest part of sea and there is a clear view over to Helsingör, Denmark. In present day when you visit the center of Helsingborg there is a grand staircase which leads up a cliff to a medieval tower that is known as Kärnan. The medieval tower is placed upon what is called *landborg* in Swedish, which means a geologically formed plateau. In combination with the stairs and Kärnan's placement on the plateau, it's impressive still today when you look up at the tower. Ever since I was younger I have tried to imagine how medieval people must have viewed it when Kärnan was part of the medieval castle with a ring-wall surrounding it and with no stairs that invite you up to visit. Kärnan was built during the beginning of the 14th century and is the only above-ground remnant that is left of the medieval castle. The castle was an important part of the Danish kingdom because of its location by the narrow part of the sea, and the high plateau which gave a good natural defense (Eriksson, Drake & Carelli 2007: 11, 91). Today the tower is open for the public but there is little information provided inside about how it may have looked during the medieval period. It's understandable why there is little furniture and material in the tower: the stairs in the tower are twisted and narrow, which makes it difficult to move anything in and out of the tower. The entrance floor to the tower is not placed on the ground floor but instead on the first floor which has wooden stairs leading up to it. With this thesis I want to develop and test a digital workflow for the digital acquisition, which is used to visualize and analyze the second floor in the tower. Specifically this work aims to demonstrate the combination of "traditional" archaeological methods and digital data allows for a complete interpretation of the space in the past. During the Master's programme (*Archaeology – Theory and practice*) I used image based modeling techniques to acquire and visualize the outer façade of the medieval tower. This result was achieved using low cost equipment, such as a digital camera for the acquisition and Agisoft PhotoScan for the data processing (Figure 1). With this thesis it's my intention to continue developing this approach of merging different digital tools and methods in order to reach a deeper understanding of the impact that these technologies have on archaeological interpretations methods.



Figure 1. A screen capture of a 3D model of Kärnan. The model was mainly reconstructed with Image based modeling, however the stairs and the roof of the tower needed to be modeled from pictures (Holmqvist, Moulin & Roe, Group work in Master's Programme: Archaeology – Theory and practice).

1.1 Aim and questions

The aim of the thesis is to investigate how the medieval tower may have been used in a bigger perspective during the 14th century. With this thesis I want to study how the castle functioned and was used by its inhabitants. With the use of digital methods I want to visualize one floor of Kärnan, combining 3D laser scanner, image based 3D modeling and visualization techniques. Despite the possibility to access the tower, the lack of any furniture in situ, makes it difficult to perceive the relationship between room and furniture. The use of virtual reality is one solution to simulate how the space could have appeared in the past.

Kärnan has been in use for many centuries and a digital interpretation of the different phases that characterize this building would have been impossible to achieve within the time limit. For this reason I have therefore decided to focus on the second floor in Kärnan. This is a floor

that has been interpreted to have been used for everyday life (such as the baking oven) in combination with the elite (access to privy). I will also focus on the time period of the 14th century since that is the time when the tower was built and when it is most likely it have had the purpose it was built for.

My questions for this thesis are:

- What purpose did Kärnan have to the area?
- Who worked/inhabited it?
- What was the medieval appearance of the living space?

1.2 The name Kärnan (the Core)

As mentioned above, Kärnan is the name of the medieval tower that still stands above the ground in Helsingborg. The name Kärnan is in Swedish, so I will therefore explain how the tower got its name, and the English translation of it. Kärnan directly translated into English as “the Core”, which refers to the towers former function and placement in the center of the medieval castle (Eriksson, Drake & Carelli 2007: 35). After Helsingborg's fortification was taken out of use in the 1680's the tower was the only part of the medieval castle that wasn't torn down. The tower's surroundings quickly turned into fields and were called Tornvången, which means a tower field area. People didn't start to call the medieval tower Kärnan until the middle of the 18th century; before that the tower was simply called “Helsingborg's tower” (Eriksson 1994: 11) or “the old castle tower”. One of the earliest mentions of the name Kärnan is made by Carl von Linné in *Skånska resor* from the year 1749 (Eriksson, Drake & Carelli 2007: 35). Since Kärnan is the name that has been used since the middle of the 18th century, I will continue to use that name throughout this thesis when describing the medieval tower that stands still today. Otherwise when referring to the entire castle that was in use during the Middle Ages I will use Helsingborg's castle.

2. Research history

The medieval tower Kärnan has been the subject of many investigations and interpretations.

There have also been many renovations and restorations to the medieval tower.

Kärnan has had different purposes from the beginning of the 14th century when it was built, to the middle of the 17th century when it was taken out of use and was left standing as a landmark for the ships at sea and had begun to turn into a ruin. The town took an interest in the tower and Kärnan became a symbol for the city. In 1741 the state handed over the Kärnan to the town of Helsingborg with no charge with the condition that the tower wouldn't be torn down. The reason for this condition was that it had become such an important landmark for the seafarers (Eriksson 1994: 15ff). One other reason that could explain why the medieval tower was left standing, aside from being a landmark, was that during the 17th century there had developed a public interest in medieval castles, even though many of the castles were still in use. During the year 1666, the regency for the Swedish king Karl XI:s asked the priests to list the ancient monuments that were placed within their parish. With this request there came a list of which monuments that were to be registered, castles and fortifications was one of the categories. The medieval castles had been important monuments in an international perspective as well, since they were associated with war and other events which had have an impact on the national history of the kingdom (Hansson 2011: 11).

2.1 Early documentation and renovation

The oldest surviving inventory list of the castle comes from the year 1537 which was made by Tygo Krabbe when he relinquished the castle to his successor, Peder Skam. These documents contain information about furniture and weapons, but not about the buildings that were placed inside the walls. From the years 1610 and 1650, on the other hand, there are mentions of all 33 buildings that were placed inside the castle ring-wall (Eriksson, Drake & Carelli 2007: 73).

Two drawings were made in the year 1766 by an officer at the Swedish fortifications agency. This is the oldest measuring drawing that exists. Even though the drawing is a bit simplified it's still of great scientific value since the drawing shows the tower and its five floors. The drawings were a suggestion for a new roof on the tower, so that water wouldn't leak in

anymore. But the plan was never made in to a reality for some reason (Eriksson 1994: 17f). During 1845 more scientific work was made by C. G. Brunius, who was a professor in Greek from the University in Lund and also an architect and an architecture historian. Brunius wrote down his investigations in “*Historisk och Arkitektonisk Beskrifning öfver Helsingborgs Kärna*”. The purpose of his investigation was to document as much as possible of the appearance of the medieval tower, since he feared that the tower, which was already a ruin during his time would not be around for long (Eriksson 1994: 20ff).

In 1863 the first repairs in almost 200 years were made at Kärnan, but there is unfortunately not much information that has been documented about this. The only documents which contains information about the repairs is in “*Samlade anteckningar om Helsingborgs historia*”, which was written in 1915. This document mentioned that it was only a repair, mainly of the roof to keep the snow and rain from leaking in to the building. Another repair was made in 1876 that is documented, but there are no mentioning’s of what kind of repairs were made. The repairs that took place in 1863 did more harm than good, so during 1880 it was in even worse shape than before (Eriksson 1994: 20ff).

2.2 Restoration 1893-1894

During the 1880’s there started a discussion about Kärnan’s need for restoration since it was literally falling apart. From 1893 to 1894 the restoration of the tower took place and the two top floors were added. The restoration was originally meant to restore the ruin and preventing the water from leaking into the tower. There are only two oil paintings that show how the tower looked inside before the restoration. One is from 1884, by Jacob Kulle (Figure 2), and shows the inside of the entrance floor. It shows how there was a second opening to the stairwell, that today is walled of. The second oil painting is from 1897, by Gisela Henckel (Figure 3), and shows the second floors wall chamber that had a window niche that was damaged (Eriksson 1994: 24-29, 60-65).

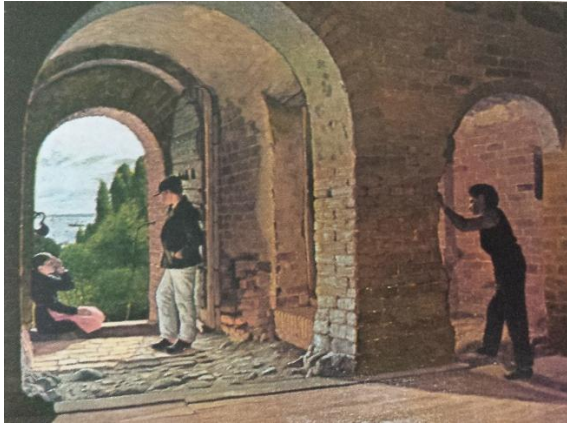


Figure 2. Oil painting of the entrance floor in Kärnan, made by Jacob Kulle (Eriksson 1994:65).



Figure. 3 Oil painting of one of the side chamber in The second floor of Kärnan, made by Gisela Henckel (Eriksson 1994: 65)

There was never a debate about how high the reconstruction was supposed to be (Eriksson 1994: 69ff). Torkel Eriksson discussed in the end of his book *“En ruin försvinner. Kärnan i Helsingborg 1880-1894”* if the restoration was more than a conservation of the tower. And according to him the interior of the tower was just repaired and cleaned up. The exterior of the building on the other hand had more done to it. It had been argued during the restoration of Kärnan that there was no way of knowing how high the tower might have been, and therefore it would be wrong to add on to its height. Eriksson claims that it's easy to figure out how much of the top was torn down in 1653. By comparing the floor and crenellations that have been torn down, Eriksson concludes that during the restoration in the end of the 19th century Kärnan was made 1 meter higher than it should have been. He also concludes that inside Kärnan today is an authentic 14th century Danish castle. Most of it has been left untouched and the reparation is almost invisible. On the outside it's like a new tower, that today can be considered to have a historical value to it since the restoration is more than 100 years old (Eriksson 1994: 77).

2.3 Excavations and interpretations in the 1930's

The first archaeological survey came about when the ground was to be lowered around Kärnan, the purpose of this was to get a better view of the foundation of the smaller square wall that was placed around the medieval tower. When a test dig was done there, excavators found unknown wall fragments that led to further investigations. From the beginning a smaller area around the tower was unveiled, but later the area expanded to Mikael's tower in southwest and then to the assumed gate tower in the east. Southwest of Kärnan the foundation of another previous tower was found, a round sandstone fortification belonging to the castle (Eriksson, Drake & Carelli 2007: 27).

In his dissertation from 1934 Torsten Mårtensson presented what had previously been done with the tower. One of the things that he mentioned is that the medieval castle of Helsingborg had parts torn down in the middle of the 17th century, because it was now out of date. In the year 1653 Fredrik III had the ring-wall that was 4 cubits (*alnar*) above ground, torn down to create a shooting field for the cannons (Mårtensson 1934: 3). This would mean with the measurements that we have today, that the ring wall was described to be equal to 2,4 meters high (aln. <http://www.ne.se.ludwig.lub.lu.se/lang/aln>, 2014-03-18).

In his dissertation, Mårtensson went through different interpretations of what it might have looked like during medieval times. He describes the investigation thoroughly, such as the buildings archaeology, which are discussed throughout his dissertation. When Mårtensson is describing the tower he gives his own interpretation of the different floors. The second floor, for example, is interpreted as the kitchen, and the third floor as a royal chapel (Mårtensson 1934: 67ff, 72). He also interpreted that the foundation of one building that had been found near Kärnan at one point in time been attached to the close wall around Kärnan, therefore making it into a large complex. Even though he admits to not having any information about how the building might have looked he made a reconstruction of this big castle (Figure 4) (Mårtensson 1934: 118ff).

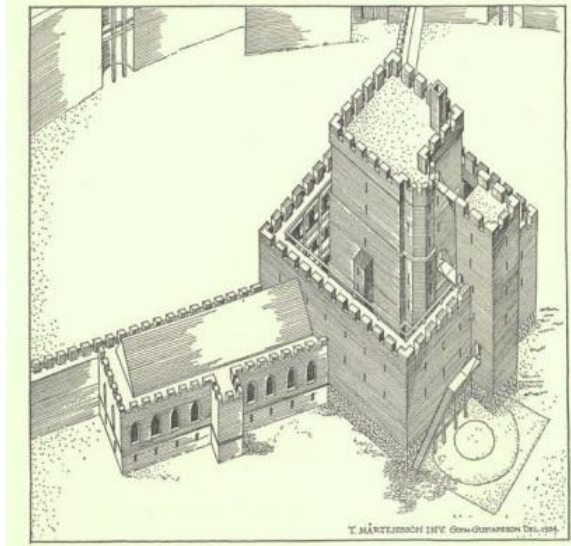


Figure 4. Mårtenssons interpretation of how Kärnan looked during the Middle Ages (Mårtensson 1934: 116).

2.4 Dendrochronological dating

Mårtensson dated Kärnan to the beginning of the 15th century. He thought that the medieval tower was built during the reign of Erik of Pomerania for the extracting of taxes from Öresund trade. But later dendrochronological testing shows that the medieval tower was already being built during the years 1317 and 1318 (Eriksson & Bartholin 1992: 43). The only remaining medieval wooden beams are placed in the ceiling on the entrance floor, first floor and the second floor. The present wooden floors are from 1950, when Kärnan got an interior renovation (Eriksson & Bartholin 1992: 46f).

2.5 Modern interpretation

Torkel Eriksson published a book in 1994 about the restoration on Kärnan, between the years 1880-1894. Eriksson presents the letters from the people who were the driving force behind the restoration, and he also tries to discuss what was done during the restoration. For example, he discusses the two new top floors and if there were any renovations inside the tower as well even though there wasn't much information about the restoration from this period (Eriksson 1994).

In more recent times there has been more and more interpretation of the medieval tower in a landscape context. Kärnan is being studied in a wider context with the city Helsingborg and the Danish kingdom. Torkel Eriksson, Knut Drake and Peter Carelli wrote the book *Kärnan och borgen – Helsingborgs slott medeltida byggnadshistoria*, bringing all the knowledge that about the medieval tower together and combining it with the information about Helsingborg's history. Interpretations made by Mårtensson in the 1930's are here challenged and new interpretation is given. In their book, the second floor of the tower that is now interpret to be the castle room (borgstugan), and the third floor is being interpreted as a kings hall instead of a chapel (Eriksson, Drake & Carelli 2007).

Kärnan has also been studied in the context of the Danish kingdom; Vivian Etting discusses in her book *The royal Castles of Denmark During the 14th century*, the Danish castles function, construction and the politics behind it (Etting 2011). Kärnan and the castle of Helsingborg is mentioned and studied as a part of this context. Even though the information about Kärnan isn't the main subject in this book there is a lot of information about the Danish castles that can be used in this thesis to get a deeper understanding of the medieval tower Kärnan, and Helsingborg's castle.

2.6 Previous digital work in Kärnan

There have been previous digital work about Kärnan in a 1 year master thesis *Tid och Rum: En upplevelseanalys av Kärnan* by Johannes Bülow. He focused on the third floor in the tower and the stairs that was placed in the middle room. He used a previous digital measuring of the tower that had been done in 2001. Bülow used this as a guideline for modeling of the third floor and texturized the third floor. After this he visualized an interpretation of the stairs (Bülow 2006). Even though 2006 wasn't that long ago, the digital technology and the possibilities of this have developed and today it's simpler to use the digital tools.

3. Material and method

As previously mentioned I have with this thesis combined “traditional” archaeological methods and digital methods. The archaeological material is the medieval tower Kärnan, since the tower still stands and is open to be studied in forms of building archaeology. The medieval tower is not enough material to go on when studying the questions I have for this thesis, I have therefore also include written sources, maps and paintings concerning Kärnan. Also books and interpretations made of other castles in the Danish kingdom.

I made a digital acquisition in the second floor of the tower which I combined with the information of interior and furniture from the 14th century and the interpretation that has been made of the second floor.

3.1 Kärnan and other medieval castles

To be able to get a view of how Kärnan has been used and why it was built, I will collect information about the medieval castle of Helsingborg and other castles from 14th century Denmark. Since the medieval castle was placed in Helsingborg, I will investigate how the castle affected the town and the area around it.

The information about the interior of Kärnan is sparse, therefore there is a need to look at the information about the interior in the context of other castles in the 14th century and combine and compare with the written sources from the same time period.

The archaeological features that need to be viewed to be able to investigate the functions of the building and housing culture are: the size of the building, plan, the room divisions, doorways and stairs, lighting, arrangements for rooms with special functions, distribution of certain artifacts, waste deposits, and the relationship to other buildings and the surrounding area. Different rooms in the houses could have different purposes. Sometimes the different purposes could be related to gender, age or status in the household or be used for formal gatherings. The basic requirements for the different purpose in the rooms were space for cooking, eating, storage, leisure activities, domestic work and heating facilities. The spatial organization is important to investigate if there is going to be an understanding of the housing culture. When it comes to archaeological record it can often be found in fragments, however it's rare that all the archaeological features that could help to understand how the daily life

was in the housing culture are still present to be studied (Roesdahl & Scholkmann 2007: 155). Kärnan was a part of the medieval castle of Helsingborg and was not a “normal” house for this period of time. But it was built by the crown and it belonged to the top of the elite. The different floors had different functions, such as a kitchen, sleeping areas and so on (Eriksson, Drake & Carelli 2007). Therefore I will use these different ways for the study of the medieval towers housing culture. As mentioned in the text above it is rare that there are all archaeological features left for archaeologists to study. In case of the castle in Helsingborg the medieval tower is the only building left standing. There are few possibilities to study artefact distribution. All that there is to go on is the plan of the different floors and their functions. When understanding the functions it's possible to study the spatial organization of the floors. Even though there haven't been found many artifacts from the tower when it was used for the purpose it was being built, there are other castle from the same time period that have artifacts that have been documented.

3.2 Digital methods

The digital data acquired for this work have been used to reconstruct one floor of the tower, and the reason for this choice is the limited time frame to develop this thesis, the entire acquisition of the tower would have exceeded the time limit. The aim of the thesis is strongly focused on giving a glimpse on how the use of this approach can be used to increase the interpretation process. In order to achieve this goal a workflow of data acquisition has been designed and tested (Figure 5). I decided to acquire the digital geometry using laser scanner technology. Despite the high accuracy and precisions of this instrument the color information came out weak. Therefore I decided to use image based 3D modeling techniques for acquiring and projecting the texture on to the model. In the second stage of this thesis, furniture from around the 14th century have been reconstructed and merged into the room using computer based visualization software.

