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Fashioning the Viking Age: 2018 to 2023

Ulla Mannering, Ida Demant, Charlotte Rimstad and Eva Andersson Strand

Abstract

From 2018 to 2023 the *Fashioning the Viking Age* research and outreach project has conducted spinning and weaving experiments using reconstructed tools and controlled fibre sorting in order to convey tactile and visual aspects of the Viking Age cloth culture. Additionally two Viking Age male and female outfits were created using the data extracted from the Bjerringhøj and Hvilehøj graves from Denmark. This article presents some of the results, ideas, and preconditions for working with reconstructions.

Keywords: Viking Age, textile, clothing, tools, experimental archaeology, reconstruction

6.1. Introduction

In September 2018, the Fashioning the Viking Age research and outreach project funded by the Velux Foundation was launched at the Department for Ancient Cultures of Denmark and the Mediterranean at the National Museum of Denmark, in collaboration with the Centre for Textile Research at the University of Copenhagen and Land of Legends in Lejre, Denmark (Mannering 2018, 2021). The general aim of the project was to create new and well-founded archaeological interpretations and reconstructions of Viking Age textiles and clothing, and the work was divided into three parts with different participants and output.

In part 1, Viking Age Textile Production, headed by Eva Andersson Strand and Ida Demant, reconstructed tools and controlled fibre sorting were combined with spinning and weaving experiments. The experiments were designed to convey tactile and visual aspects of the Viking Age cloth culture based on a selection of contemporary archaeological textiles. In part 2, Viking Age Clothing, headed by Ulla Mannering and Charlotte Rimstad, two completely reconstructed Viking Age outfits, intended for a man and a woman, were recreated. Both project parts were finished in winter 2021 and are summarised in the following.

In part 3, Viking Age Clothing Catalogue, the many different sources linked to Viking Age clothing design, including archaeological, iconographic, and written sources, will be reviewed and the results presented in an online open-access catalogue. It is the goal that the catalogue can be used by researchers and laymen as an overview of sources for Viking Age clothing and textile production.

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6.2. To reconstruct archaeological textiles

Reconstructing archaeological textiles has a long tradition, and the Danish textile researcher Margrethe Hald was one of the first at the National Museum of Denmark to reconstruct ancient textiles (Mokdad and Grymer-Hansen 2021: 101). In the late 1920s and early 1930s, Hald was employed to reconstruct some of the completely preserved Danish Bronze Age clothing items, which brought her into the core of archaeological textile research. However, most archaeological textiles are not as complete as some of these Danish prehistoric textile collections, but are instead just small, poorly preserved, and visually far from their original appearance (Hald 1980; Bender Jørgensen 1986). This is also why archaeological textiles can be hard for non-textile experts to understand and decode. Furthermore, many published archaeological textiles are not supplemented with photos, which makes visual identification even more difficult. Altogether, we lack well-presented and visually understandable archaeological textile data that can be used for outreach and educational purposes. If the preserved textile fragments can be brought to life in a reconstruction where shape, colour, visual, and tactile effects are more readily understood by an untrained audience, textile knowledge is also likely to have a much larger research and outreach effect.

Nevertheless, reconstructing any ancient object is never an easy task, and many considerations and decisions must be made before the actual work can begin when reconstructing a garment or a textile. In the Fashioning the Viking Age project, the purpose of the reconstructions was the first issue to address, as this would influence the entire work process and the appearance of a finished item. To help clarify this precondition, we were inspired by the different key models used in the Textile Workshop at the Land of Legends in Lejre in Denmark. As an experimental research centre, they have worked for years with different kinds of reconstruction levels, divided into A, B and C models (Demant and Batzer 2015).

An A-model aims to get as close to the original textile/garment as possible, including the materials, techniques, and production processes. Furthermore, fibres, colours, and other details from the original must be analysed before the reconstruction process can begin, which also requires access to comparable modern raw materials. The yarn or the finished textile should also be dyed with natural dyes comparable to the original sources. An A-model reproduction is ideally used for research-based purposes, and enables observations of labour intensity, tool functionality, and the properties of raw materials.

A B-model is less time consuming, and therefore also cheaper to produce. The focus is on the textile/garment shape and visual details, and it is possible to cut corners in the production processes. The yarn can be machine spun, but should be dyed with natural dyes. The weaving can be done on a modern loom, or machine-woven fabrics can be used. Seams and hems are still made by hand. This model is often used when more garments are produced.

A C-model focuses exclusively on shape, colour, and raw materials. The garment is made of machine-woven textiles. Non-visible seams are sewn on a machine, while visible seams are sewn by hand and the fabrics dyed with natural dyes. This model is useful for large-scale garment production, and quantity goes before quality.