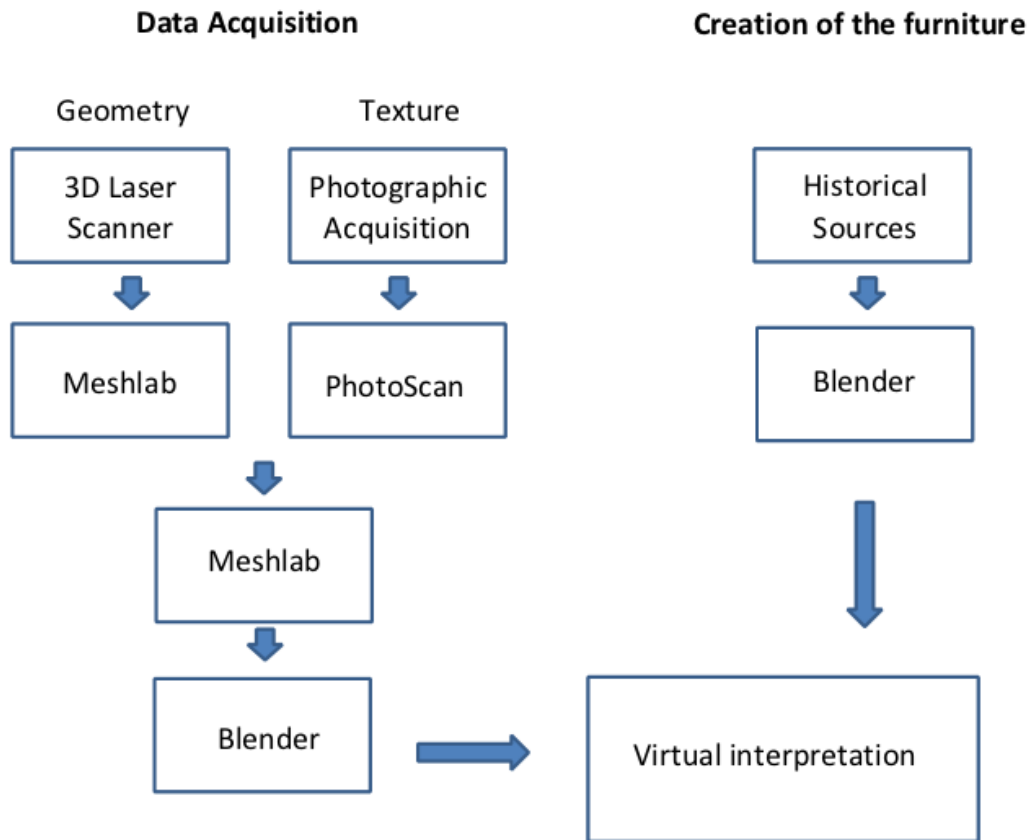


Figure 5. The workflow of the different steps of the digital methodology.

3D laser scanning

The recent development of digital technology allows documenting of archaeological sites using less intrusive methods. This allows creating virtual replicas of the monuments or artifacts in high resolution and with high accuracy details for the documentation analysis and visualization.

The architectural and the archaeological heritage can this way be saved for future generations and studied with more accuracy, in fact the use of 3D models to simulate past scenarios allow gaining a deeper understanding of how buildings where used in the past (Baracchini et al. 2004) .

The laser Scanner I used for the data acquisition was a Faro laser scanner focus 3D 120. This type of laser scanner is used for acquiring, inside and outside, fast and exact measurements in 3D. These scanner models are equipped with GPS and have the possibility to

scan in bright sunlight. The scanner also provides fast and accurate measurements of objects and buildings. It can for example record architectural features and complex structures (<http://www.faro.com/en-us/products/3d-surveying/faro-focus3d/overview#main>). This typology of instruments allows for reliable measurements of millions of 3D points, which are based on reflected light pulses and afterward are used to generate a dense geometry of the surface (Al-kheder, Al-shawabkeh & Haala 2009: 537).

Recently survey techniques based on 3D laser scanning have become very popular (Balzani, Santopuoli, Grieco & Zaltron 2004: 169). Development of communication technology today makes it possible to visualize the data generated by this technology through visualization platforms such as 3D Geographic Information System or web browsers. Increasing the possibility for this “new” material to reach a large number of researchers and scholars (Balzani et al. 2004: 179f).

The future development of this work could bring a complete acquisition and interpretation of Kärnan, involving a large number of researchers such as archaeologist, archivists and architects; moreover the result of such work could easily find a location in museums and exhibitions.

The use of this instrument allowed acquiring the entire floor of the tower in few hours, without having any direct contact with the material. However the use of this method imposed a “preparation” of the space such as removing the furniture in the rooms and planning the scan positions.

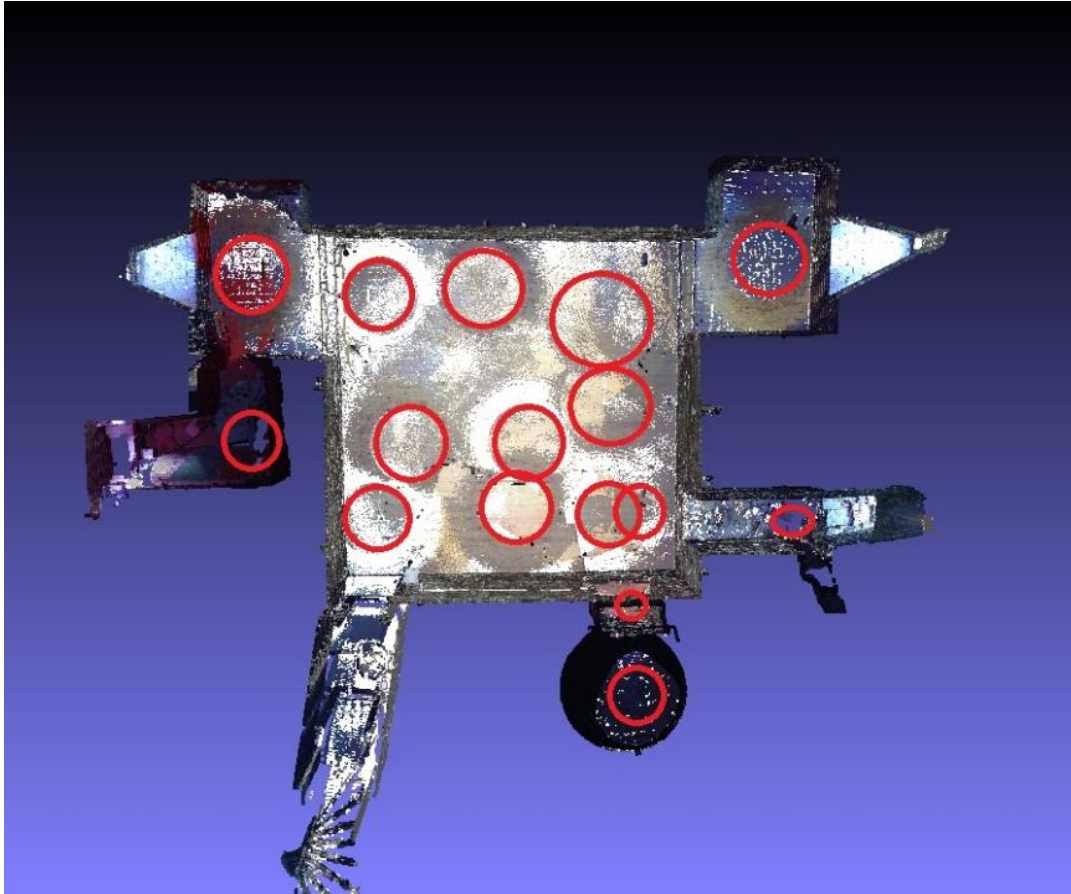


Figure 6. Screen capture of the point-cloud, showing the floor plan. The drawn red circles represent where the 3D laser scanner were placed during the acquisition.

As previously explained the laser scanner employs a laser beam towards the surface of the object to record the material by means of a dense point cloud (Balzani et al. 2004: 172). Once acquired the point clouds are aligned and cleaned by an operator in order to visualize the space acquired during the field campaign. The point cloud can be considered as the raw material and once aligned, a work of post processing needs to be performed in order to generate the geometry and projecting the color information (textures) (Barber & Mills 2011: 4).

A 3D model generated with of Laser scanner can be employed to measure high accuracy details of the building that can be very difficult to reach, or it could be employed to generate simulations to further explore the spatial relation between the monument and the surrounding landscape. Three dimensional replicas can be easily used by different experts with no geographic limitations, and through internet, 3D models can be shared among a larger group of researchers in order to run tests and analysis (Barber & Mills 2011: 4f).

Three dimensional models generated using acquisition technology can be used to build more reliable interpretation of the past to use inside museums or exhibitions as a powerful communication instruments. (Dell'Unto et al. 2014).

In this work I combined data coming from Laser scanner (geometry) with Image based modeling techniques (texture), in order to achieve a reliable high resolution replica of the second floor. I have later used this 3D reference to virtually simulate the environment as it could have looked in the 14th century. Specific furniture have been reconstructed using 3D modeling software (Blender) and added in the space according with the historical sources. With this work I tried to perform a 3D simulation of the space in order to achieve a better understanding of how the room was used in the past.

In order to perform the reconstruction I decided to use a completely open source approach, building a workflow of data post processing based on open software. Open source software is computer software with its source code made available and licensed with a license in which the copyright holder provides the rights to study change and distribute the software to anyone and for any purpose. These informatics tools are developed in a public and collaborative manner. Specifically I used Meshlab for the data post processing and Blender for the digital interpretation of the interiors of the room.

Image based 3D modeling

The laser scanner I used for this part of the thesis did not allow the acquiring of sufficient color information, in order to fill this gap I decided to use image based 3D modeling techniques in order to get high resolution textures to apply on the digital geometry. Agisoft Photoscan is the software I have used for the Image based 3D modeling in this thesis. PhotoScan uses uncalibrated images to create a 3D model and a high quality texture map. The software can be used locally without the need of internet access, and allows for documentation with sufficient precision. When creating a model the software calculates the image matching, camera orientation and performance of a dense reconstruction. The camera parameters are associated to each other, and between each couple of images the software match and extract features. Each of these feature points have their position calculated and oriented in space. A point cloud of few thousand points are created and the camera parameters

are determined. Using the camera parameters and all the pixels from the camera a denser cloud is created that later can be transformed into a high-resolution 3D model (Forte et al. 2012). The accuracy of the result depends on the camera that is used for acquiring data, however the natural settings of the object also affects the result

(<http://www.agisoft.ru/wiki/PhotoScan/Capabilities>, 2014-05-08).

This could have been used to create the entire model but it will not be as good or correct result as it can be with a 3D laser scanner. There are some difficulties with this technique when it comes to larger objects such as the complexity in capturing sufficient pictures to provide the software with enough information to generate the model. If the acquisition of the images is not done properly the software can experience difficulties in estimating the internal parameters of the camera. In that case it would be impossible for the software to reconstruct the camera positions and therefore not give an accurate result. In this specific case I think that the use of this technique wouldn't be sufficient for acquiring digital geometry.

Meshlab

“MeshLab is an open source, portable, and extensible system for the processing and editing of unstructured 3D triangular meshes.

The system is aimed to help the processing of the typical not-so-small unstructured models arising in 3D scanning, providing a set of tools for editing, cleaning, healing, inspecting, rendering and converting this kind of meshes.” (<http://meshlab.sourceforge.net/>, 2014-04-25).

This software allows aligning, cleaning, and merging the different points cloud acquired during the acquisition campaign (Figure 7) shows. I mainly used this tool to align and clean the point clouds that were acquired during the acquisition. The point clouds were later merged into a 3D model without texture. After creating the texture I imported it into Meshlab and aligned it with the model created from the scanning acquisition.

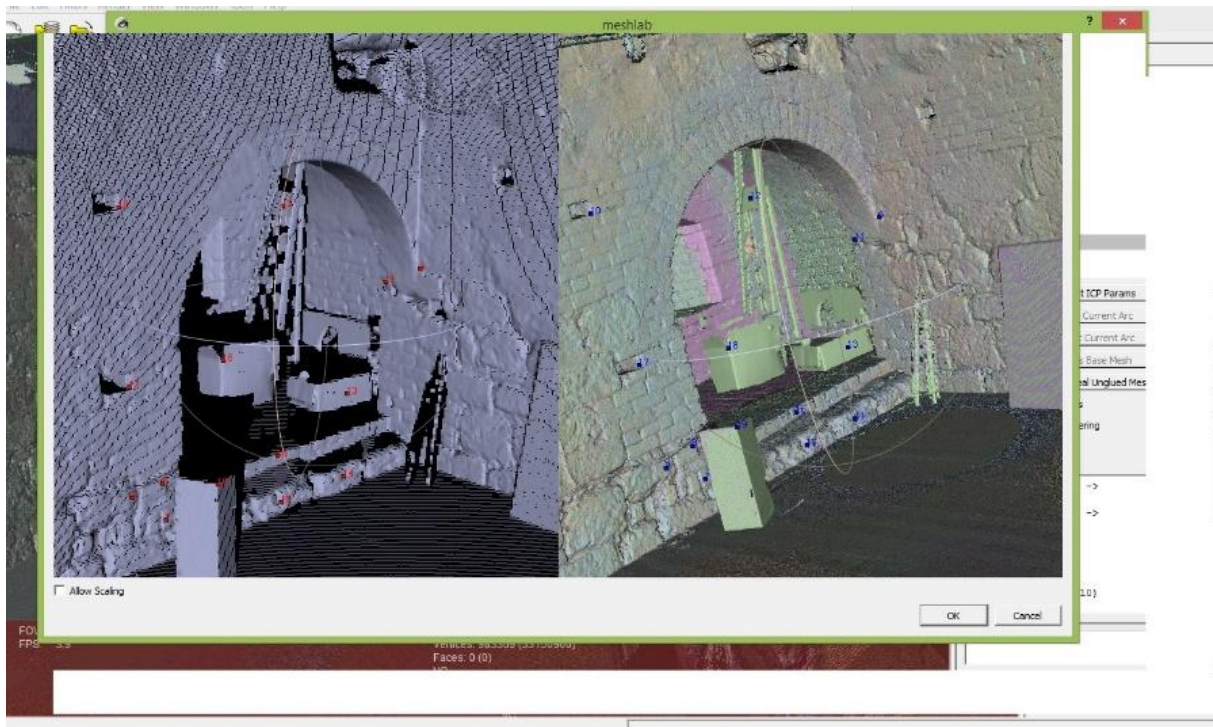


Figure 7. A screen capture of Meshlab, where points were placed to align the two scans.

Blender

“Blender is a free and open source 3D animation suite. It supports the entirety of the 3D pipeline – modeling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation.” (<http://www.blender.org/about/>, 2014-04-25). This product is often used to generate 3D models or editing 3D data acquired by means of instruments such as Image based modeling or Laser scanner. I have in this thesis used this software to virtually build the furniture and some of the interior of the room.

I later used the software to gather all the digital parts together with the goal of visualize the second floor and simulating the space.

4. Theoretical perspective

The aim and questions of this thesis require the use of different methods and therefore different ways of viewing them. It's not possible to use one theoretical approach to be able to cover the whole subject of Kärnan, you can study and investigate one archaeological object,

in this case a medieval tower, in many different ways depending on what you want to know. I have divided this section of my thesis into three different sub-chapters, the first one is about the tower itself (sub-chapter 4.1), second one is about how the people used Kärnan (sub-chapter 4.2) and how it affected the landscape and third one is about the digital reconstruction (sub-chapter 4.3) of the second floor.

4.1 Medieval castles and towers

I feel there is a lack of the connection between the castle of Helsingborg, the politics, sieges and society, the individual and daily life and work that occurred at the castle. Torsten Mårtensson discussed in *Hälsingborgs Slott under medeltiden* how the castle of Helsingborg may have looked during the Middle Ages. Mårtensson looked on the building archaeology and the medieval tower's building history in general. He does this through investigation of the different parts of not only Kärnan but the whole of Helsingborg castle, found when investigating the area around where the castle had been placed. The building is divided in different floors and it's discussed how the different floors may have been used (Mårtensson 1934). Anna-Lena Eriksson mentions in her dissertation that Norwegian castles owned by the crown can be more fully understood by looking at the context that castles and their artefacts were found in (Eriksson 1995: 7). The same archaeological material can be used differently in different contexts (Johnson 2010: 110). But when it comes to this thesis I don't think that looking at the context is the only way to get the answers to my questions (this is further discussed in chapter 4.2). Because I'm not only looking at what is left of the medieval castle of Helsingborg, but also how it has been used and who lived there. To be able to visualize one floor, and have it represent the interpretation, I need to look at the material that isn't there anymore. The reconstruction is going to be a product of my interpretation and the material that I have chosen.

4.2 Interior and way of living

In the previous chapters it is mentioned that castles and Kärnan itself have been interpreted and viewed in different ways. A visual inspection of the building is essential, however its equally important to view the whole context. I agree, but in the case of Kärnan and the medieval castle of Helsingborg, the medieval castle has been standing through multiple

periods of use and therefore the items that normally would be left for the archaeologists to find in the ground with the foundation of the tower. Have instead been replaced or removed as the function of the different floors has changed. The tower had many different purposes throughout the years and has been altered to fit does needs. How then can we find out how the people lived and used the medieval tower?

It is possible to study different social identities in the archaeological record, if the archaeological material is considered as a product of actions made by individuals and not as a result of economical or environmental forces (Greene & Moore: 285).

“Archaeological analysis should not be about the mapping of a static spatial order as if it represented some cosmological or structural rule, but rather about considering the agencies found places for themselves in the contexts of their own world.”(Barrett 2001: 160).

When it comes to discussing how Kärnan may have been used there are many different perspectives. The tower has been used for housing. When thinking about this you start to think about how it may have looked and what the different floors were used for. Today there are stone and brick walls with wooden floors and beams in the ceilings, it seems very cold and bare. But it didn't look like this during the Middle Ages. There is a need for investigating space and discuss how the different floors were used. When thinking of a medieval castle you think about kings and castle lords but there were "normal" people that worked and lived there. In such a place there has to been hierarchies, someone owns the castle, someone is running the castle, someone is defending the castle, someone is working in the kitchen and someone is running the everyday life in the castle.

In the book *Behind the castle gate*, English castles and their functions is being investigated and discussed. Matthew Johnson argues that castles are not to be seen simply as only military or defense buildings. Castles were not only accommodation of the social status of the owner either. They were more complex than that. The castles were all those things, plus the complex and active parts of the landscape and the material culture. To be able to find out how the castles worked as an elite structure we need understand the identities of how women and men functioned. What needs to be understood and investigated to get a better understanding of the castle's complexity is the landscape around the castles. Surveys have shown that castles made use of the surrounding landscape as a defense that framed the castle. Another thing to consider is the agency, to study how people moved through and lived in the buildings, how living there was experienced. The social identity, how the elite expressed their identity and

what the identity was of the people who dealt with the everyday practices that made the castles function. It is also possible to make social interpretations in the castle by looking at the organization of the space and the castle themselves being a symbol of social status and hierarchy. When talking about castle and its functions it is not only the male activities that occurred at the castle, there were also women working there. Johnson described that the castles were mostly occupied by men and that this should not be the end of the gender analyses, but the starting point instead (Johnson 2002: 3, 7ff). Even though that these theoretical perspectives were created for English castles, I think they can be used to study castles in other countries as well. One thing that doesn't change between the castles is that they are built by human beings and they are shaped by the society and its views and values of the time. Therefore I think that the different theoretical views that Johnson is using in his books can work in answering the questions I have in this thesis.

The material world of medieval Europe communicates the individuals of the time and also their daily life. The physical environment such as the settlements, landscapes, buildings and housing can give a clue about the medieval peoples view and display of power, religion and economy. An object can give information of its use if you look at the archaeological data, production, technology and later consumption and its patterns, trade and exchange. An object could have had many different functions and meanings depending not only on its function or origin but also depending on the social, cultural and economic context. The artefacts functions weren't isolated and they were one part of the big picture; a part of a more complex social relation. An artefact wasn't only linked to the society and its views and standards it was also linked to other material artifacts, and wasn't a passive piece of wood, steel or other material. It was an agent that had an active role in people's behavior and the material and social culture (Roesdahl & Verhaeghe 2011: 189).

4.3 A digital approach

Digital models can be used to increase the level of involvement of the public, increasing their understanding of how the process to interpret a site engaged by the archaeologists has been developed. More than the "reconstruction itself" it is, in fact, crucial to use digital technology to make transparent the interpretation process that characterizes reconstruction (Greene & Moore 2010: 301). New technologies have provided a number of options for what concern the

recording of material data exponentially increasing the possibilities for archaeologists to develop and test archaeological interpretations. Archaeological practices have been strongly affected by the diffusion of digital technologies, as they are able to provide more complete overviews of archaeological contexts. In particular, the diffusion of digital formats and the availability of powerful visualization platforms, such as the Geographic Information System (GIS), have increased the possibilities to highlight and identify new information by placing data of different natures into a spatial relationship (Dell'Unto 2014).

Within this research activity I test limits and potentials in using such approach to simulate the possible aspect of the room in the 14th century, the implementation of reconstructed furniture and artifacts allowed an estimation of the way of how people in the past would have used and lived that specific environment. Despite the possibility to have full access to the information regarding Kärnan, it has been very complicated to find sources describing the furniture that characterized that specific monument, for this reason I used sources from case studies which resembles similar characteristics in time and style choosing elements that would fit with the specific space acquired using Laser scanning technology.

Digital techniques are a great way of visualizing ones interpretations, also a great tool to further you interpretations an analyses of the past. However there is a need for professional accuracy. For example a written text about culture heritage, the author is expected to reference the information, state questions and arguments. The argumentation and interpretation of the text is expected to be visual an in the end be evaluated. However if we instead consider computer based visualization, it can be researched and interpreted but how will the process behind it be shown to a viewer that looks at the finished image. The London Charter is a set of guidelines for computer-based visualization of cultural heritage. It was conceived in 2006 and had an aim of addressing the need for merging cultural heritage visualization with professional standards of argumentation and use of evidence. They have created a set of principles were guidelines are stated. Principle 1 is about implementation, *“Each community of practice, whether academic, educational, curatorial or commercial, should develop London Charter Implementation Guidelines that cohere with its own aims, objectives and methods”* (<http://www.londoncharter.org/introduction.html>). Principle 2 is about the aim and method, which states the computer based visualization, should only be used when it's the most appropriate choice of method. It needs to be a method that fits the aim of the research instead of focusing on what is possible to create and visualize with digital

technologies. Principle 3 is about the research sources and that there is a need for identifying reliable sources in a documented way to be able to guarantee the intellectual integrity.

“particular attention should be given to the way in which visual sources may be affected by ideologies, historical, social religious and aesthetic and other such factors”

(<http://www.londoncharter.org/introduction.html>). Principle 4 is about the documentation,

“Documentation of the evaluative, analytical, deductive, interpretative and creative decisions made in the course of computer-based visualisation should be disseminated in such a way that the relationship between research sources, implicit knowledge, explicit reasoning, and visualisation-based outcomes can be understood”

(<http://www.londoncharter.org/introduction.html>). The level on documentation that is needed may vary depending on what is being visualized. The importance of the visualization within the arguments, dictates the required level of documentation that is needed. Principle 5 and 5 is about the sustainability and access, There should be a plan or strategy to make sure that a 3D model or the digital visualization is sustained for long term used to avoid being lost. These could mean that there is a need to consider where it's going to be saved, and in what digital format it should be (<http://www.londoncharter.org/introduction.html>).

5. Castles and society in medieval Denmark

Kärnan is a medieval tower built in the beginning of the 14th century as a part of a bigger complex called Helsingborg's castle. The tower is the only thing that remains today of the former castle. Kärnan has been standing for over 700 years and has had different roles through the years (Eriksson, Drake & Carelli 2007: 11, 35).

There are different styles and types of castles that were built during the Middle Ages. Royal castles during the 13th century consisted of different types of ring-wall castles. These kinds of castles could have many different buildings with a ring-wall of stone around them; the center of the complex was usually a tower. In older castles the tower was placed in the center of the castle but later on the tower was moved to the ring-wall to strengthen the defense. The medieval castle in Helsingborg was a type of ring-wall castle. During the Middle Ages it was the most important castle in Scania for the Danish king. The ring-wall was made of sandstone with a number of half-round flanking towers. Inside the walls there were workshops, stables, store houses and other buildings. The ring-wall took advantage of the naturally formed

plateau that it was standing on. In the east where the defense was the weakest there was a 30 meter wide and 15 meter deep moat. Before Kärnan was built there was a round tower made out of sandstone that was placed in almost the same place. Next to the round sandstone tower there was a rectangular building that has been interpreted to have been a palace for public gatherings. About 50 meters to the west of the tower the foundation of a round church have been found. The round sandstone tower, the church and the palace and the rectangular building was probably erected during the 12th century. When Kärnan was built the functions of the round sandstone tower and the palace building was combined in to one building (Hansson 2011: 60ff).

5.1 Helsingborg and the medieval castle

Kärnan is placed in Helsingborg and the medieval castle has played a big part of the town's history. The archaeological record of the earliest part of Helsingborg's history is fragmentary, however what have been found indicates that the earliest period of the city's history was placed on top the high plateau. Helsingborg was one of the most important cities in the eastern part of the Danish kingdom, until Scania became to be under Swedish rule. The city was placed in the most central and narrowest part of the Öresund area, and together with Helsingör the town created a strategic placement in the kingdom which therefore made it possible to control the seaways. The town's placement was due to the geographical advantages that the narrow coast had to offer, and also the natural defense the high plateau could offer (Eriksson, Drake & Carelli 2007: 9, 11). The first mentioning of the name Helsingborg is in the written sources from Adam of Bremen, from the 1070's, there the name Helsingborg is spelled Halsinburg. This name can be divided into two words, Hälsing and Borg. The word Hälsing means a person living by or on a naturally formed strait that is called *hals* in Swedish, it referred to the narrowest part of the sea (Öresund). The word borg needs some more explanation. In Swedish, borg directly translates to English castle. The word borg could therefore refer to an earlier castle or defense fortification, but it can also refer to the high natural formed plateau, *landborgen*, that also has the word borg in it (Eriksson, Drake & Carelli 2007: 10).

In the Danish kingdom cities were founded during the late 10th century. It was a result of the societal changes that occurred during this period of time, when the Danish kingdom was

united during the rule of one king. These early cities were important to the Danish king's continuity of rule, because they had the functions of royal centers where the administrative, political and economic functions were gathered. It was during this period of time that the foundation of the city Helsingborg occurred. In Knut the Holy's deed of gift, from May 21 in 1085, to the cathedral in Lund, the city Helsingborg is described as an urban settlement that differed from the countryside. The royal right to taxes that was to be paid annually was also mentioned. The royal land tax in Helsingborg indicates that there was a close connection between the king and the city. In king Valdemars land register (jordebok) from 1231 Helsingborg is described to be the king's land (kungalev), a royal estate. Therefore it is reasonable to initiate the city foundation since it was placed on royal domain (Eriksson, Drake & Carelli 2007: 10f). During the 13th and the first half of the 14th century Helsingborg and the Danish urban landscape went through a change. The cities royal management and power political central towns evolved into commercial centers. This development was supported by the royal power that initiated new towns and granted town privileges where the freedom of trade was emphasized. This changed affected Helsingborg in the way that during the latter half of the 14th century it was referred to as a "villa forensis", a town with the trade of goods and services, and it had an effect on the towns building types. When the town started to build on the foreshore, the high plateau was turned into a more pronounced institutional area (Eriksson, Drake & Carelli 2007: 12).

Helsingborg was during the Middle Ages an important temporary residence for the kings when they visited Scania; however it never became a permanent one. Bigger castles such as Nyborg, Skanderborg, and Vordingeborg could be considered as residence castles since they were big enough to house the court for longer periods. At the castle in Helsingborg there is no evidence of there being palace buildings with grand halls for royal representations and meetings (Eriksson, Drake & Carelli 2007: 110).

During the reign of Valdemar the great (1157-1182) there were a number of royal castles built in Denmark. These castles were built in the central parts of the Danish kingdom and functioned as important centers for the royal territory. That means that the castles were a way for the crown to maintain its power through monitoring of crossings, borders and important markets. The system of the castles also made it possible to defend the kingdom against foreign enemies. Surely the castle of Helsingborg was a part of this nationwide network of castles. After the year 1241 the conditions changes when the king Valdemar Sejr died, which

caused internal fights about the throne. This went on for another 45 years and resulted in a strain on the country's finances. The castles got new roles in the society during this time, since they were strongly connected to the power of the land and the people; they became a part of the internal fights. During this time castles were built, torn down and sieged. (Eriksson, Drake & Carelli 2007: 12f). It wasn't until Erik Menved became king, in 1286, that there were attempts to restore the royal power over Denmark. Peace was made between the church and the outlawed lords that had challenged the nation. Erik Menved started a new power political approach in the beginning of the 14th century, with the ambition of reviving Valdemars supremacy, where concurring foreign nations played an important role. However war cost money and there were an increase of taxes for the people. This led to an uprising in which both common people and aristocracy participated in Jutland, 1312. Menved forces crushed the uprising. To be able to keep the peace he erected a number of castles and updated many of the older castles. Helsingborg's castle was one of the old castles that got modernized, and it's around this time the building of Kärnan is dated. It was an extensive castle building that cost a lot of money and at the end of Menveds life, the kingdom was nearly bankrupt. The power had been pawned to many foreign and domestic noblemen. The result of this was an unstable domestic climate after Erik Menveds death in 1319 (Eriksson, Drake & Carelli 2007: 13f).

The kings that followed Menved were Christoffer II (1320-1326 and 1330-1332) and Valdemar III (1326-1330). Both tried to buy back the pawned estates, however the prices were too high to follow through with the plans of a reunited Denmark. The Swedish king Magnus Eriksson took this opportunity and managed to negotiate Scania from count Johan of Holstein in 1332, however the payment wasn't paid in full until 1343. Valdemar Atterdag (1340-1375) which was now the Danish king had the same ambition to reunite the Danish kingdom. This led to negotiation between Atterdag and Eriksson regarding Scania in 1359. The next year Valdemar Atterdag took both Malmö and Helsingborg with military force and Scania belonged to Denmark again. Atterdag started to fight the power that the German Hansa had gained in area. This led to that Hansa taking Helsingborg, and was not returned until the piece in 1370. The piece gave Hansa the right to free trade in all of Denmark and right to 2/3 of Helsingborg's income for 15 years. Queen Margareta (1387-1397) came to Helsingborg with her son Olof II (1376-1387) and requested Helsingborg back in 1385, and Helsingborg's castle was after that a Danish residence again (Eriksson, Drake & Carelli 2007: 13f).

5.2 Castles and medieval towers

A castle can be defined as fortified housing that is surrounded with physical obstacles which can provide a defense and makes it difficult for others to enter. It is often the defense aspect that is emphasized when talking about castles. The natural resources were often used for defense and controlling who entered the castle. Natural obstacles that were commonly used were bogs, wetlands, lakes, waterways, heights and slopes. In northern part of Europe the castles were built of timber, stones or bricks, but the downside with timber castles was that they could burn down easily. To make walls out of stone was a knowledge that came to the Nordic countries during the Middle Ages, however building stone castles could be expensive and there was a need for experts that knew what they were doing, often they were imported from other countries. For this reason stone and brick castles became a symbol of status (Hansson 2011:33ff). There were three types of building developer for castles during the Middle Ages. But the biggest castle building developers was the Crown. A royal castle did not only function as a military fortification that protected against both foreign and domestic enemies. They also functioned as administrative centers where the collected taxes were brought. For every royal castle there was populated area that supported the castle. The bigger castles also served as a royal residence. The king's castle was usually bestowed to his confidants within the aristocracy. Bishops also built castles, and by being landowners and working for the church they were given members of the king's council. There were also castles built by private initiative, often by the aristocrats (Hansson 2011: 41ff).

Castles were built during different periods throughout most of the Middle Ages, but there was not just one reason for this. You can roughly divide the castle building into two groups. During the time periods where the power of the king was strong, especially during Valdemars reign, castles were built by the crown to defend against foreign enemies. In periods where the crown was weak, especially in the time from the murder of Erik Klipping in the year 1286 to the queen Margretes prohibition on building castles in 1396, there was a lot private building of the castles to protect the aristocrats and their families. The primary goal of these private castles was to protect the owner, his family and property. Security was important but in most cases they also considered the living comforts of the castle. In the worst-case scenario you

had to stay a long time in the castle under siege. The living standard and the interior of the castle were dependent on the family's social status and economic situation (Andersen 2003: 101).

Castles in Denmark

In Europe castle building was heavily influenced by social hierarchies and political situations, which could vary over time and influence building and use of the castles. In Scandinavia there were a lot of changes that occurred with the transition from the Viking Age to the Middle Age. The religion changed and so did social society, which manifested itself in the physical landscape. Denmark became an official part of Christian Europe when King Harald Bluetooth was baptized. There are no records which indicate that King Harald had a permanent residence, but during this time there were large circular fortresses that were built with a geometrical design. Dendrochronological analysis determined that these were built during the reign of King Harald. The fortresses helped the King with political and military power but they were only in use for a short time. During the Viking age there was a focus on warfare at sea and plundering, therefore castles were not needed for defense purposes. In Scandinavia there may not have been castles until the 12th century since open battles and wars at seas were the typical kind of warfare. The medieval castle was introduced in the beginning of the 12th century, but the Danes must have known about the existence of f. ex. motte and bailey from Normandy and England. When castles made an introduction in Denmark there was internal instability between different members of the royal family and fights with Slavonic Wends whom plundered the Danish coasts. Now there was a need and use for castles in the Danish kingdom since there was a need for defense. The defenses that were being built during this time can by today's standards barely be qualified as castles; they were not permanent buildings and the defense consisted of palisade surrounding a mound. There are few examples of the European type of donjon or keep in Denmark during this period. In Helsingborg the remains of one of these round keeps have been found (Etting 2010: 11- 16). The keep in Helsingborg was placed in the same area as where Kärnan later was built, and the markings of the foundation are visible in the ground today (Eriksson, Drake & Carelli 2007: 31).

5.3 To live in a castle

Even though medieval castles could differ from each other, they were all places that provided an aristocratic environment. To understand the medieval castle it is therefore important to get a view of how this culture could appear (Hansson 2011:069). Investigations about the interior layout and the furniture of the Middle Ages can provide an understanding how it might have looked inside a medieval castle. But is it this enough information? To visualize one floor in the medieval tower is not possible without knowing who used the room, and what they used it for.

Hierarchies in society

During the beginning of the Middle Ages in the north, one of the big changes was that the aristocracy became tax-exempt. War-services were the basis for this change (Hansson 2011: 22). During the beginning of the Middle Ages, when the king needed the people (farmers) to contribute to the military power, the people were obligated to contribute with manpower, ships, equipment or supplies for the monarchy's fleet (ledning.<http://www.ne.se.ludwig.lub.lu.se/lang/ledning>, 2014-03-17). However the armored knights on horse proved to be superior and the kings of the Nordic countries realized they needed new and modern military advantages so in order to establish their power. The previous war service that included all able-bodied men was now replaced with taxes instead. With this new way the kings had the income to build castles, warships and enlist soldiers which were needed for new warfare techniques. But getting all the armors that was needed was expensive, thus the aristocracy got tax-exempt and in return they had to report to the king service as armored knights when the king needed them. It was allowed for anyone to belong to the aristocracy as long as they agreed to serve the king, and had their own equipment and a war horse. Therefore in reality it was only possible for people with considerable economic assets. This aristocracy was the precursor for the later nobility and castles started to gain their importance for them too. It wasn't just the king that built castles, the aristocracy also built them to establish their status and power (Hansson 2011: 22f).