At the same time, experimental archaeology with textile tools has an important role to play in understanding the technological parameters for textile production. At the Centre for Textile Research, the testing of function and efficiency of archaeological textile tools and processes have clearly demonstrated how tools and materials influence the final product (Olofsson et al. 2015). Furthermore, these results have also demonstrated the importance of using correct and contemporary tools and materials in reconstruction work.

In the Fashioning the Viking Age part 1, it was decided to only work with tools reconstructed from known Viking Age contexts. This included working processes such as combing the wool before spinning the yarn on a drop spindle, and weaving on a warp-weighted loom. For project part 2, where many different garment types were to be reconstructed, it was decided to use the B-model.

Before the reconstruction processes could begin in both project parts, all relevant original finds selected for reconstruction were thoroughly analyzed. This primarily included analysis of textiles, species identification of fur/skins/down, and tanning/curing methods. For the textile-technical analyses, the recorded parameters were: fragment size, thread diameters, number of threads per cm, twist direction, twist angle, and fibre type. In the reconstruction processes, great attention was paid to the fact that any textile texture is deeply dependent on the choice of raw material. It is not possible to produce a luxury textile with low-quality raw materials, or a soft textile with coarse fibres. Furthermore, the fibre preparation has great influence on the look and properties of a textile, depending on how parallel the fibres are and how much air it is possible to "store" in the yarn. In a Viking Age context, it is well-known that combing was the most common way to prepare the wool fibres. This process also made it possible to give the yarn a very high twist angle.

Furthermore, analysis of functional elements, such as sewing techniques, stitches, selvedge position, and analyses of related grave goods, such as jewellery and remains of human bones were also included. Some of the more composite textile fragments, with several layers of compressed and sewn-together pieces, were recorded with special stratigraphic analyses, such as X-ray and CT scanning in order to understand their layer sequences. Many of these analyses were performed by invited specialists (see for instance Brandt and Mannering 2020; Rimstad et al. 2021; Brandt et al. 2022).

6.3. Viking Age Textile Production, project part 1

For this part of the project, a range of Viking Age textile tools were replicated to be used in the reconstruction of the selected textiles from the same era. The majority of the tools, such as the wood spindles, spindle whorls, and loom weights, were selected from a huge range of registered tools from the Viking Age settlement at Hedeby in northern Germany, while the wool combs with iron teeth are based on a Norwegian find (Andersson Strand 1996, 2003). Conical clay spindle whorls were made in seven different sizes, weighing from 5 g to 48 g. This type of whorl was the most common type in Hedeby, as is the weight range. Likewise, the spindles were made based on the Hedeby find. For the loom weights, three sets of doughnut-shaped weights in different sizes were chosen, representing the wide range of loom weights registered in Hedeby. The loom weights were produced in numbers suitable for a setup of 60 cm in four rows on a warp-weighted loom (Figure 1).

Three textiles from Hedeby in the collection of the Stiftung Schleswig-Holsteische Landesmuseen Schloss Gottorp in Schleswig were selected for reconstruction. These textiles are from the harbour area, dated to the 10th century (Hägg 1984: 212). The Hedeby textiles are exceptionally well-suited for reconstruction as they represent a great variety of textile qualities, some of which have also been identified as parts of known garment types, made for everyday use. The selected textiles were H14 (tabby interpreted as a fragment of a suspended dress), H2 (2/2 twill interpreted as a fragment of a hose) and H39AB (2/2 diamond/herringbone twill interpreted as a fragment of legwear) (Hägg 1984: 20, 28, 38) (Table 1, Figure 2).

The textile samples from Hedeby were initially analyzed and interpreted by the textile researcher Inga Hägg (1984). For the Fashioning the Viking Age project, these results were supplemented with renewed analysis of yarn diameter and twist using an USB DinoLite microscope, as well as fibre analysis. Irene Skals performed the fibre analysis, and compared the wool qualities to samples from modern sheep of so-called primitive breeds (Skals 2023). Based on these results, it was decided to use spelsau wool from a Danish sheep farmer for the reconstructions.

The fleeces were first sorted into outer and undercoat wool, to match the different yarns in the original textiles, and then combed with the reconstructed wool combs. All yarns for the three samples were spun on a drop spindle. The individual spinner selected the spindle sizes that were most suitable for matching the yarn of the original samples. Depending on the fibres and the thickness of the yarns,

Figure 1. Some of the reconstructed tools from the project: a) wool combs, b) spindles and spindle whorls, c) dressed distaff and d) loom weights. (Photographs: C. Rimstad and I. Demant)

Figure 2. The textile fragments from Hedeby reconstructed in the project: a) H14AB, b) H2 and c) H39AB. (Photographs: C. Rimstad)

Table 1. Technical data of Sample I-III.