People during the Middle Ages followed the Christian world view and its ideologies, a mentality that was always present and that made people of every class and social status in society give gifts and land to the church. Through these gifts it was believed that they would

have it better in the afterlife. The average life expectancy was shorter than it is today and death was always present in people's lives, which affected their behavior. Martin Hansson described that the Christian ideology counteracted the changes in medieval society, by keeping everyone in their given social groups in society. During the Middle Ages, which is described already in 9th century Europe, the society was divided into three different kinds of social groups. The ones that prayed (oratores), the ones that fought in wars (bellatores) and the ones that worked (laboratores). The different groups were considered equally important but had different responsibilities to make the society work. The priesthood prayed and maintained contact with the higher power, the aristocrats defended the society with weapons in their hand, and the farmers and craftsmen supported themselves and the other two social groups. This is a simplified view of the different social groups that existed in the society of the Middle Ages. Later with the urbanization, another group of people grew stronger, the merchants. This view of the society was spread across Europe and was a system based on unequal terms and hierarchy society. At the same time the priesthood and the aristocratic extinguished themselves from the other social groups in society. There were also different levels of hierarchies within the different social groups. For the aristocratic society it was important to show their divine duty to protect the society. Therefore to live in a castle wasn't just about defense, it was also a way to establish your social status and position. Feudal society was a way for the rulers to control the agrarian-based society by imparting the primacy of one's land to their followers, and in exchange receive f. ex. military services. If nobility promised their military services in wartime then he could control a part of the land in exchange, a fief, for the king. What this nobles could get control over incomes, such as fines, that otherwise would go to the king. The power was based on the owning of land; the nobility got privileges that ensured them a piece of the farmer's production in form of taxes or tenancy. Martin Hansson discussed that when you study the medieval castles the social ties between lords and farmer become important to investigate. Sometimes there can be different types of feudal phenomenon in the landscapes (Hansson 2011: 26f). Even though the medieval castle in Helsingborg was owned by the crown and not the nobility it is still important to take a look at the different social aspects of it because the King was at the top of the hierarchy.

An aristocrat needed to be able to handle his weapons and horses successfully, not only to be able to survive in battle but it was also a big part of their identity. Therefore a lot of the aristocratic life was to prepare for battle in their daily activities. Some of these daily routines

were hunting with bow and arrow, attending tournaments gave them an opportunity to show that they could handle horse and weapon (Hansson 2011: 70f).

With the beginning of the 11th century Europe, a new literature genre made an entrance. This was in the form of stories about knights that fought against the heathen forces, and they contributed to how the aristocrats were viewed in society during this period. For example there were legends about King Arthur and famous novels as Tristan and Isolde. The Nordic novels of knights were often adaptations of the continental novels. These novels were created an image of how the knights should behave, dress and live. A knight was supposed to be brave, fair and loyal warrior; he was also supposed to be a Christian campaigner with no regard for his own gain or glory. There were big differences between the view of knights and how they actually were. However the novels still contributed to this image. In the Nordic countries during the 12th century the kings and the aristocracy started to portray themselves as warriors on horseback on their seals (Hansson 2011: 71f).

The aristocracy didn't live in, what we would call today, international environment. But they had international contacts of their equals throughout Europe. The aristocrats sent messengers to each other and they observed the different cultures and reported it back. They also let their sons be raised by foreign courts to live up to the European standard. The different royal families also worked in the same way, and there were marriages between the different royal families (Hansson 2011: 73f).

Castles, fiefs and fief holders

During the medieval times in Denmark castles had a purpose to work as a defense, but that was not the only purpose. They also had an important role as administrative centers for the Danish crown, especially since the king didn't have a permanent residence. Until Copenhagen became the crown's permanent residence, the court traveled and lived at different castles in the Danish kingdom (Etting 2010: 39).

When the king wasn't living in a castle it was run by fief holder who was in charge of the castles and lands that belonged to the crown. The responsibilities that these fief holders was to look after the forest and farmland belonging to the fief, and also to maintain the castle and the buildings in the courtyard. A fief holder was a representative for the king and had to administer the fief and its income, such as taxes and maintaining law and order. During

wartime the duties were to defend the castle and also to be prepared to assist the king with armed forces if needed. The condition for obtaining a fief could vary, but it was of importance that the fief holder remained loyal to the king during wartime. There was tough competition between the noblemen to be a fief holder for the best fief and castle. One fief holder could be in charge of several castles at the same time; usually in these cases it was neighboring fiefs and castles (Etting 2010: 39).

The systems with the use of fiefs and fief holders emerged from an older system of farms and property owned by the king. During the 11th century there was a development of a structure where the main part of the Danish kingdom was divided into big castle fiefs (slottslän). This structure is partly still in use today in our fief organization (länsorganisation), fief of Helsingborg (Helsingborgs län) is one example of this (Svensson 2001: 490).

Etting described four different types of fiefs where the fief holders had different types of duties and rewards. The first kind of fief meant that the fief holder had to present accounts annually for all the expenses and income. The fief holder was granted a sum of money; however the surplus went to the crown. The second type of fief was a fief of rent where the fief holder had to pay an annual sum of money (rent of the fief and castle) to the crown and in return all the incomes from the fief went to the fief holder. The third type of fief that is described is considered to have been the most advantageous for the fief holder. Here the fief holder only had to fulfill the duties of being a king's representative and received all the income. The last type of fief was when the fief functioned as a mortgage for a sum of money. When the crown borrowed money from the rich noblemen they could pawn a fief or castle. In this way the nobleman gained control of parts of the country, which could be a dangerous situation, certainly in time of war or political instability (Etting 2010: 39f).

Not only could the different fiefs vary in advantages and responsibilities, they also varied in size. A fief consisted of herreds (shires) and one herred consisted of circa 10 parishes. Some fiefs could consist of one herred and some could consist of up to ten herreds, and sometimes one herred could be transferred to another castle. Helsingborg's castle consisted of a large fief (Etting 2010: 40f). Luggude, Bjäre, Södra Åsbo, Norra Åsbo och Göinge herreds belonged to Helsingborg (Eriksson, Drake & Carelli 2007: 13). From the early 14th century there are sources about the fief of Helsingborg (Helsingborgs län), however it's not until the 16th century there are information about its extent. The fief of Helsingborg was during the 16th

century run by ha fief holder that could keep a part of the income (in money and merchandise) and the rest of the surplus was given to the king (Svensson 2001: 491).

The fief holder purpose was to act as the important representative of the Danish crown. The two main duties of was to announce (inform) the contents of the royal decrees and take care of the land owned by the king. He was to make sure the laws were followed within the fief of his domain. Another important duty was to collect the crowns revenue from the self-owning farmers and the interest and fees of the renting of the kings land (Svensson 2001: 491).

Helsingborg's castle was a castle with many fiefs and the king with the court visited the castle many times during the 14th century. Etting has put together a table (Figure 12) over the royal visits during the 14th century (Etting 2011: 112).

	Erik Menved	Kristoffer II	Valdemar Atterdag	Margrete I
Aggersborg				
Bygholm	4		1	1
Gottorp (Slesvig)				
Gurre			4	8
Falsterbo			2	2
Flensborg (Slesvig)				6
Helsingborg	15		5	21
Hindsgavl	1			1
Kalundborg	1		9	16
Kalo		1		
Kolding	5	2	3	5
Korsør				2
København/Copenhagen	7	1	12	6
Laholm				
Lindholmen				1
Nyborg	18	1	4	10
Nykøbing	5	5	4	1
Ravnsborg			1	
Riberhus	8	1	3	2
Skanderborg		1	1	
Skæner		1	3	2
Stegeborg	2	1		1
Søborg	20	3		2
Sønderborg (Slesvig)			4	
Traneær	4		1	1
Tårnborg	2	1	1	
Vordingborg	37	18	7	11
Ålborg	2		9	3
Ålholm			2	1

Figure 8. A list of the rulers who visited the different castles in Denmark during the 14th century (Etting 2010: 112).

The fief holders that were living at the castle were important and probably rich people. Kärnan was a living area of representation and the people living there represented the kings presence in the castle (Eriksson, Drake & Carelli 2007: 110).

The everyday life in castles

There is documentation preserved from the 14th century that gives us insight in how life in castles could have been. There are accounts from the Swedish royal castle Nyköping, from the years 1365 -1367 (Etting 2010: 42). A German knight called Raven van Bornekow was responsible with the administration of the castle. The income consisted of taxes, custom, judicial charges etc. The expenses were calculated every week and consisted mostly of food, household necessities, salaries for the workers and craftsmen and extra expenses when visited. During the years that were documented there was a large quantity of food that was consumed, such as wheat, grain, butter, salt, spices, rye, malt, onions, fish, pork and meat from 378 cows and 655 sheep. When the king or other important people visited the castle there were additions to the menu with wine, mead, eel, smoked meat, hares, almonds, figs and rice. Based on the accounts of these documents it is estimated that 300 men were working during this time in the castle. However the castle had been destroyed before and was being rebuilt during this time, therefore it was an unusually large household, since it contained the craftsmen that were working temporarily. The permanent household was probably a lot smaller and included people that worked as bakers, brewers, grooms and the cook. Due to the lack of sources about Danish castles from the same period it is impossible to see if and how there were similarities in the running of the castle, but this account gives an insight to how the royal castles functioned. There are also accounts that have been preserved from a minor castle of Brink that was placed in the southern part of Jutland, owned by the bishop of Ribe (Etting 2010:43). These accounts include the years 1388 to 1399 and gives us insight into not only the income and expenses but also the wages and staff of a smaller household than a royal castle. The castle was mostly self-sufficient and relied on the agricultural production and income that came from the duties to the bishop. Annual wages for the household (which was 24 persons) was the main expense. There were different salaries for the different jobs in the castle, which could be a reflection of the hierarchies in the household. 5 armed men were paid 26 shillings sterling each, making them the top of the hierarchy. The baker and cell master got paid 10 shillings sterling each and the kitchen master earned 8 shilling sterling, the two tailors were paid 7 shillings sterling and a baker was earning 6 shilling sterling (Etting 2010: 42f).

Preserved accounts from the royal castle in Copenhagen in the 1440s gives an insight into how the household functioned in a royal castle. Even though the accounts were from the 15th century, there are probably similarities in the previous century, at least the size of the households. There were 119 people listed in these accounts and at the head of the social

hierarchy is the head of the royal court. Other professions that occur at the royal castle are written in these accounts that Etting mentioned in her text, such as:

- 31 courtiers
- 10 ladies-in-waiting
- 1 butler with 3 servants
- 1 chef and 9 cooks
- 1 baker-woman with 2 assistants
- 1 fisherman
- 1 butcher
- 38 men of unspecified occupation

Craftsmen

- 1 shoemaker
- 1 tailor
- 1 barber
- 1 armourer

Entertainment

- 1 falconer
- 3 trumpets
- 1 jester by the name of Caspar

It is likely that there could be more people added to this list that are not mentioned in the accounts, such as the garrison and the families to some of the staff members (Etting 2010: 44).

The Danish households seem to have been organized with a strict hierarchy, as it was in other European courts. This was reflected in the table arrangements. Everyone had their place that showed their social status. At banquets the table was set with fine bowls, cups and drinking horns while musicians entertained the guests (Etting 2010: 44).

The households of the nobility were smaller than the royal household, but when the rulers and the court were visiting different castles they must have generated a lot of expenses. Bailiffs at royal castles were obligated to house the court at any time, which caused a lot of extra

manpower and expensive, without getting any compensation for it. The court travelled with a great entourage that included horses, carts and wagons. There is no description of these carts left for us to study, but there are sources that describe the luxurious coaches when Queen Philippa married Erik of Pomerania in 1405. The coach is described to have had trimmings of cloth of gold, red leather, golden ribbons and silk laces. The inside of the coach had six leather cushions covered with cloth of gold and silk for comfort (Etting 2010: 45).

5.4 Kärnan - the building

When describing the buildings archaeology in this thesis I will count the entrance floor as the first floor and the basement (which is placed above ground) will be referred to as the ground floor. I will only describe the floors up to the fourth floor, since those are the floors that have a medieval context. The floors above are from the reconstruction that took place in the end of the 19th century.

The outer façade

Like mentioned above, Kärnan is the only remnant above ground of the medieval castle in Helsingborg and its current façade was given in 1893-1884 when a big restoration occurred. The little stairwell tower on top of Kärnan got 4 meters added. From old pictures before the restoration it is possible to see that on the third and fourth floors there were openings in the northwest façade. There were once two privies but were taken away at some point in the past; and there was also sign of a broken away sewerage shaft. Around the window on the southeast façade there are signs of a doorway (Eriksson, Drake & Carelli 2007: 35).

The stairwell

A part of the building is sticking out on southwest façade that has a pentagonal shape, this is the stairwell. The bricks have the same brick bonds in the façade on both stairwell building as the rest of the tower. The bottom floor of this building should consist of a compact wall and from the entrance floor there is a spiral staircase that connects the entrance floor with the upper floors. On every floor there is a thin vaulted passage which leads to the middle room of

every floor. Iron pieces in the walls shows that the doors to the middle rooms opened outwards. There are three small windows on every floor that begins on the second floor, there are evidence that shows the windows was fitted with wooden shutters. By one of the windows between fifth and sixth floor there is a weapons shield engraved in a brick, probably before it was burnt. This engraved shield can also be found higher up on the wall; however no one has been able to identify this engraving (Eriksson, Drake & Carelli 2007: 67, 69).

The ground floor

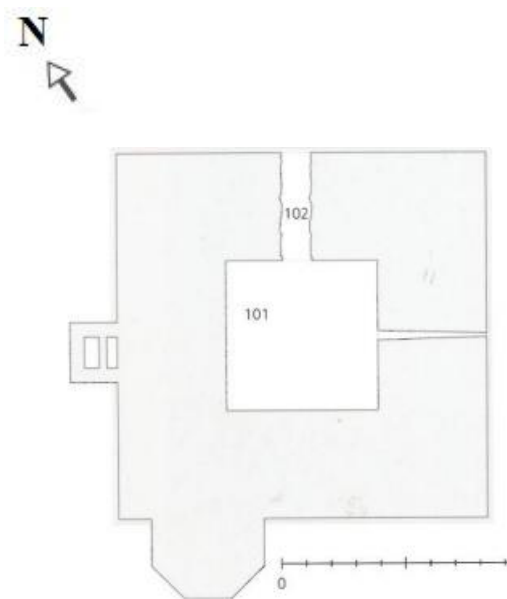


Figure 9. The floor plan of the bottom floor, the narrow entry (102) is from the middle of the 19th century (Eriksson, Drake & Carelli 2007: 20).

The ground floor consists of one large room that resembles a basement, even though it's placed above ground. The only entrance during the Middle Ages was through a hatch in the ceiling. The walls are 8 meters high and consisted of sandstone blocks. A little more than half the wall consists of large sandstones blocks with little mortar in between. Higher up on the wall the stones are smaller, less organized and there is more mortar between the stones. Until 1893 this room was divided into two floors by wooden beams, which could be traced back to the Middle Ages. That the ground floor didn't have a connection with the outside world is a common phenomenon that occurs in most of the detached medieval towers. The main purpose of the ground floor was to elevate the living floors. By not having a door to the ground floor they could prevent the enemy from gaining entry to the tower, they would remove the wooden

stairs or ladder. The bottom floor was used as a beer basement during the middle of the 19th century and the northeastern window was turned into a doorway (Eriksson, Drake & Carelli 2007: 43f).

First floor

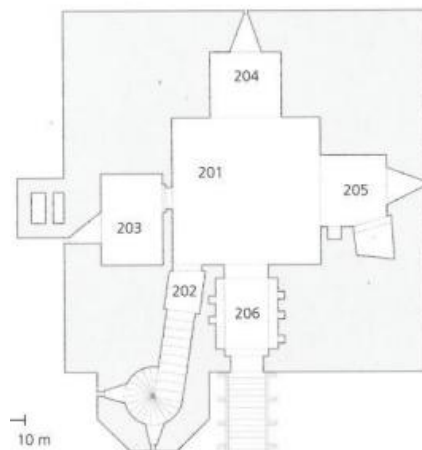


Figure 11. Floor plan of the first floor, the entrance to Kärnan (Eriksson, Drake & Carelli 2007: 20).

Modern wooden stairs lead into Kärnan's main entrance on the first floor. This floor consists of six independent areas. The middle room's walls are built out of sandstone, with the exception of the wall openings that consists of bricks. The windows niches are also built with bricks, and the small windows have been interpreted as loopholes but it's more likely that their main purpose has been as a light source. In the southeastern wall there is a big open fireplace that may have served as a kitchen. The first floor has served as a main entrance to the tower during the Middle Ages, and has also been used as a kitchen. One of the rooms on this floor may have served as a bedroom for the gate-keeper or the cook or for some other people that worked in the tower. The doorway leads to the middle room, and through the middle room there is a connection to the stairwell. Before 1893 there was a direct connection between the doorway and the stairwell. People walking in to the tower didn't have to go through the middle room where the kitchen was or where the staffs were sleeping (Eriksson, Drake & Carelli 2007: 45f).

Second floor

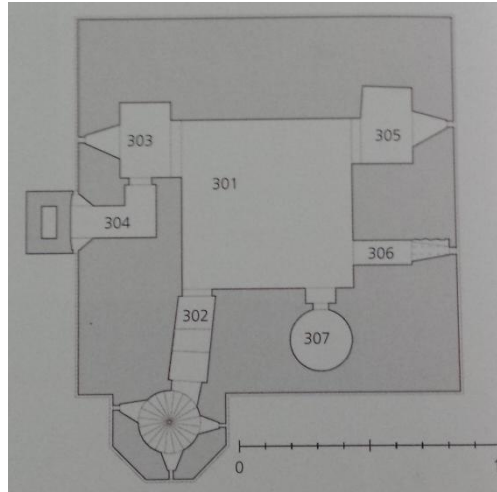


Figure 12. The floor plan of the second floor (Eriksson, Drake & Carelli 2007: 20).

The second floor of the tower is divided into seven different spaces, where they are all connected to the room that is placed in the center of the floor. The walls in the middle room consist of sandstone blocks and bricks. The main source of light to the middle rooms comes from the two side chambers, and a little light comes from a narrow window in the southeastern wall. Narrow indents in the wide openings of the side chambers indicate that they have been provided with walls of wood. There was maybe a need to be able to close in the chamber from the middle room. One of the side chambers has its own entrance to the privy from the northwestern wall. There are openings in all of the middle room walls, except for the northeastern wall. In the southeastern wall there is one side chamber with a small window, and a window niche were its possible to see signs of a sink. In the northwestern wall there is a kept baking oven with smoke channels that leads straight up from a niche that is placed inside the wall. In the middle room there are eight wooden beams in the roof that are original, and they are colored black from soot. Despite that the tower is over 700 years old the walls are whole and clean, this can be interpreted that they had panels on the wall that would absorb all fat and soot that everyday life brought. The small square beam holes in the wall could have worked as attachment for the panels. The side chambers probably served as

bedrooms for important dignitaries or officials in the household. The privy and the side chambers indicate important housing functions (Eriksson, Drake & Carelli 2007: 48f, 51).

Third floor

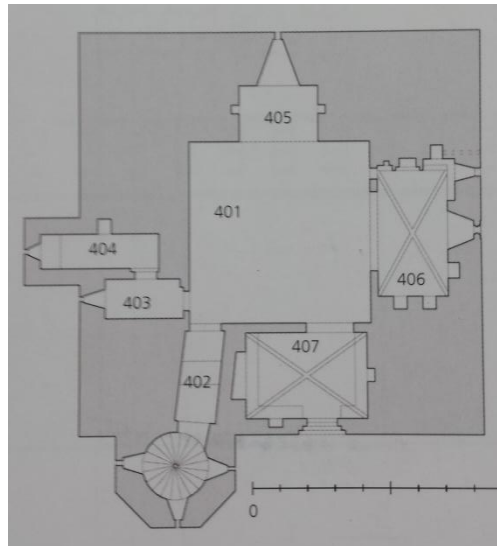


Figure 13. The floor plan of the third floor in Kärnan, the middle room (401) is today merged with the floor above (Eriksson, Drake & Carelli 2007: 21).

The third floor includes two floors. It's the medieval towers core, today mentioned as the king's floor. The middle room of this floor was joined with the room above it. Between the two rooms there originally were wooden beams, as in the three floors below. When the two floors were joined, the beam holes were filled. However they are still visible in the walls. Small fragments on the walls show that it was polished; there are also traces of color in the bow opening between the middle room and the southwest chamber. This hints that the floor was decorated with paintings (Eriksson, Drake & Carelli 2007: 51).

The floor's middle room has five chambers coming out from the sides. In the northeastern wall there is a privy with a reconstructed bench. This privy is designed as a narrow thin arched corridor/hall that is connected to a chamber with the same shape/design. This is a layout that stresses this living area's high standard. The middle room has originally had two window niches. The one in the northeastern wall is left in its original shape, and of the southeast window there is only the framing left. The rest of the Southeast window has been

replaced with one twice as large, which must have served as the castle lord's private chapel. The chapel room has a round window that is a reconstruction from the restoration that took place in the 1890's. In the wall towards the middle room there is a minor opening that is topped with a cloverleaf arch. The altar in the chapel is marked in the brick floor with a different pattern. In the northeastern wall the altar is marked with three niches, and the middle one is shaped with a pointed vault that was meant for the crucifix or religious picture. The niches on the sides were small, but later enlarged. The southwest wall has two openings, one which leads to the stairs and the other one to a wide wall opening in the southwest chamber. Between these two openings there are traces in the wall of a secondary added fireplace (Eriksson, Drake & Carelli 2007: 51, 54). The southwestern chamber has a window that is a creation from the restoration in 1893, and is based on the leftovers that already existed from older windows. This chamber has an entrance that has been closed that at some point have been closed (Eriksson, Drake & Carelli 2007: 62).

The middle room on the fourth floor has from the beginning been the tower's finer living space. There has been heating and privy, but no sleeping area. There could have been a bed in the middle of the room. However in other castles during the Middle Ages you slept in rooms with no fireplace. The room on the fourth was lower and had a simpler design. The fourth floor could have been used as a living room and slept on the fifth floor. After the fifth and the fourth floor merged there was a wooden stair leading up the chamber on the fifth floor. The new living arrangement on the third floor was no longer a humble castles lord's room; it was now a representative castle hall (Eriksson, Drake & Carelli 2007: 62).

Fourth floor

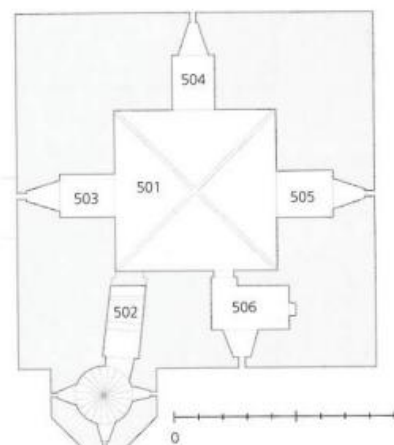


Figure 14. The floor plan of the fourth floor, which today is merged with the middle on the floor below (Eriksson, Drake & Carelli 2007: 21).

The present fourth floor consists of two floors that have been merged together. Before the merge the two floors had an almost identical floor plan. It's thought that the merge of the floors was due to the lower floor levels had to be raised, since the royal hall was vaulted. The top of this floor rises more than half a meter over the original floor height (Eriksson, Drake & Carelli 2007: 62, 65). The beam holes were original discovered when Torsten Mårtensson removed the filling that was lying on top of the vault. When they removed the filling from the vault of the third floor during 1924 they found fragments of an Assyrian glass bowl, which can be dated to 1260-1280. When the dig was completed in 1932 they found an additional five fragments of the bowl (Eriksson, Drake & Carelli 2007: 65, 67).

The top floor (defense floor)

We don't have much information about Kärnans original defense floor, other than it was torn of in 1653. A painting from the 1580's show Kärnan and the castle of Helsingborg, however there are some details missing from this picture (Figure 11). For one, the chimney that must have been placed in the south corner doesn't show and the stairwell building is also not shown. The painting pictures the defense platform with a crenellation with few spaces that was used for crossbows (Eriksson, Drake & Carelli 2007: 67).



Figure 15. A drawing of Helsingborg during the 16th century, it gives a view of the tower and how the walls were placed around it (Eriksson, Drake & Carelli 2007: 74).

5.5 Interior and Furniture

Kärnan is standing still today but it has been used in different ways during its lifetime. And the interior is something that is not mentioned with Kärnan. I will therefore use information from other research and excavations regarding castles in the Danish kingdom during the 14th century.

There are no furnished medieval rooms or buildings that have been preserved to our time. There are medieval buildings that are left standing today but most of them have been rebuilt or heavily restored. However it is still possible to collect information and get an understanding about how the medieval people lived in the houses, and how they have looked and might have been furnished. The development of heating technologies that occurred during the Middle Ages changes the way of how people used the room's layout. Furniture and increased comfort now became a way of expressing identities and social standings. The houses started to divide into rooms and privacy became an issue. The medieval furniture that are left today were mostly from the churches, or furniture from larger houses. This furniture is often out of context, and excavation findings are fragmented (Roesdahl & Verhaeghe 2011: 200).

There is information about medieval castles in Denmark in the 14th century, but when it comes to everyday items and interior we are not as lucky. Earlier excavations from the 19th and the 20th century had an interest in the spectacular objects and the everyday items did not get as much attention as today. Royal castles have often been excavated many times and there are mixed collections from different excavations. The finds are hard to date from the 14th century, but Vivian Etting writes that it is possible to get a general view from the material (Etting 2010: 179).

The need for shelter from the different seasons, preparation for food and safety were basic necessities for living in Europe. Emergence and development of houses during the medieval times led to a different and specific housing condition for different and specific social and

economic groups. Different solutions were developed for the spatial organization of the housing and managing of the daily life. The differences that appeared in the housing culture depended on the social, economic and cultural aspects. These made the housing culture vary from basic necessity to very comfortable living and sizes of the households also varied. Specifically during the twelfth century there was a change in the physical division of the living space in the housing culture. Throughout Europe there were new elements in the housing culture, practically in urban, aristocratic and monastic environments. It shows that there was communication within Europe, and it developed to a more coherent culture during this period (Roesdahl & Scholkmann 2007: 154f).

Written sources

Illustrations and written sources can provide additional information about the interior of houses during the Middle Ages. Paintings can show furniture and how they were used in different social settings. They can also show items of furniture and textiles that hasn't survived to present day, such as wall-hangings, towels, table-cloths etc. The written sources can consist of testaments, inventories and accounts (Roesdahl & Verhaeghe 2011: 201). Inventories, especially from the late Middle Ages can give information about the furniture's existents and status. In some cases there is information about the furniture's placement and use in different rooms of the homes. Sometimes there is also information on the furniture's design and appearance, and how they were manufactured and decorated (Roesdahl 2003: 227). There is an inventory from Copenhagen castle that mentions food items and kitchen utensils f. ex. 12 barrels of beer, butter, 6 barrels of salt, 4 kettles, 5 pots etc. The inventory also included table arrangements of 1 tablecloth, 1 towel and 9 cochins. From 1364 there is a list of King Håkon's personal property from the castle of Varberg that was under Swedish control for a time. Some examples from the list are: 4 bed curtains with stripes of silk, 2 sheets edged with golden silk, 2 pillows embroidered with gold thread, 4 pieces of blue cloth embroidered with crowns and griffins, 1 suit of armor, etc. In some cases the written sources can tell a lot about the furniture in the royal apartments. The English courts tailor what princess Philippa was bringing with her when she married King Erik of Pomerania. Besides from all the clothing like gowns, robes and tunics, he mentions a wedding bed, with hangings made of cloth of gold from Cyprus. The canopy, curtains, bed cover and 6 cushions were decorated with birds and fringes in silk. What was also included was the furnishing for the princess's private chapel (Etting 2010: 183f).

Interior

There were some big changes in interior culture during the Middle Ages in Denmark and in the main part of Europe. The foundation of our way of interior design was made during this time. Among the most important new elements was the dividing of the rooms that now got specialized functions. Another change of importance during this time was the introduction of new heating technology: wood burning stoves, hypocausts (a heating system) and chimneys replaced the traditional open fireplaces. This meant that there would no longer be smoke in the rooms and with new heating technology the space on the floors became more open, since the open fireplace didn't have to be placed in the middle of the room anymore. This made room to put in more furniture. During this time there was a rich development of specialized furniture. The homes during the Viking age and the older Middle Ages were characterized by fixed interiors such as wall benches and low wide platforms. The fixed interior continued to dominate during the Middle Ages but a need for removable furniture other than chests and small tools was added gradually, f. ex. chests, covers, chairs, benches, beds and tables in many different forms. During this period it also became common to have personal toilets for houses in the cities. The physical environment for housing functions became more and more specialized and the development occurred parallel with the development in north and central Europe. Housing now became more comfortable, and it now became possible to show social and economic status in the households. The light that had come from the open fireplace now had to come from other sources, such as oil lamps, chandeliers, candlesticks etc. After a while windows became more common and there you got the daylight. During the 15th century windows became more and more common (Roesdahl 2003: 223).

Houses had the functions for eating, sleeping, some forms of labor, and spending time with the family. None of the interior from the Middle Ages has been preserved for study to present days. Pictures of the interior are at the earliest from the 15th century and mostly from the southern parts of Europe. Inventory lists and wills are examples of written sources that give information about textiles and other interior items that didn't make it to present time. These sources mention for examples candlesticks, chandeliers and other sources of light, vases and flower arrangements, towels etc. (Roesdahl 2003: 239).

To understand the housing culture in Denmark during the Middle Ages, you need to collect information of the items being used during the same period of time, and how they were placed. The furniture and the interior in Denmark had much influence from items/layout from Germany and west European areas. All the evidence points at the interior of the homes were following a set of rules and norms. At the same time there are social and local differences. It is therefore possible to pick out medieval furniture from the same period in a medieval room or house given that the attached furniture, the heating system, social status, windows, doorways is known. It was during the 14th and the 15th centuries the biggest changes occurred (Roesdahl 2003: 239ff).

“It is obviously true, that all European countries influence one another to some extent in the Middle Ages, and even the Scandinavian countries cannot be ignored in this wide context.”
(Eames 1977: xv).

Furniture

Furniture have been used for the most fundamental needs such as eating, working, sleeping/resting and storage. There were not only mobile furniture that we have today, but also built-in which was less adaptable. The built-in furniture's presence can be explained by not needing to transport furniture, and was basic protection against thieves, as they couldn't steal the built-in furniture. The social aspect of furniture is also an important perspective to be able to understand the uses and design of the interior (Eames 1977: xviii).

The aristocracy undoubtedly knew about furniture such as chairs, beds, benches and tables. Else Roesdahl gave the Osebergwoman's grave goods as an example: she was buried in the year 834, and in her grave were found chests, beds and a chair. However only chests and footstools were commonly used in the Nordic countries during this period. These other types of furniture got more and more common during the Middle Ages, especially during the later period. In the written sources it is mentioned about furniture that folds, f. ex. folding tables and folding benches. When the furniture was folded they didn't take up so much space in houses and they were also easily moved and transported. Much of the furniture was mobile in a general sense, and homes were not furnished as they are today. Most of the Viking age furniture has been found in graves. From the Middle Ages there are a small number of furniture fragments in cities and castles. Iron parts from chests are some things that are found

in many archaeological contexts. Whole furniture has been bought, sold or traded in antique shops, and therefore the exact provenance is uncertain. Most of the furniture that we have left today from the Middle Ages comes from churches, mostly chests and cabinets. The furniture can often still today be found in the churches unless it has been moved to museums. There is all reason to believe that chests which were placed in churches could also have been found in different houses. They may not have been as decorated or have had iron brackets, as chests in churches often were. Cabinets may also have been looking the same, except for the sacrament cabinets that had special interiors and uses. It is also likely that the surviving chests and cabinets first were manufactured for residential use, to later be placed in the churches (Roesdahl 2003: 225ff). The furniture that is whole still today is that they may have been repaired and restored. The locks can have been changed and the decorated parts might have been taken away. The archeological material of furniture can be complimented by frescoes. These images can show tables, chairs, benches, chests, beds and also towel racks. Of the furniture that is found within churches, the oldest chest is from circa 14th century. The cabinets in general are from 15th century or later, and the only bench from the church context that Roesdahl mentioned is from the 15th century. To date the furniture from their decoration or style is done with much uncertainty because the furniture traditions were continual both in decorations and structures (Roesdahl 2003: 230-234). What is important to think about when it comes to the furniture that was being used during the Middle Ages, was that the furniture throughout this period was often built in. Wall niches for cupboards, built in benches and built in tables existed. Most of the furniture were simple carpenters work, were they were decorated and strengthened with iron mounts. From the 13th to the 16th centuries the carving decoration became more common and the furniture became lighter and sophisticated. Some of the furniture could also have been decorated with colors. There have been some traces of color found on furniture and it's also mentioned in the written sources (Roesdahl & Verhaeghe 2011: 201, 204).

Medieval furniture can be sorted into different categories; storage, sitting, eating and sleeping. Cupboards and chests belong to the storage category. Chests were the most common furniture used for storages of various items. Cupboards became more and more popular and they could be in all sizes, even decorated with iron mounts. Finer cupboards made it possible to display the homes luxury items. In the sitting category there were small stools, chairs and benches that had cushions. The benches and the chairs could be decorated with carvings of lathe-turned posts, and other details. The tables consisted of a loose table-top and support to hold it

up. There was often a table-cloth on top for decoration. The beds were a status symbol, and were placed in the sitting-room throughout the Middle Ages. It wasn't until the late Middle Ages when the sitting-rooms started to be filled with decorations, such as candle sticks, chandeliers, flower vases, wash-basin etc. This reflects a change in how people lived their lives. Different functions were now divided into different rooms. There were also a growing need for comfort and privacy, which can be seen as the start of how we today live and uses our homes, which was a big change from the earlier times (Roesdahl & Verhaeghe 2011: 204f).

Chests

The chests were the most common furniture in the different households during the Middle Ages. They are mentioned in different written sources. The chests were used for storage of clothes, letters, jewelry or other valuable items. Chests were also being used for transportation (Karlsson 1928: 57).

Many of the wooden chests were equipped with iron brackets, either simple ribbon-shaped bracket or small brackets to strengthen the structure and secure the content. The furniture could also have been decorated with carvings, have lathe details, or be painted. The vast majority of the furniture from Denmark during the Middle Ages was made with different kinds of planks. Chests and cabinets often came with brackets and are associated with wrought iron or wood carvings (Roesdahl 2003: 228).

Chests made out of tree stems are technically made in the simplest way of all the chests: a hollowing of a piece of tree stem. This means that the bottom and the sides are in made out of one piece where a lid was later attached. They were also reinforced with iron brackets. They are known from Norway, Sweden and the southern parts of Europe. There is no chest of this kind left in Denmark, but they were probably used there as well (Roesdahl 2003: 231).

Chests made out of planks could be assembled and combined in different ways, with iron nails and dowels. The corners of this type of chests were put together with iron brackets, but there exists chests of this sort without the iron brackets on the sides. Many of these chests have iron rings on the sides that were used when the chest were moved. Some of the chests are characterized by the long sides of the chests, which rest on a flange on the floor pieces.

There is only one example of this kind left in Denmark, which has been found in Hedeby and is from the Viking age (Roesdahl 2003: 231). Combined plank chests are on the other hand well known in Denmark. The iron-bound chest that is from Dallerup is maybe from around the 14th century is a combined plank chest and may be one of the oldest preserved chests. A re-used coffin from Lejre shows that this type of chest building already existed in the 10th century. Based on what has been found the chests were reinforced with iron brackets, which could have a strap-shape or/and have less or more decorative brackets. The most decorated chests are found in poor condition today. No chest had figures or animal decorations on them; they could have existed but just not been preserved (Roesdahl 2003: 231).

Chests with four legs have been used during the ancient times. In northern Europe there are examples for this type of chest before the late Middle Ages, but it was during this period the use of these chests increased. They are in principle a carpenter work without iron brackets, and in the front there was space for carvings of architectural type. The chests were made of horizontal planks where the bottom plank was placed above the ground thanks to the legs. In Denmark there are far less of these preserved than the plank chests (Roesdahl 2003: 234).

Beds

Beds functioned as luxury items and were often mentioned in different wills. They could be inherited by family members, close friends or in some cases they were donated to hospitals. The beds that are mentioned in wills were described to be given with all the items that belonged with the bed, such as the sheets, cochins etc. (Karlson 1928: 47).

In Denmark there is no known bed from the Viking age or Middle Ages. The oldest known beds in the Nordic countries are from the *Oseberg* grave and *Gokstads* grave in Norway. The graves are from the year 834, and around the year 900. There are different theories about why the beds were easy to disassemble. One is that they were meant to be easy to transport, another theory is that the furniture during this time was mobile in general. Some of the beds were a lot shorter than the beds we have today, around 165 cm, so the people sleeping in the beds had to sleep half-sitting. Normally the beds were built in and attached to the wall, but as mentioned above there were also a lot of beds stated in wills, that could be transported and given to someone else after the owner passed away. There are also a lot of paintings of the beds from

the Middle Ages, on frescoes and altar-paintings. The bed was in high regard as a symbol of status and was connected to marriage, births and deaths (Roesdahl 2003: 238f).