Sample	Thread direction	Visual colour	Twist direction	Twist angle	Average yarn diameter (mm)	Fibre	Threads per cm
I:Warp-faced tabby	Warp	Brown	z	*42–57°	0.5*	Medium	15
	Weft	Brown	s	*28–48°	0.6*	Medium	9
II: 2/2 twill	Warp	Dark brown	z	*40–45°	0.48*	Relatively coarse	11–12
	Weft	Light brown	s	Open	0.88*	Relatively fine	8-9
III: 2/2 diamond/ herring-bone twill	Warp	Light	z	*30–51°	0.44*	Medium	14–16
	Weft	Light	s	*30–46°	0.68*	Relatively fine	11

*measured using a DinoLite microscope.

Table 2. The amount of yarn needed for producing each of the three samples at a size of minimum 60 x 60 cm.

Yarn needed	Warp	Weft
Sample I	1478 m	347 m
Sample II	1281 m	292 m
Sample III	1630 m	480 m

Table 3. Time registration for combing and spinning the yarn for sample III.

Sample III	Average speed	Total time use	Final result
Combing wool for the warp	11 g in 15 minutes	7 hours	322 g wool
Spinning the warp	46 m per hour	37 hours	1700 m yarn
Combing and sorting wool for the weft	6 g in 12 minutes	4 hours	119 g wool
Spinning the weft	31 m per hour	12 hours	372 m yarn

the spinners chose whorls ranging from 15 g to 25 g. The spindles were mostly 21 cm long. For the first sample, the wool fibres were held in the hand while spinning. However, for the second and third sample they were placed on a distaff, which increased the speed of spinning remarkably (Figure 1c).

While spinning, much attention was given to getting the right amount of twist in the yarn. Generally, the warp yarns had a relatively high twist, from 30 to 57 degrees (Table 1). The yarn twist was monitored in a combination of exact tests using a USB DinoLite microscope and the eye of the spinner. Basically, it was a question of getting into the right flow of drafting and keeping the spindle in motion. Each sample was planned to be 60 x 60 cm, so for each setup between 1400 and 1600 metres of warp yarn, and between 300 and 500 metres of weft yarn was needed (Table 2).

Time registrations were attempted for as many of the processes as possible. These demonstrated, in the case of sample III, that it took one person 7 hours to comb the wool necessary for the warp yarn, and 37 hours to spin (Table 3). Likewise, the 372 m weft yarn was combed and spun in 16 hours. The total production time of sample III before weaving was 60 hours. Even if it cannot be claimed that the skilled spinners working in this experiment were equally as fast as a spinner in the Viking Age, the measurements give an indication of how time consuming it was to produce yarns for weaving.

The looms were set up with reference to the previous loom weight experiments performed at CTR (Mårtensson et al. 2009; Olofsson et al. 2015). These experiments established that there is a close relation between the weight of the loom weight and the desired tension for each warp thread. This dictates how many threads can be fastened to each loom weight, and consequently the thickness of the loom weight dictates how densely the warp thread will be in the finished fabric. Within the project, it was only possible to produce three sets of loom weights, and therefore it was decided to produce a light set of 200 g, a medium set of 400 g and a heavier set of 600 g, based on the large numbers of loom

weights registered from Hedeby. We assume that the Viking Age weaver knew based on experience which loom weights would be suitable for the planned project. However, the challenge for the present weaver was to estimate the tension needed for the particular threads in each sample, before the fibres were analysed and the yarn was spun. It was not possible to experiment with more weight-sizes within the timeframe of the project

Based on the weaver's experience, it was estimated that between 25 g and 30 g tension per thread was necessary for sample I. However, among the loom weights from Hedeby, very few examples were suitable to the necessary requirements: a warp thread density of approximately 15 threads per cm with the loom weight distributed over two rows. These were all to be found among the atypical weights. Considering the relatively high frequency of warp-faced wool tabby weaves in Scandinavian Viking Age contexts, this seemed strange (Bender Jørgensen 1986: 168). However, if the loom weights were distributed over four rows, it would then be possible to choose from a larger range of weights. Thus, it was decided to test weaving tabby with the loom weights in four rows, set up in a similar way to twill weaving (Olofsson and Nosch 2015) (Figure 3).

The heddles were distributed on three heddle rods and knitted with one warp thread per heddle. While weaving, two heddle rods were lifted forward for each shed. It worked, but it was hard to see the advantage in this setup, in contrast to weaving with only two rows of loom weights and only one heddle rod. This question will be interesting to investigate in future experiments.

The coarse-fibered warp threads of sample II were set up with the 600 g loom weights, adding 36 g tension per thread, and it was relatively easy to change the shed. The warp threads of sample III were set up with the 200 g loom weights, adding 18 g tension per thread. As this was a diamond twill, it was assumed before the fibre analysis was made, that the lightest loom weights would be best suited. Meanwhile, the analysis showed that the warp should be spun of a mixture of outercoat and undercoat fibres. Although a higher tension may have been more beneficial for the weaving, it was decided to continue as planned. This weave turned out to be the slowest in production of the three samples.

Weaving with hand-spun yarn presented its own challenges. The question is, if this is a realistic problem relevant in a Viking Age context. In a modern wool yarn and in the yarns produced for these experiments, many fibre ends were sticking out of the threads. This made the warps very sticky, and changing the shed for every weft a very slow and time-consuming process. The average weaving speed was between 16 to 29 wefts per hour, or approximately 3 cm per hour depending on the number of

Figure 3. Sample I on the warp weighted loom using 400 g loom weights. (Photograph: I. Demant)

threads per cm in the weave. It is thus likely that the weavers in the Viking Age had a solution to this problem. For example, a possible solution would be using a kind of glue i.e. bone glue, although this technique is still not documented archaeologically (i.e. Kjellberg 1943: 382).

A fourth textile sample was produced in the winter of 2020/2021, based on Hedeby H11, a 2/2 twill with 5 wefts per cm. The aim of this experiment was to produce a large textile, for which workflow, production time, and the wear-and-tear on warp threads and loom weights were examined. The sample size was 1 m x 3 m, or about 2 ells x 6 ells, which is the equivalent of a legal Icelandic Viking Age cloth measure (Hayeur Schmidt 2018: 19). Since the production of this sample required a larger quantity of yarn, it was decided to use machine-spun yarn given extra twist on a modern spinning wheel, instead of a hand-spun yarn. It was set up with loom weights weighing approximately 300 g with 23 g to24 g tension per thread, distributed in four rows. The weaving speed for this sample was 10 cm to 15 cm per hour.

The first three finished textile samples made with carefully selected fibres and hand-spun yarn bore a close resemblance with their archaeological counterparts. They can therefore be seen as accurate representations of the tactile and visual appearance of Viking Age textiles. Although perhaps itchier than a modern person would prefer, the tabby in sample I is lightweight, with a good drape and is suitable for a suspended dress (Figure 4a).

Sample II is a more solid piece, and likely to be appropriate for cold weather (Figure 4b). Sample III, which was interpreted as loose legwear, may in fact represent a equivalence of modern day ”denim”, a flexible and durable fabric suitable for many purposes (Figure 4c). The fourth sample indicates that glueing the warp yarn significantly speeds up the weaving process.

The conclusions of the project are that the quality of a textile is the result of a complex relation between fibre, tools and the craftsperson. Therefore, it is important to work with the parameters and as much data as possible from the same time period, and the results depend not only on skilled craftspeople, but also on having good knowledge of the time period and its techniques. Finally, the experiments also demonstrated the advantages as well as the necessity of having a range of tools to choose from when producing a specific textile. This is also clear from an archaeological context such as the one from Hedeby (Andersson Strand and Demant 2023).

6.4. Viking Age Clothing, project part 2

The reconstructions of a man’s and a woman’s outfits are based on the textile finds from two Danish inhumation graves: the male burial from Bjerringhøj, dated to AD 971, and the female burial from Hvilehøj, dated to the late 10th century AD (Thomsen 1900; Iversen et al. 1991). The textiles from these two graves, although fragmented, are much larger and better preserved than textiles from most Viking Age contexts in Denmark and Scandinavia (Bender Jørgensen 1986). This is particularly true of the Bjerringhøj burial, which was found in 1868 by the local farmers, and contains some of the most luxurious but also peculiar textile pieces from any Viking Age context. Unfortunately, the farmers completely looted the grave before the find was discovered by the authorities, and the difficult task of recollecting the objects began. At that time, important knowledge about the position and use of the individual objects in the grave was already lost. Had the grave been excavated by professionals, the textiles would likely have been in a much more complete state today (Iversen et al. 1991). The textiles from Hvilehøj, on the other hand, were excavated in 1880 by professionals, but at that time terrible weather conditions hindered a detailed excavation. The excavation report only indicates that most of the textiles were found on the woman’s chest (Thomsen 1900). Another important feature in the Hvilehøj grave was that it did not contain the typical oval brooches connected to the Late Iron Age suspended dress type, as is known from many other Late Germanic and Early Viking Age graves