Cabinets (Cupboards)

The earliest known cabinets in Denmark are from the late Middle Ages, but their existence were known before that. Wall niches in buildings could be traces of built in cabinets, and from some churches it is known of this kind of cabinets. From the written sources of the late Middle Ages you get the information that the cabinets were also placed in homes and not only in churches. There also existed low cupboards where the more practical items could be placed, and there were cupboards that allowed for a display of the more luxury items that showed the peoples social status, such as nice tableware (Roesdahl 2003: 235).

Penelope Eames mentioned furniture that is called an armoire. This furniture is still being called so in France, and she described it as being equivalent to the modern cupboard. The armoire consisted of two basic types and one of them was a built-in one. The fixed armoire was not mentioned in many written sources since it was an item that came with the building. There are however mentions in some written sources, but mostly for the reasons of finding other items that were stored in the armoire (Eames 1977: 1f).

Tables

Fixed tables didn't become common in the households until well into the Middle Ages. They demanded more space on the floors which wasn't a given in during the Middle Ages. The word table originally meant boards or planks, which gives the clue that they were very mobile furniture in the beginning. The tables could, for example, be taken out when it was time for guests and then could be put away. In Norway there are examples of it being hanged on the wall when it was being used. Many frescoes shows scenes from different meals where there is a long table with tableware on, and is often decorated with a nice tablecloth (Roesdahl 2003: 237).

Benches and chairs

There are not a lot of archaeological data about the sitting furniture during the Danish Viking and Middle Age, except for the bench from the Ribe cathedral. The situation is different in Sweden and in Norway, where a number of chairs and benches have been preserved in churches. These give an impression and understanding of the finer medieval sitting furniture. The oldest chairs that are known of in the Nordic countries are Bronze Age folding chairs and a painted box chair with animal ornamentation (Roesdahl 2003:235). One chair from around the middle of the 11th century has also been found in Lund. It was probably long into the Middle Ages when the chairs and benches became common in houses, even though they have been known about from earlier times. Chairs and benches were not mentioned in wills until the middle of the 15th century, except for simple folding chairs. However the many pictures that can be found of the sitting furniture on late gothic frescoes and some altarpieces show that the chairs and benches were well known and well used furniture during this period in time in Denmark and elsewhere in Europe. The main sitting furniture until the late Middle Ages was the furniture that was attached to the walls. The pictures and preserved pieces of furniture show that the sitting furniture could vary in size and shape. The most of the chairs during the Middle Ages, except for the folding chairs, consisted of post (stick) chairs in different variations. From Norway the “kubbestole” that was carved out of a piece of tree, and the back of the chair was added after that. There were chairs that was made out of planks that were used around Europe, some examples of are *Suntaksstolen*, that was found in Västergötland, the *Blakerstolen*, from Norway and the throne in Westminster Abbey (Roesdahl 2003: 235ff).

How the furniture got in to the tower?

The medieval tower has a narrow stairwell and as mentioned in the introduction I could imagine that it would be difficult to bring furniture in the tower today. Did they build the furniture in the castle and then take them apart when moved out?

One answer to this question could be the window on the third floor in the tower. This floor was restored heavily during the end of the 19th century and it is difficult to investigate its building archaeology. But during the restoration the architect Alfred Hellerström wanted to emphasis the third floors important function as this floor was thought to be for royal housing and he replaced the former door opening in the southwest with a big and stylish window

(Eriksson, Drake & Carelli 2007: 61). Was it possible to get the furniture in through this window. If so, how did the transportation of the furniture to the rest of the tower go? Or was the furniture in the rest of the tower not as big so they could be put together in the rooms?



Figure 16-17: Photo to the left is the former door that today is a window (Eriksson, Drake & Carelli 2007: 61). The picture to the right is Kärnan before its restoration and the red circle shows where the former door was placed (after Eriksson, Drake & Carelli 2007: 36).

6. The Reconstruction of the second floor

The whole thesis has been about finding out how Kärnan was used in the medieval context, how it was run and which people lived and worked in the castle. There has been a lot written about castles and especially Helsingborg's medieval castle, for the ownership of the king and the defense view of the castle. Also about wars and politics. In this thesis I wanted to study something that I felt was missing the first time I visited Kärnan, which was long before

I started studying archaeology. I wanted to find out the everyday life of the people living there and how it may have looked during the Middle Ages in the tower. This is my way of doing this and finding the answers to my questions I've had for a long time.

The second floor has been interpreted to have functioned as a common area for eating and for administrative work (Eriksson, Drake & Carelli 2007). There is an oven placed on the floor in one of the walls, and there is a big middle room with two side chambers, a narrow window niche and one privy that is connected to one of the chambers. I have above described the floor in a building archaeological ways (in chapter 5.2), now I will describe the room in how it may have look during the 14th century and how it may have been used.

6.1 3D laser scanning of the second floor

The plan of the second floor is considered to be the same as it was during the Middle Ages. Therefore I decided to acquire the digital data from the second floor of the medieval tower Kärnan using 3D laser scanner. The use of this instrument allowed a complete acquisition of the second floor in less than 3 hours for a total of 16 scans; ten of which from the middle room (large room), one for each chamber (Figure 6), two scans in the oven (inside and outside) and one scan in the narrow window niche (Figure 21).



Figure 18. Picture from the acquisition with 3D laser scanner, I'm placing the laser scanner in the narrow window niche (photo taken by: Nicolo Dell'Unto).

Once acquired the scans I worked with Meshlab in order to align and clean the different point clouds (Figure 7). At the end of this process it was possible to obtain one large point cloud (Figure 19) that later on been further developed and transformed into a 3D texturized mesh.



Figure 19. Screen capture of the merged point-cloud of the second floor in Kärnan, in Meshlab.

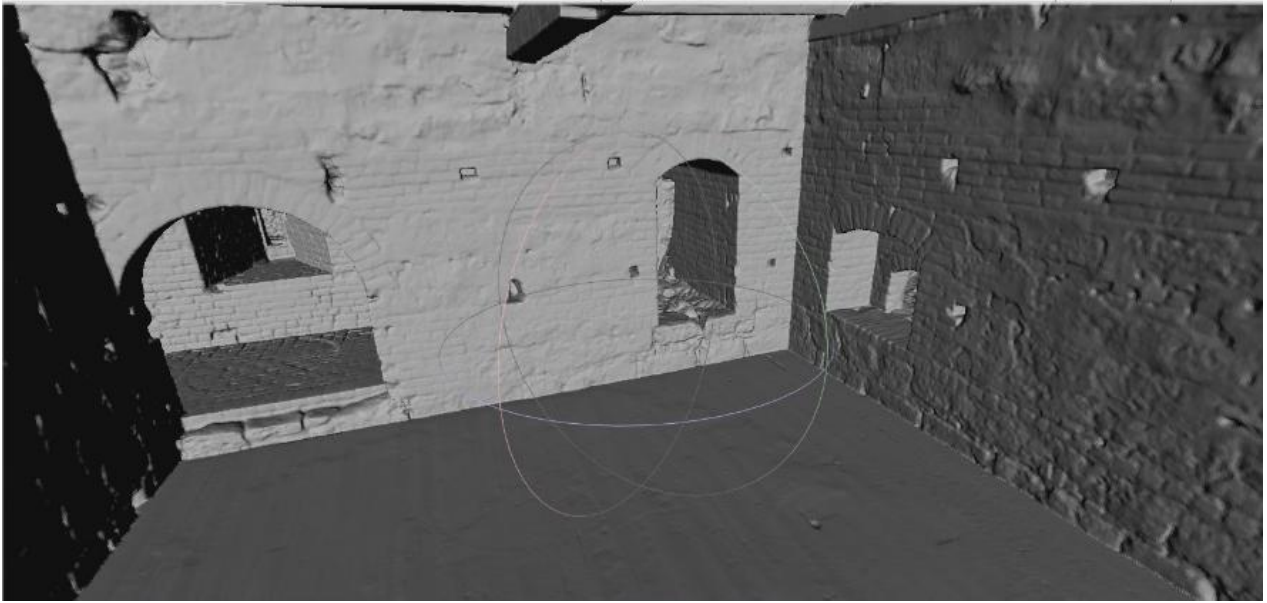


Figure 20. Screen capture of the mesh after adding poisson in Meshlab, without any texture.

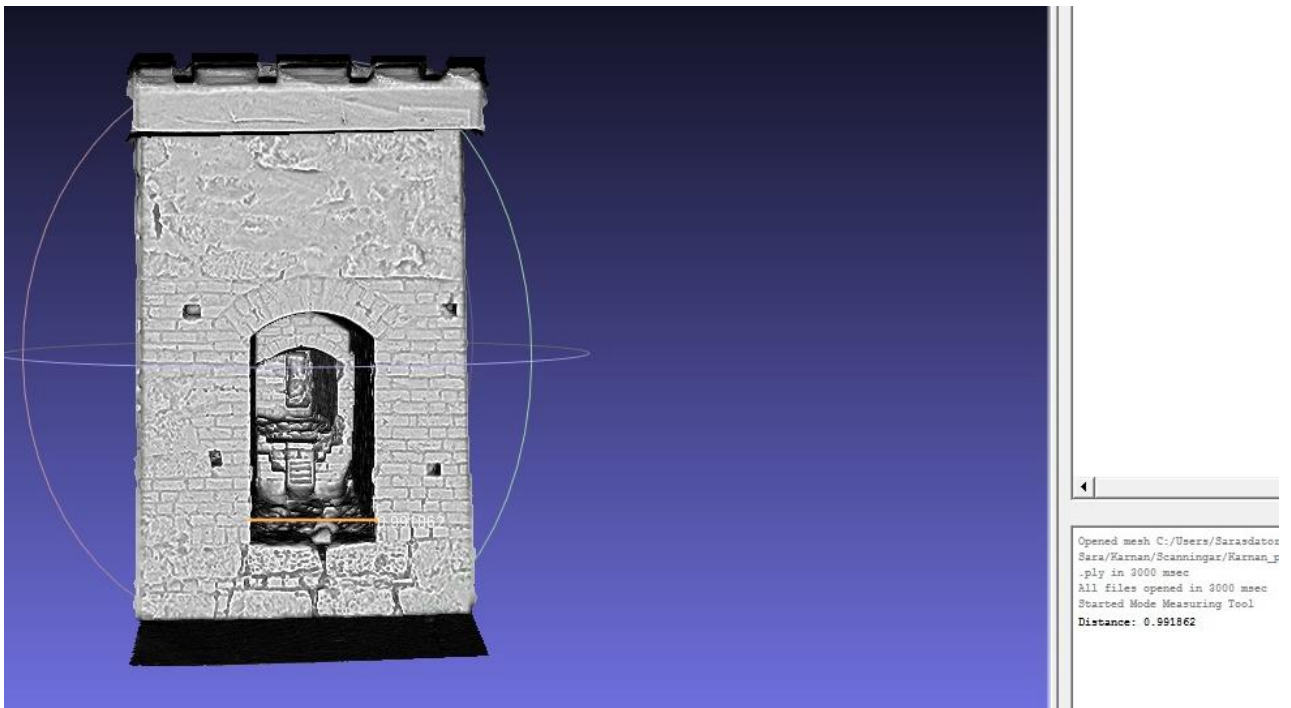


Figure 21. A screen capture of the narrow window niche in Meshlab.

As shown in Figure 21, this information has been used to visualize and analyze with high accuracy of the brick “patterns” that characterizes the room.

6.2 Texture

As mentioned above, the use of image based modeling for the acquisition geometry would have prevented an accurate and complete 3D model, for this reason this technique has been mainly used to create and project the color information on the model.

The acquisition campaign has been generated using a Canon D50 and in order to cover as much surface as possible a wide angel lens was used with the camera. Despite the accuracy in defining the right pattern to follow the acquisition of the images, there weren't enough pictures acquired to be able to achieve a complete color projection. For this reason a second acquisition campaign was made. Using the results of my second acquisition campaign it was finally possible to obtain enough information to texturize the entire model.

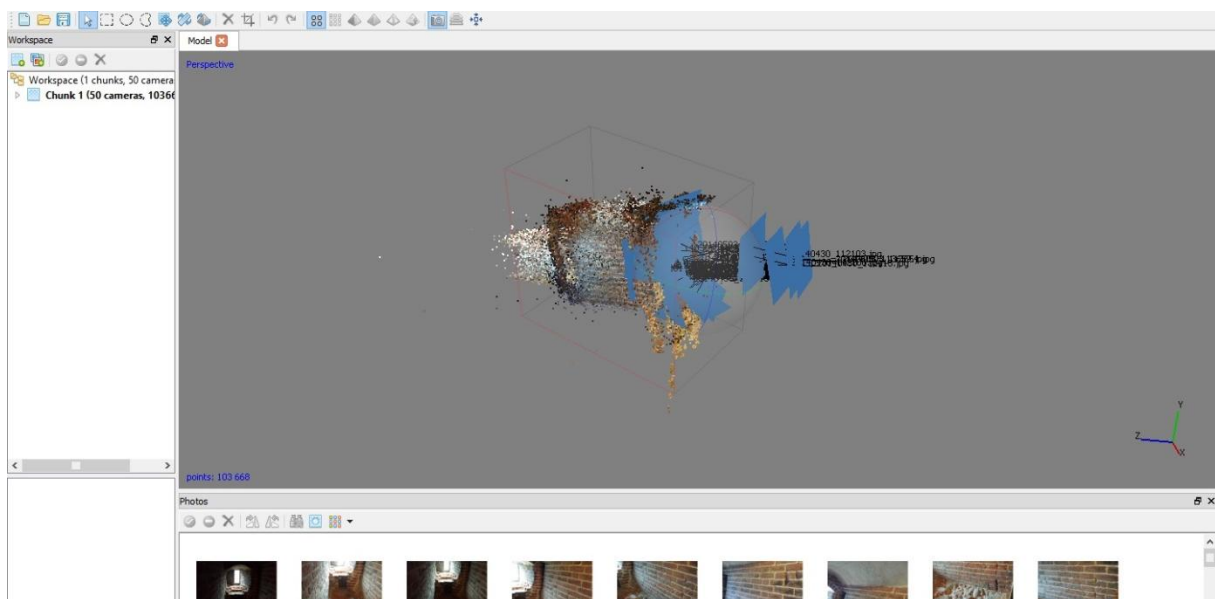


Figure 22. Screen capture of Agisoft Photoscan where the blue squares are where the camera was placed when acquiring the pictures. Show a point-cloud of the acquired data that later will turn into a mesh with texture.

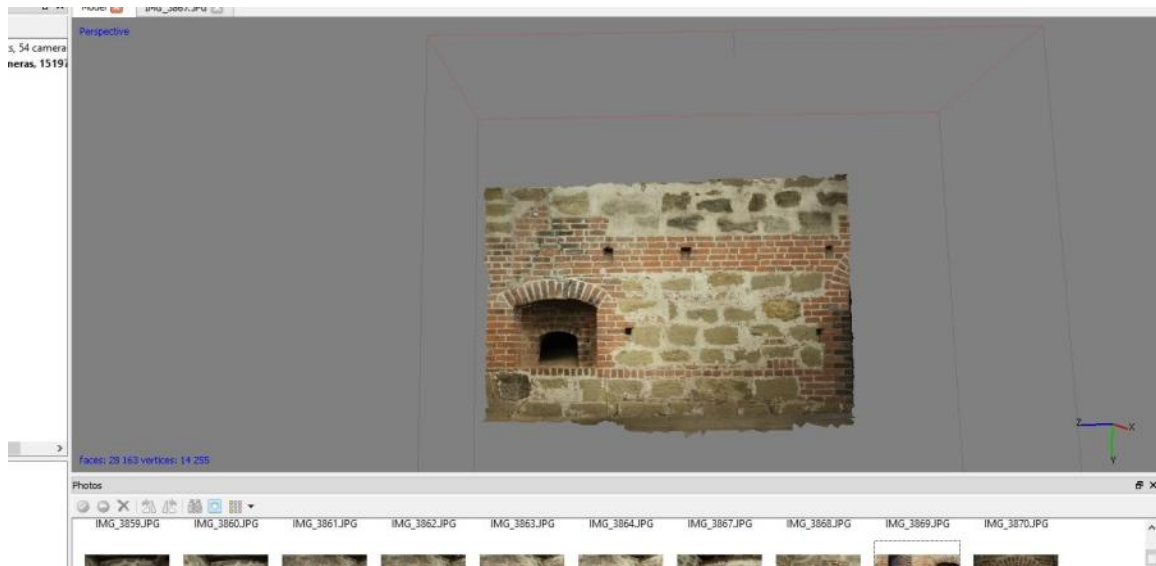


Figure 23. Screen capture of a final result with Photoscan, the texture were later applied on to the 3D model created with the 3D laser scanner.

6.3 3D modeling

This model has been used as a geometrical reference where testing and merging the virtual furniture reconstructed. In the next paragraphs a complete description and a discussion of the methodology used to reconstruct the furniture merged in the room is provided. This part of the work has been developed using software of 3D modeling (blender), this instrument has been employed to reconstruct the objects using the information coming from the literature and from comparison with similar case studies. In specific the information retrieved has been transformed into a geometrical shape, scaled according with the correct proportions and merged in the room.

The narrow window niche

The narrow window niche that is located in the southeast wall and it has been interpreted as a sink. If it was a sink it would be practical since it was placed near the oven (Eriksson, Drake & Carelli 2007: 48ff).

In the models below (Figure 24-25) it's possible to see in the wall inside the window niche, that there are narrow indents. These indents are placed in a straight line, and I think they show the possibility of something being attached in the walls. It could have been a window shutter.