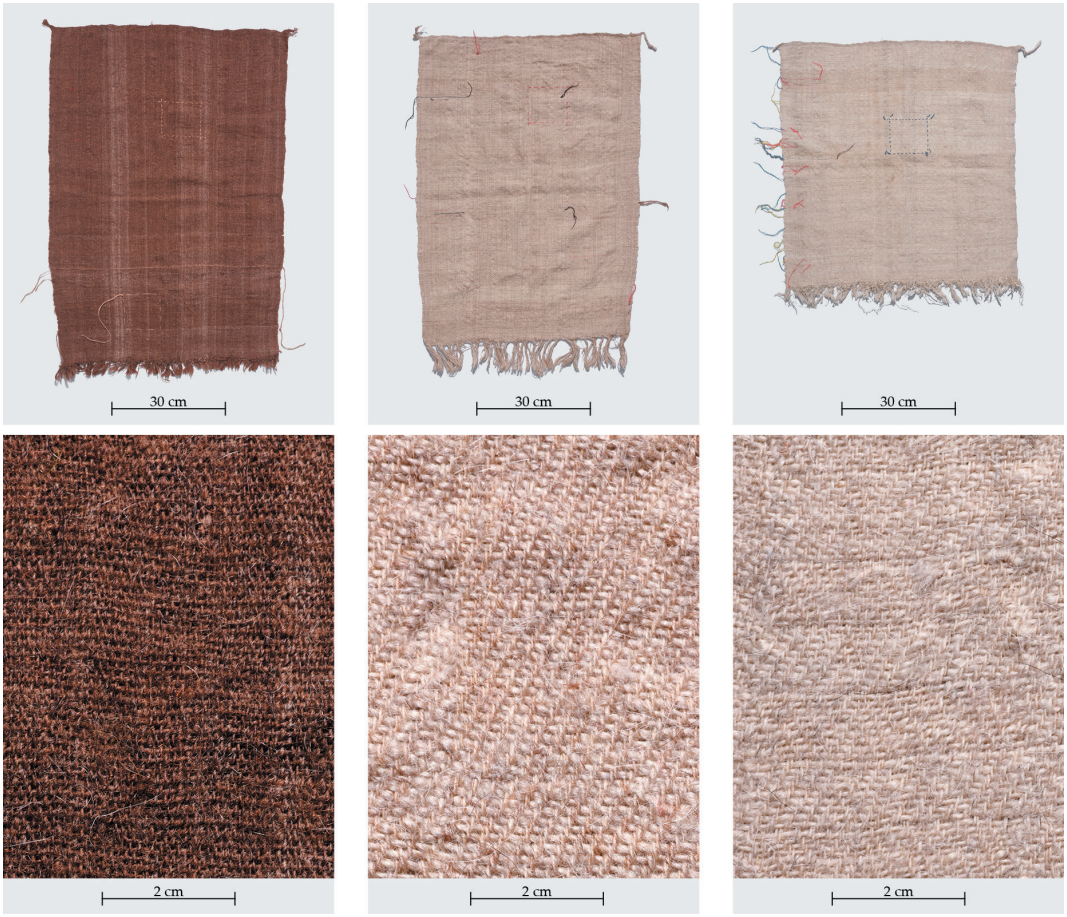

Figure 4. The three finished samples in overview and close-ups: a) sample I, b) sample II, and c) sample III. (Photographs: I. Demant)

(Hägg 1974; Mannering 1997). Therefore, we have interpreted this as representing the clothing style typical for the late part of the Viking Age, which is also supported by the dating of the grave (Hedeager Madsen 1990; Mannering 2017: 161–164).

The textiles from Bjerringhøj and Hvilehøj have until now never been fully detailed described and analysed (Hald 1980; Østergård 1991; Hedeager Krag and Ræder Knudsen 1999). In the Fashioning the Viking Age project, a complex analysis procedure therefore preceded the reconstruction work. As mentioned earlier, reconstructions can be made with different degrees of accuracy, depending on how closely they are intended to resemble the originals. In this part of the project, the decision was made from the beginning to focus on garment shapes and visual details, comparable to a B-model, and to make compromises in the production processes. However, it quickly turned out that several of the needed fabric qualities for the male and female outfits were not available commercially. Most of these fabrics and some yarns were therefore produced specifically for this project. Yarns were either spun on a spinning wheel, or a machine-spun yarn was given extra twist on a spinning wheel in order to match the very hard twisted threads used in these Viking Age textiles. Furthermore, fibre and dye analyses of the original textiles guided the creation of the reconstructions. Hald conducted dye analyses on some of the textiles from Bjerringhøj as early as the 1940s (Hald 1980), which was supplemented with additional dye analyses in the late 1980s (Walton 1991). A few of the Hvilehøj textiles have also been previously tested for dyes (Hedeager Krag 2018). For the Fashioning the Viking Age project, many new samples for dye analysis were taken from the Bjerringhøj and Hvilehøj textiles, with the exception of some of the complete silk textiles and tablet-woven bands from Bjerringhøj where further sampling would damage the objects. When no dye results were available to guide the selection of

colours, the choices were based on best aesthetic match compared to the overall design, and adjusted for whichever colours could have been used in this specific context (Vanden Berghe et al. 2023). In this way, the fibres and other materials match the original ones, while the production processes were generally optimised using modern tools.

In this way, the majority (but not all) of the textiles and fur or skin objects from Bjerringhøj and Hvilehøj were included in the two outfits. The excluded textiles are generally interpreted as not being parts of the clothing, but more likely wrappings for grave goods or grave furnishings such as mattresses and cushions (Rimstad 2019, forthcoming). Only very few of the textiles and fur or skin objects contain construction details, such as seams, that can be related to the design of the original garments. It was therefore decided to use more complete clothing finds from contemporary Scandinavian contexts as inspiration for the design and patterns for the outfits.

Altogether, the two outfits are designed on the basis of current knowledge of Viking Age male and female clothing, which has demonstrated a mix of different inner and outer garments (Mannering 2017). The man's outfit included: a fur caftan, a plain linen tunic, an embroidered wool kirtle, a belt in wool and silk, wool trousers with straight legs, two silk wrist cuffs, and leather boots (Figure 5). The woman's outfit included: a fur cape, a plain linen dress, a wool outer dress with woven-in decorations, and goatskin shoes with the hair retained (Figure 5). The leather boots and the linen undergarments

Figure 5. The final version of the man's outfit based on the Bjerringhøj grave find and of the woman's outfit based on the Hvilehøj grave find, with and without the outerwear. (Photographs: R. Fortuna, National Museum of Denmark)

are not based on data from the Bjerringhøj and Hvilehøj finds, but are included to make the outfits comfortable to wear. Furthermore, the garments were sized to fit two volunteer models so they can be comfortably worn for outreach purposes (Mannering and Rimstad 2023).

Another novel method used in this project is the high resolution photography which, combined with light exposure from beneath the textiles, were used to create an overview of all the pieces and to reveal disintegrated sewing, weaving, and embroidery details. The latter method was especially helpful during the documentation of the 64 fragments of the Bjerringhøj embroidery. First, all of the photos were transferred to Adobe Photoshop, where embroidery yarns were marked with colour codes, giving each pattern its own colours. The photos were then printed on paper at the proper scale and the fragments cut to shape. In this way, the fragments could be puzzled around without handling the original, fragile textiles; this process resulted in reconstructing the final embroidery design (Figure 6). Although this was a very time-consuming process it also turned out to be very rewarding, as it is the first time that the full scale design of this unique textile was presented. A similar procedure was used to create the woven-in patterning of the Hvilehøj tabby weave (Figures 7 and 8).

Altogether it can be concluded that all preserved embroidery stitches in the Bjerringhøj textile are done in stem stitches. Different contrasting nuances of the wool yarns were observed in both the contour and the filled-in areas. Unfortunately, the dye analyses of these yarns gave no clear results except a few yellow and blue dyes on trace level in different yarns (Vanden Berghe et al. 2023). The previous identifications of blue and red dyes on the fragment with the neck-opening and the leopard (now fragment 64, Figure 9) are thus the only instances where these two colours have been clearly identified (Walton 1991: 142). Based on the earlier and the current dye analyses, it was decided to use brown, yellow, and green shades for the major part of the reconstructed embroidery design, as