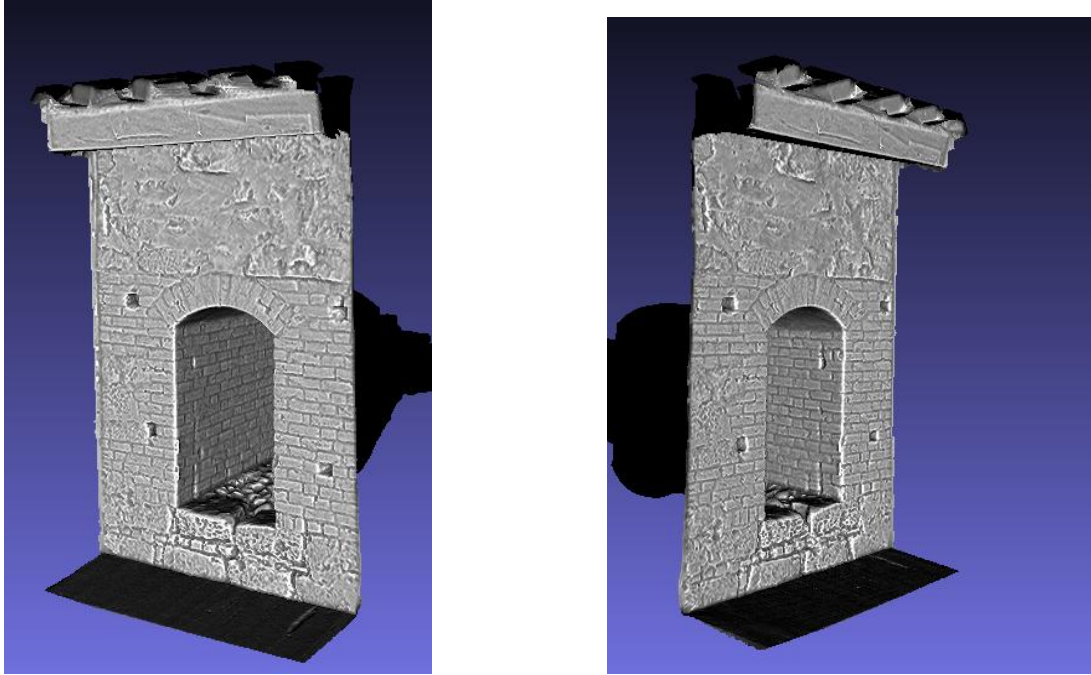


Figure 24-25. The two pictures shows screen captures from Meshlab. It's the same model of the window niche from different views. It's possible to some long narrow indents near the opening, on both views.

The wall –wood panels or stonewalls?

There have been interpretations that the stone walls have been covered with panels of wood. The small square holes that are repeated throughout the room has been interpreted to have been for the wood panels (Eriksson, Drake & Carelli 2007:48ff). But the question is; have there been wood panels in the 14th century when the tower was built, or are they placed there afterwards?

The walls in the middle room of the second floor consists of big stones and bricks, on some walls you can see a pattern and on other walls it looks almost as they are patches of random bricks and stones. Could this show that it didn't matter how the walls looked since it had wood panels that covered the walls? Or did the walls have patterns from the beginning but as been altered through time. The square holes in the walls I believe can have been for wooden beams. But were these beam holes there when the castle was built or were they made afterwards to follow the fashion? The problem with this is that there are so many questions

about some of the interior that are hard to answer since there isn't much information from this time. Therefore I'm not going to digitally reconstruct the wood panels.

Benches and chairs

The benches during the Middle Ages that were placed in the aristocratic household were benches made out of wood with textile on it for more comfort. The benches that are view in the pictures (Figure 26) and (fig 33) below show that the benches were long with ornaments in the wood on the sides.

I decided to make a reconstruction of a bench alongside a table in the middle rooms since the benches seemed to be similar to one another and I have afterwards placed textile on the bench that had the color red after the inspiration of (Figure 33) below.



Figure 26. A painting from the 15th century. It's a detailed painting that shows interior and furniture (Roesdahl 2003: 240).

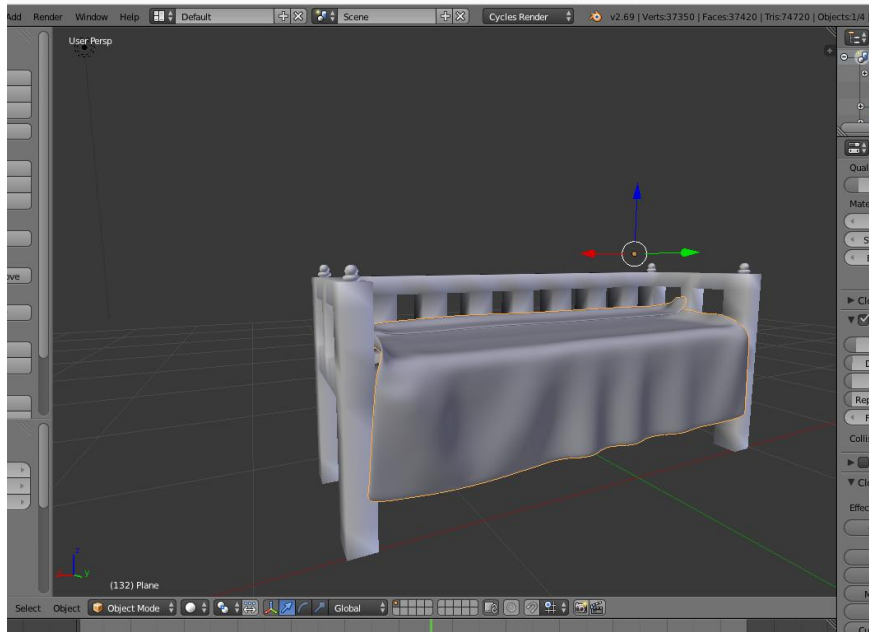


Figure 27. Screen capture from Blender, of a model of a bench.



Figure 28. The picture to the left is a chair from the 13th century (Eames 1977: Appendix).



Figure 29. The picture to the right is a chair from Lund and a reconstruction made from the back part of the chair (Roesdahl 2003: 237).

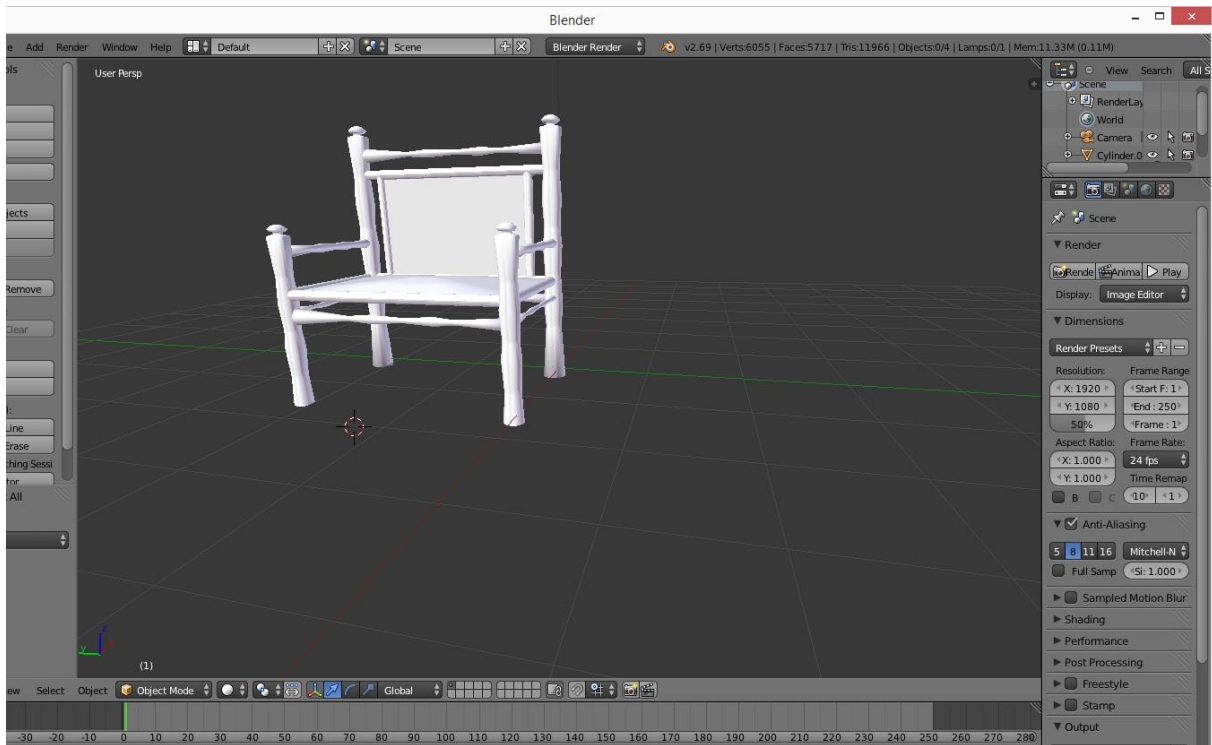


Figure 30. Screen capture from Blender. The two chairs above was combined and modeled in Blender.

Table

The tables seem to have been of simple design and there are descriptions that they have been put away when they weren't used but there are also examples of them being decorated with nice table cloths (Roesdahl 20036: 237). Therefore I made a model in blender with fairly simple design with a table cloth.

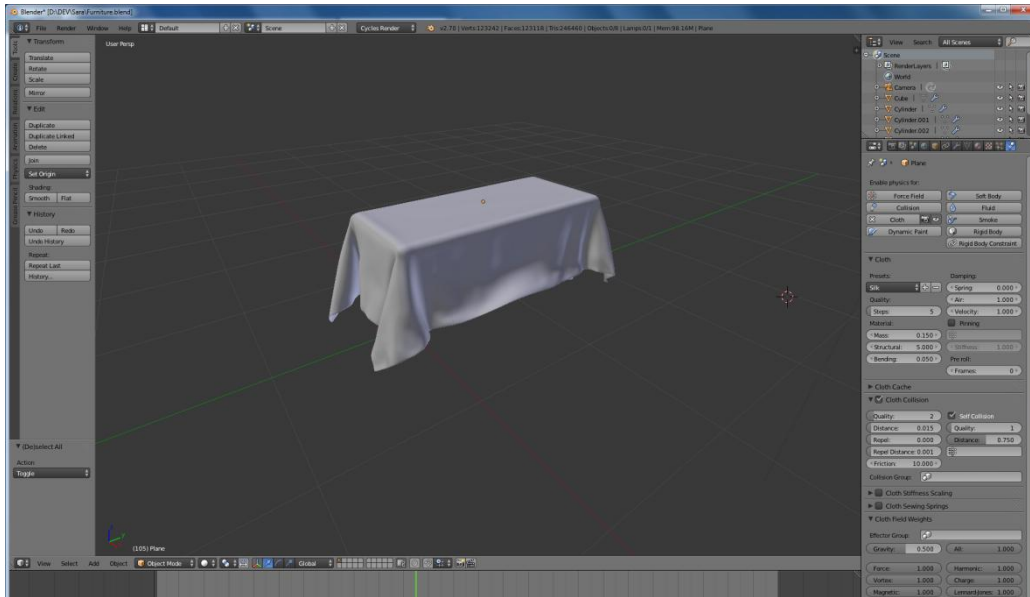


Figure 31. Screen capture from Blender of a model without texture of a table.

Bed

The fact that the beds are mentioned in wills with the bed textiles can show that this was a luxury items. But there aren't so many medieval beds left here in the Nordic countries to study (Karlsson 1928: 47, Roesdahl 2003: 238f). But there are descriptions of them and mentioning's about their appearance, Eames has drawn a bed with the different pieces of a bed (Figure 32), this from an English context but I still think it applies to the Scandinavian beds since there were influences to Skandinavia (Eames 1977: xv, 74). There is a picture of a painting from the 15th century that Etting put in her book, it has the same shape as Eames shows in her drawing of the different parts of the bed (Figure 32 and 33).

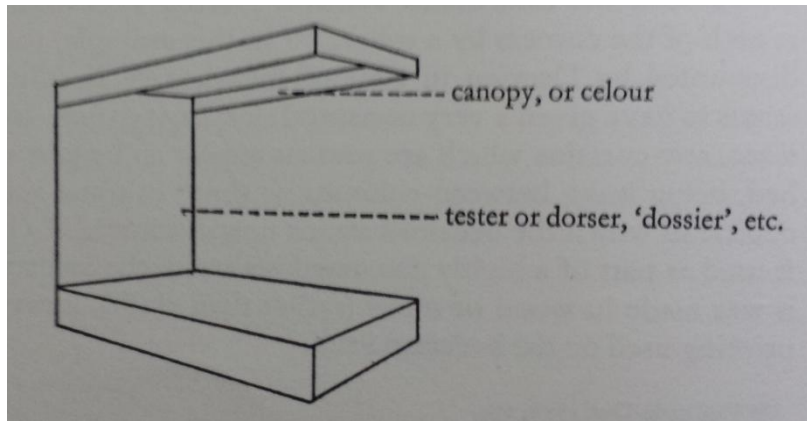


Figure 32. Drawing of the different parts that beds were built of (Eames 1977: 74)



Figure 33: A picture of interior rooms of a royal castle, from 1448 (Etting 2010: 48).

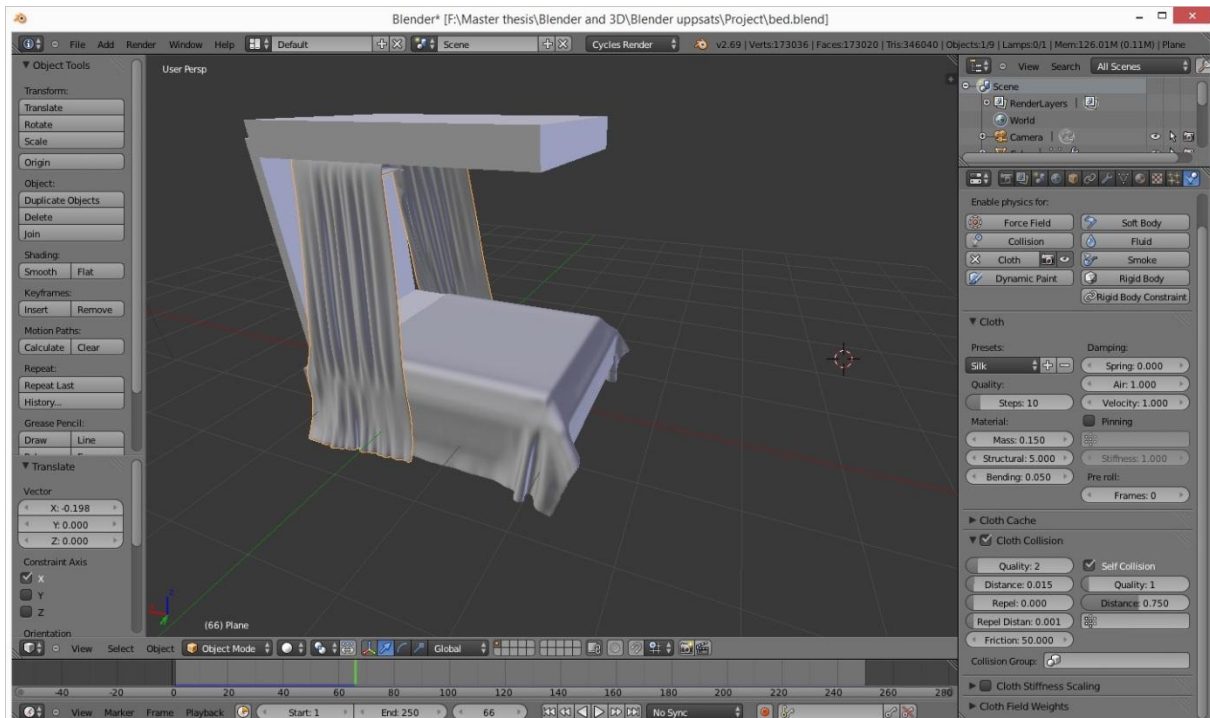


Figure 34. A screen capture of Blender, a model of the unfinished bed

I have made the reconstruction of the bed in blender (Figure 34), with the inspiration of this picture (Figure 32, 33) and of the different parts of the bed and also the painting.

Chests

The chests during the medieval times were common furniture that could be found in most households. There are as mentioned above in this thesis different types of chests from different time periods and households. Most of the chests that are preserved to present day come from churches (Karlsson 1928: 57, Roesdahl 2003: 228).

I choose to use one picture of a chest that has been interpreted to be the latest from the 15th century and decorated with iron brackets (Roesdahl 2003: 232). From the beginning in making the model in Blender I used a lot of the iron brackets (Figure 36) however the vertices become to many and the chest became too heavy to place together with the rest of the models in blender. Therefore I removed some of the brackets to make it into a simpler model (Figure 37).

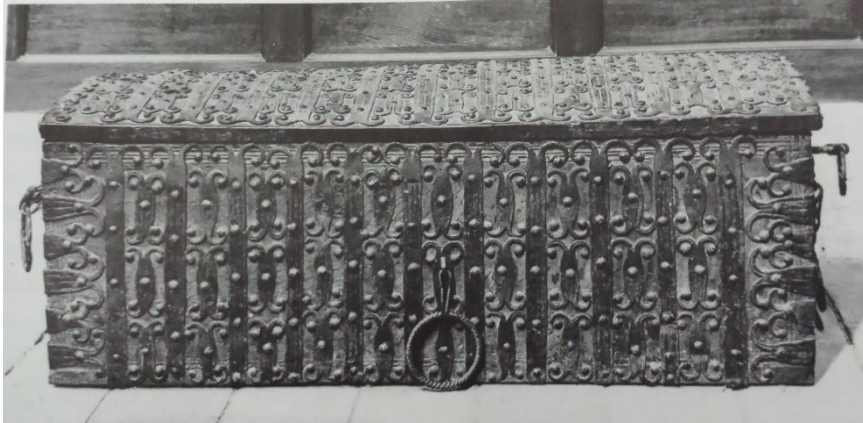


Figure 35. Picture of a chest from the church Sorø in Denmark, that is dated to the latest from the 15th century (Roesdahl 2003: 232).

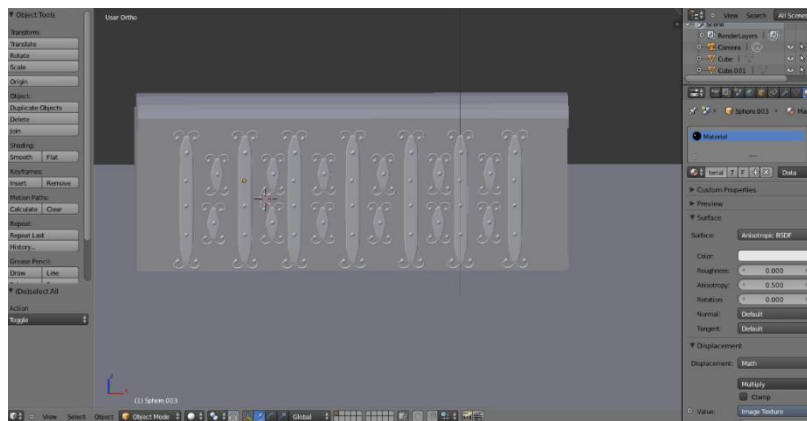


Figure 36. Screen capture from Blender, of the reconstruction of the chest.

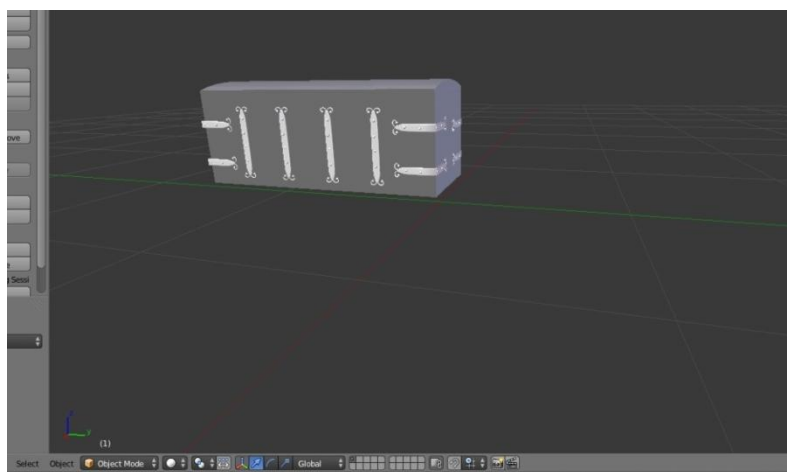


Figure 37. Screen capture from Blender, of further work with the chest.

6.4 Result of reconstruction

The side chambers have been interpreted as bedrooms for important persons (Eriksson, Drake & Carelli 2007: 48). Therefore I made one of the side chambers into a bedroom adding to the 3D model of the room a bed and a chest.

A baking oven was placed in one of the walls in the middle room (Eriksson, Drake & Carelli 2007: 49). Therefore I placed a table and seating's in the middle room.

The virtual furniture can easily be moved or modified, and they can be moved around without difficulties. After making the 3D model of the second floor it's possible to add or replace furniture and interior.

Once implemented the furniture in the room I used Blender to produce images of the virtual room. The software allows generating in order to achieve a more realistic reconstruction of the second floor (Figure 40-42).

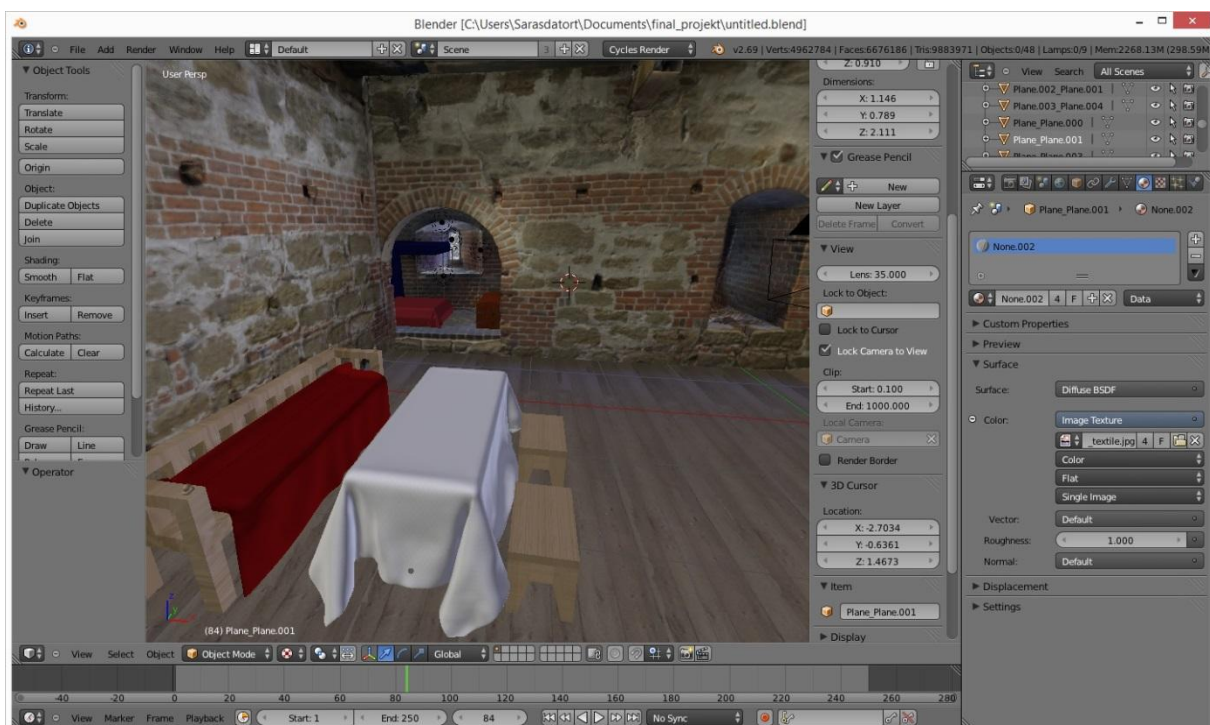


Figure 38. Screen capture of the scan models of the floor and the texture from Photoscan and the 3D models created in Blender.

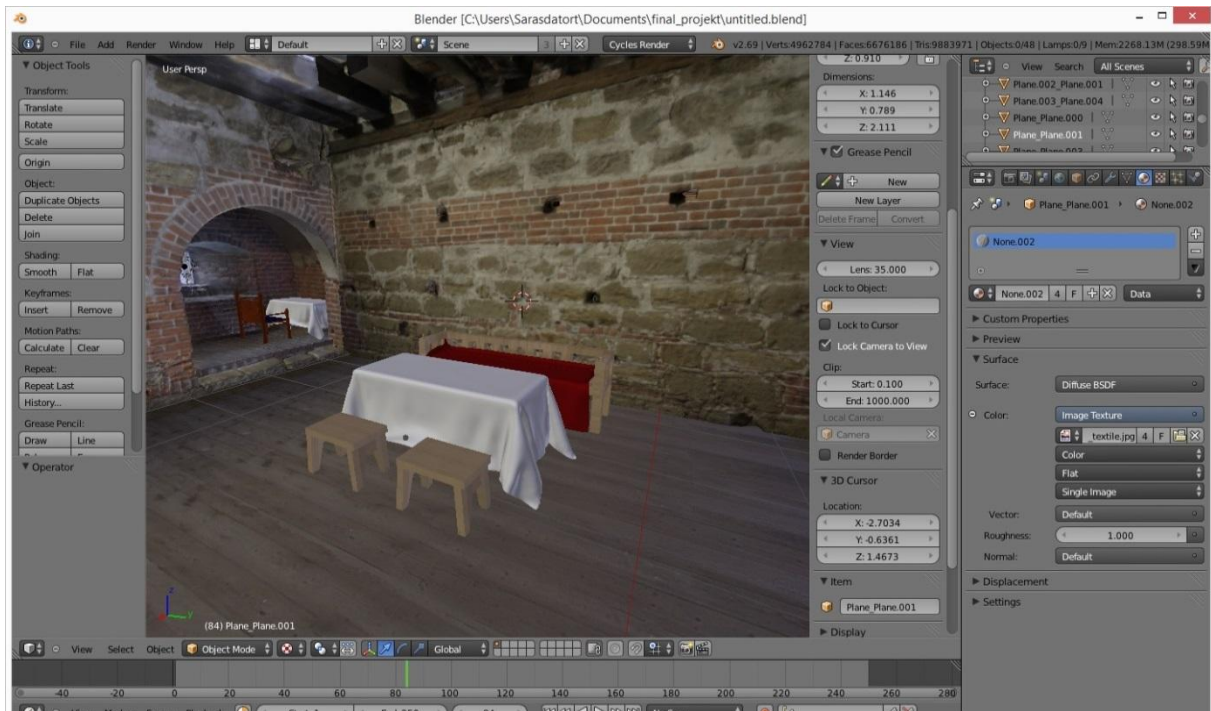


Figure 39. Screen capture from Blender, where all the scans, textures and 3D models are put together.



Figure 40. Rendered image from Blender of one of the side chambers.



Figure 41. Rendered image from Blender of the middle room in the second floor.



Figure 42. Rendered result from Blender of one of the side chambers in the second floor.

7. Discussion and conclusion

In this thesis (chapter 5) I have referenced a lot information about Kärnan, the castle in Helsingborg, the city Helsingborg, Castles in the Danish kingdom during the 14th century etc. In this discussion I will try to bring all this information together to answer the questions about Kärnan.

7.1 The purpose Kärnan had to the area

Helsingborg was important to Danish king, since the city was placed by the narrowest part of the sea. The castle was placed on top of a naturally formed plateau that functioned as a defense. Kärnan was a part of Helsingborg's castle and had a defense purpose, even though this was one important purpose, it wasn't the only one (Eriksson, Drake & Carelli 2007). The castle was owned by the king; however it was not his permanent residence. The court travelled around in the Danish kingdom and the king ruled from the castle he was living in at that time. The one who could have lived in the castle was an appointed fief holder. The royal castles also functioned as administrative centers for collecting taxes and maintaining the law. There were different fiefs that belonged to the different castles, and it was administrative managed by the fief holder (Etting 2010).

There were many fiefs that belonged to the castle, and there is confirmation of Helsingborg as an administration of fiefs in the 12th century (Svensson 2001).

To conclude, Kärnan that was a part of the castle was placed by the place that combined eastern part of Denmark with the western part of Denmark (Eriksson, Drake & Carelli 2007). The castle was an administrative place that collected taxes and maintained the law in the surrounding area (Etting 2010). The medieval tower and the castle had an important purpose and affected the landscape around it greatly. As mentioned in my introduction, I still think that Kärnan gives an impression. Without the inviting stairs and walls around it, I can only imagine how it must have felt to stand and look up at the castle. This was arranged mainly for defense purposes, but I think it's more to it than that. It must not only give an impression on the people living in the city, but to the enemies as well. The castle states power, to the ones

trying to siege the castle and to the landscape and the people living in the area. For the fief holder who had the privilege of running the castle and the fiefs that came with it, it would have been a sign of personal status to their which gave them a place far up in the social hierarchy.

7.2 The people who worked/inhabited Kärnan

The king owned the castle and was living there occasionally when travelling to Scania. The fief holder was running the castle and probably living there. A fief holder was someone with power and money and had people working for him in the castle (Eriksson, Drake & Carelli 2007, Svensson 2001).

Kärnan's different floor has been interpreted for different functions in the daily life. The first floor could have served as a kitchen. The second floor in the tower, the one I decided to digitally reconstruct, has been interpret as a sort of castle room where there have been gatherings of the people working in the castle and also important people staying overnight. The two side chambers have previously been interpreted as bedrooms. The third floor has been mentions as the king's hall, with its high vaulted ceiling (Eriksson, Drake & Carelli 2007). The first floor shows the people working with the everyday life in the kitchen and the guards who watched the entrance. The second floor has access to a privy, which could be a sign of status and two side chambers that have been bathrooms and also an oven in the middle room. Even though there have been hierarchies in the tower, I don't think it means that the people working there were invisible and that the people at the top of the elite was never involved in the daily life of the castle.

As mentioned above I have been using different sources for how the spatial use may have been for both the medieval castle as a whole and the second floor in the medieval tower Kärnan. When I started this thesis I didn't think so much on the use of furniture as later discovered needed to be investigated. What was luxury then? F.ex. If you have a big court that travels around, today one might think that luxury then would be to have peace and quiet and your own room when you get to the castle you were living at, but was it so during the 14th century? In The tower Kärnan there couldn't have been any room for the whole court to have

privacy, and were there a need for privacy? These aren't the questions that I began with when I started this thesis but questions that naturally occurred when working with this thesis. These questions are a part of the social identities and hierarchies of the 14th century. With the reconstruction I have tried to show how one floor of the tower might have looked and been used.

7.3 The medieval appearance of the living space

When starting this thesis I was planning on the digital reconstruction part to be a small part of this thesis. I wanted to show that the digital techniques could be used in combination with the "traditional" archaeological methods. Without the archaeological methods there is no place for the digital methods in archaeology. However I realized when my thesis developed that the digital techniques would get more attention in my thesis than originally planned. The more I worked with it, the more I realized what was possible with it.

The aim with the digital reconstruction was to show how the second floor in Kärnan might have been used. To be able to visualize this I have put in furniture to be able to see how they fit, how the room was used and what appears to be realistic. I have tried to make interior and furniture as realistic for their time as possible, however the aim of this thesis was not to research about medieval furniture. I have deliberately not copied any of the furniture that is part of the reconstruction. In the making of the digital visualization of the furniture I have used others interpretation of medieval furniture, pictures of preserved furniture and reconstruction/drawing of furniture as inspiration.

The reconstruction of the second floor of Kärnan, ended up with nice furniture that might be considered as luxury items, such as a bed. The presence of a privy also shows that it was a floor with high status. The most important lessons I have learned when working with this thesis is; that it is easy to make interpretations about the interior, furniture, and how people used them, until you have to visualize them all together. The digital reconstruction of the second floor shows one of the possibilities with this digital approach. The reconstruction could also have been more detailed with interior and furniture; however that would have required a lot of research. This digital reconstruction serves as a visualization of what

furniture could have been placed on this floor. This reconstruction is not the one interpretation of the floor; it's one of many possible interpretations.

The digital model of the second floor that was acquired with the scanner was the part of the digital work that was the most time consuming. This model is now done and the reconstruction of furniture and interior can be redone and changed with this scanned model as a base. If there would be further development for the digital work, the rest of Kärnan's interior could be scanned and later there could be digital reconstruction of the different time periods. This would make it possible to change interpretation with little money, time and material.

8. Summary

Kärnan is a medieval tower that once was a part of a castle, today the tower is the only building that is left standing above ground from the castle in Helsingborg. Kärnan was built during the beginning of the 14th century and was owned by the Danish king. The king himself didn't live at the castle, he travelled around in the Danish kingdom since there were no royal permanent household during this period. The castle of Helsingborg was, as many other castles, not only built for defense but also for administrative reasons. There were fief holders living in the castle during this period in time. The castle in Helsingborg was an important castle for the king to get access to Scania through the narrowest part of the sea.

There are floor plans in Kärnan that is preserved since the Middle Ages, one of these is the second floor, which has been interpreted to have been the castle lord's floor.

The second floor of the tower was acquired digitally with a 3D laser scanner and textured with image based modeling. The second floor represents, in this thesis, possibilities which are possible with combining archaeological methods with digital ones. The second floor is reconstructed and furniture, such as a bed, table, bench and chests were 3D modeled using Blender, to show one interpretation of the floor might have looked and used.

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Pictures

Figure 1. A screen capture of a 3D model of Kärnan. (Holmqvist, Moulin & Roe, Group work in Master's Programme: Archaeology – Theory and practice).

Figure 2. Eriksson, Torkel (1994). *En ruin försvinner: Kärnan i Helsingborg 1880-1894*. Helsingborg: Helsingborgs museifören.

Figure. 3. Eriksson, Torkel (1994). *En ruin försvinner: Kärnan i Helsingborg 1880-1894*. Helsingborg: Helsingborgs museifören.

Figure 4. Mårtensson, Torsten (1934). *Hälsingborgs slott under medeltiden: ett bidrag till det nordiska borgväsendets historia*. Diss. Lund

Figure 5. The workflow of the different steps of the digital methodology

Figure 6. Screen capture of the point-cloud, showing the floor plan. The drawn red circles represent where the 3D laser scanner was placed during the acquisition.

Figure 7. A screen capture of Meshlab, where points were placed to align the two scans.

Figure 8. Etting, Vivian (2010). *The royal castles of Denmark during the 14th century: an analysis of the major royal castles with special regard to their functions and strategic importance*. Copenhagen: National Museum, Danish Middle Ages & Renaissance

Figure 9. The floor plan of the bottom floor, the narrow entry (102) is from the middle of the 19th century.

Figure 11-16. Eriksson, Torkel, Drake, Knut & Carelli, Peter (2007). *Kärnan och borgen: Helsingborgs slotts medeltida byggnadshistoria*. Helsingborg: Dunkers kulturhus

17. After Eriksson, Torkel, Drake, Knut & Carelli, Peter (2007). *Kärnan och borgen: Helsingborgs slotts medeltida byggnadshistoria*. Helsingborg: Dunkers kulturhus

Figure 18. Picture from the acquisition with 3D laser scanner, I'm placing the laser scanner in the narrow window niche (photo taken by: Nicolo Dell'Unto).

Figure 19-21. Screen capture from Meshlab.

Figure 22-23. Screen capture of Agisoft Photoscan

Figure 24-25. The two pictures shows screen captures from Meshlab. It's the same model of the window niche from different views. It's possible to some long narrow indents near the opening, on both views.

Figure 26. Roesdahl, Else. Møblerogindretning. Roesdahl, Else (red.) (2003). *Bolig og familie i Danmarks middelalder*. Højbjerg: Jysk Arkæologisk Selskab

Figure 27. Screen capture from Blender, of a model of a bench.

Figure 28. Eames, Penelope (1977). *Furniture in England, France and the Netherlands from the twelfth to the fifteenth century*. London: Furniture history soc.

Figure 29. Roesdahl, Else. Møblerogindretning. Roesdahl, Else (red.) (2003). *Bolig og familie i Danmarks middelalder*. Højbjerg: Jysk Arkæologisk Selskab

Figure 30-31. Screen capture from Blender.

Figure 32. Eames, Penelope (1977). *Furniture in England, France and the Netherlands from the twelfth to the fifteenth century*. London: Furniture history soc.

Figure 33: Etting, Vivian (2010). *The royal castles of Denmark during the 14th century: an analysis of the major royal castles with special regard to their functions and strategic importance*. Copenhagen: National Museum, Danish Middle Ages & Renaissance

Figure 34. A screen capture from Blender.

Figure 35. Roesdahl, Else. Møblerogindretning. Roesdahl, Else (red.) (2003). *Bolig og familie i Danmarks middelalder*. Højbjerg: Jysk Arkæologisk Selskab

Figure 36-39. Screen capture from Blender.

Figure 40-42. Rendered image from Blender.