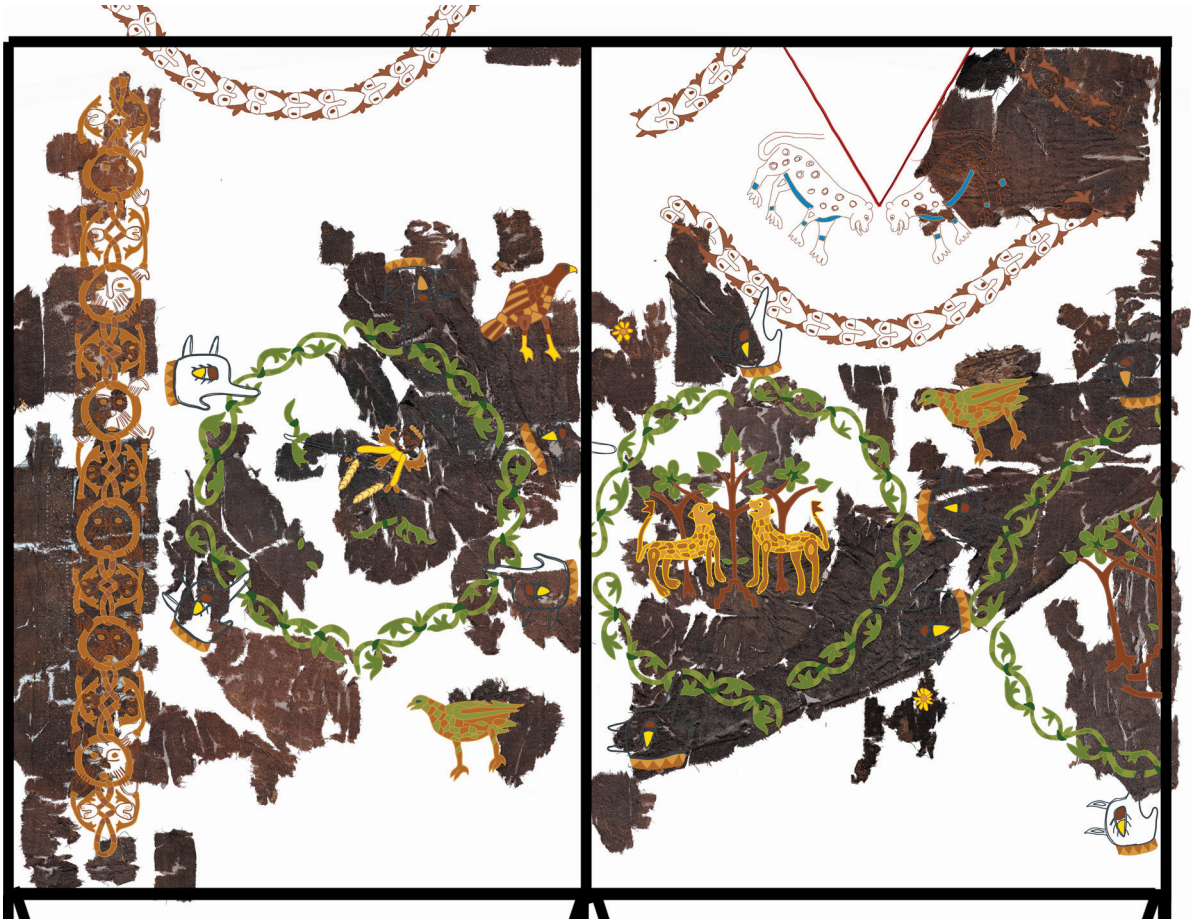

Figure 6. The combined design of the Bjerringhøj wool embroidery with the 64 pieces in place. (Illustration: C. Rimstad)

these dyes would have been most prone to disintegrate in the ground or subsequently in the museum while exposed to light.

According to our interpretation, the overall design is dominated by curving lines of acanthus leaves which encircle different centre motifs. In one case this consists of two animals mirrored around a tree. These animals have been interpreted as lions (Østergård 1991). An often repeated motif of wolves' heads with a decorated collar was identified for the first time as a part of this research, and in several places bites into the acanthus leaf roundels. Hald interpreted this motif as a bird, but by turning the design 180 degrees the outline of the head with the open mouth and pointed ears becomes clear (Hald 1980: 104–105). Different full-size birds are represented between the acanthus leaf roundels, but as neither of these creatures are fully preserved, they are difficult to identify by species. Based on the preserved details they could be pigeons, chickens, or falcons.

An often represented fragment holds the motif of large human faces, aligned on top of each other and connected by hands gripping on to each other. On another fragment (the same as the one with the leopard, see Figure 9) two separate curving lines of smaller human faces are shown. These two designs have clear connotations to contemporary Viking Age art and jewellery, and support the interpretation of this textile as produced within the Viking world. The roundels, leopards, and lions, on the other hand, seem to represent a different iconographic tradition, possibly inspired by Byzantine and Late

Figure 7. The combined design of the Hvilehøj woven-in pattern with the preserved pieces in place. (Illustration: C. Rimstad)

Figure 8. One of the patterned fragments of the wool tabby from Hvilehøj. (Photograph: R. Fortuna, National Museum of Denmark)

Antique textiles. Based on the overall design and the execution in wool, it is our interpretation that this textile was produced locally in Scandinavia.

As part of the embroidery analysis, its origin and the meaning of the overall design was studied, including an evaluation of its level of creativity and craftsmanship, and if the somewhat random execution could be the hands of several different embroiderers. This important part of the research will be presented in a separate article. Furthermore, it was also possible to document that the embroidered wool textile represents a secondary use. Once again, the fragment with the leopards contains key elements vital for this interpretation, with remains of a selvedge, a seam, and a hemmed fold, of which the latter constitutes parts of a V-shaped neck-opening. The embroidery on this piece reveals that the design, in this case the tale of the leopard, continues into the hemmed fold. Altogether this is strong evidence that this garment was created after the embroidery was finished. According to our interpretation, it is most likely the textile was originally used as a kind of decorative wall hanging, table or bed cloth, after which it was reworked into an clothing object which could be drawn over the head with a nicely executed neck opening. It is thus uncertain when this change took place. The excavators noted that this was the first textile visible in the grave, and remains of this piece were also found on the leg bones. It may therefore not have been a functional garment, but just a cover with a neck-opening that was placed over the body in the coffin.

In Hvilehøj, a different decorative motif was found on the textiles (see Figure 8). Fragments of a wool tabby contain thick plied pattern-threads, creating very strict square shapes. The analysis showed that the squares formed cross-shaped decorations which were placed on the chest area of the deceased. In the female outfit, this textile was used for the dress. As the textiles were only preserved in this particular place in the grave, it is uncertain if the rest of the textile/garment was similarly decorated. The dye results of the wool tabby showed the presence of kermes, a scale insect native to the Mediterranean, which can produce a deep, red colour (Hedeager Krag 2018; Vanden Berghe et al. 2023; Mannering et al. forthcoming). This dye was highly valued in the medieval period, but until now has only
been identified on silk textiles. This is the first time that kermes has been discovered in a wool textile, and also the earliest find of kermes in a Danish context. No dyes were detected in the pattern threads, which is why the project decided to keep them white.

It can be concluded that although the textiles from Bjerringhøj and Hvilehøj are some of the best preserved specimens from any Danish Viking Age burial context, there is still a gap between

Figure 9. The 2/1 wool twill piece with the neck-opening and the embroidery of the leopard and the small faces (Bjerringhøj, Fragment 64). (Photograph: R. Fortuna, National Museum of Denmark)

the archaeological finds and the finished reconstructed outfits. The many analyses conducted as part of this project have been a great help and invaluable guide for the different production processes and the final design – but also somewhat of a hindrance. Once the results of the fibre, dye analyses, and species identifications were ready, they were incorporated into the outfits' designs, regardless of modern aesthetic taste. Other research results came after the design plans were made and the production process had begun. Therefore, some of these results were not incorporated in the current reconstructions. For instance, the recovery of the human bones from Bjerringhøj, which for many years were stored with the finds from a different Viking Age grave termed Slotsbjergby, turned out to contribute important new information about the colour of the embroidered wool textile (Rimstad et al. 2021). Minute fragments of this textile still adhering to the bones had never been previously recorded, and when tested for dyes it turned out that this textile was originally dyed with a yellow dye. The reason why the colour substance is still preserved in this piece is most likely because it has never been subjected to conservation and cleaning methods, and was stored away from daylight. Altogether, this discovery means that the reconstructed embroidery ground weave, which early in the design process we interpreted as being white, should have been yellow while the colours of the embroidery yarns remain uncertain. This further demonstrates the value of regularly revisiting and reanalysing old museum finds, and analysis with precision tools and methodologies before it is too late.

As a final remark it is important to state that, despite many hours of research, analyses, and skilled craft work, the finished outfits represent one of several possible interpretations, not final truths. The current base of research results could have been interpreted differently, and combined in other ways to produce a range of different outfits. These other options and interpretations belong to the future.

6.5. Fashioning the Viking Age Outreach

From December 2020 to March 2021, the reconstructed man's and woman's Viking Age high-status outfits were included in an online web-exhibition at the Museum of Cultural History in Oslo, Norway. The exhibition was first planned in a physical format; this quickly changed to a digital format due to the COVID-19 pandemic, during which the museum was closed to the public. During these four months, the outfits were viewed more than 25,000 times. In June 2021, the two outfits were included in the new Viking Age exhibition at the National Museum of Denmark in Copenhagen, where they are placed close to the original textile finds. Several of the short films produced for the exhibition can also be seen via the museum website (https://www.viking.natmus.dk/vikingernes-toej). Additionally, the Textile Tool Box, which includes the reconstructed textile samples and the

Figure 10. The Textile Tool Box with the reconstructed tools produced and used in the Fashioning Viking Age project. (Photograph: R. Fortuna, National Museum of Denmark)

various textile tools used in project part 1 is now ready to be used for outreach purposes at universities and museums, in order to give a "hands-on" feeling of Viking Age textiles and textile production (Figure 10).

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