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Sprang Bonnets from Late Antique Egypt: Producer Knowledge and Exchange through Experimental Reconstruction

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The largest number of historical sprang fabrics come from the Coptic burial grounds, and the bonnets comprising a large portion of these Coptic textiles feature a wide variety of surface designs.¹ A set of nine Coptic bonnets in the German Textile Museum in Krefeld, Germany offers a unique sampling for studying design possibilities using the sprang technique.

Studying sprang since the mid-1990's, and seeking to better understand historical sprang patterns, I accepted an opportunity in 2013 to examine the bonnets at the Krefeld museum. I mapped out the patterns and later made replicas from my patterns as I find that a visual inspection is insufficient in the investigation of textiles. Reconstruction allows me the chance to verify my understanding of the structure. As well, I find that the "hand" of the fabric is important, and pieces must be touched in order to begin to understand what the original owner took for granted. Therefore, I find it is important to make replicas. Space allotment prevents the inclusion of the patterns here, but anyone interested is invited to contact the author for such details. This paper discusses the structures that create the designs in these bonnets.

Sprang is a braiding technique, worked on threads that are set on a frame. The worker manipulates threads at one end of the frame, and mirror-image crossings happen at the other end of the frame. While several structures are possible, the simplest 'stitch', the structure most commonly seen in these bonnets, is the interlinking stitch. It looks like chain-link fence. Each thread wraps around its neighbor to the right, and then the neighbor to the left. Each row of work yields a mirror image of cloth at the other end of the frame, making sprang a two-for-the-price-of-one technique.

Researchers must consider the provenance (history) of the article they are studying. Many Coptic bonnets made their way directly from the ground at dig sites in Egypt to museum collections. Other bonnets were obtained from traders, and their provenance can no longer be traced. The nine bonnets in the Krefeld collection can be counted among this second group. They were acquired from three different dealers, Max Heidweiller, Ernst von Scheven, and Christian Grand, between the years 1894 and 1977, and are very representative of the larger genre that is sprang Coptic bonnets. The find site for these bonnets is not known, but they nevertheless give us a fair amount of information about their makers.

I will define three different aspects typical of Coptic bonnets before speaking in detail about the bonnets in the Krefeld collection. The three aspects are: names of the component parts of the bonnets, overall shape and type of surface design.

¹ Peter Collingwood, *The Techniques of Sprang, Plaiting on Stretched Thread* (New York: Faber and Faber, 1974), 40.

In her article, “Sprang hairnets in the Katoen Natie collection”, Anne Kwaspen identified several parts of sprang bonnets.² To enable discussion and to highlight pertinent features, I have expanded the number of named parts (Diagram 1). Beginning with the parts common to all bonnets, these are: body, selvages at the side seams, crown (top of the hat), and brim (edge that goes around the face and the back of the neck).

Diagram 1

*Schematics of a sprang bonnet, showing the location of diverse parts.
Drawings by Carol James*

Some bonnets have other interesting features. Some have designs in the main body, distinct from the border pattern and also distinct from the pattern near the brim and top of the bonnet. Differences can be seen in the treatment of the cloth as the bonnet nears the top of the head, and in the brim, the part that goes around the face and the back of the head. Sometimes there is a small chain line, sometimes a woven band has been sewn on, and sometimes there is a drawstring at the back.

Many aspects of the bonnet parts can be explained by the manner of working. The side seams, the chain at the crown, and the drawstring at the back exist because of the method of construction and the shape of the human head. Some elements seem to be purely decorative and do not appear to have any structural or functional reason. Nevertheless, because they are features of many bonnets, they are worthy of study.

The two overall shapes can be understood as different ways of dealing with a challenge arising from the construction method. Sprang is worked on threads set on a frame. As the two pieces of

² Anne Kwaspen, “Sprang hairnets in the Katoen Natie Collection,” in *Dress accessories of the 1st millennium AD from Egypt* (Lannoo 2011), 71

cloth approach each other, the space in the middle becomes tight. It is then difficult to carry on with the pattern. As the space gets smaller, the worker generally opts to adopt a simpler pattern, often doubling up the threads, thereby creating a narrowing in the cloth. Sometimes the worker doubles, and then doubles again and again and again. The worker makes the front and the back of the bonnet at the same time, creating, for example, a long rectangle. When the worker folds the rectangle along the line of symmetry at the middle and sews up the sides, a rectangular bonnet results. When significant narrowing occurs as the middle gets tight, the hourglass shape results. When the hourglass is folded over to sew up the bonnet, the triangular-shaped bonnet results (Diagram 2).

Diagram 2

*Two different bonnet shapes, obtained by two different manners of working near the center of the warp.
Drawings by Carol James*

The third aspect I will discuss is the type of stitch in the body of the bonnet. I identify three categories of design stitch used in the bonnets of the Krefeld collection. Lace patterns feature a series of holes comprises the first category. The second category of design stitch is the use of a solid color, decorated using the lean of the stitches, S-lean or Z-lean. The third category of surface design uses colors. Two types of stitch are used to create these colored designs, twining and double-cloth worked on a background of interlinking.

Table 1

Collection Number	Shape		Surface Design		
	Conical	Rectangular	Lace	S&Z	Twining
202		x			x
203	x		x		
204	X		X		
12729		x			x
12773		x			x
12774		x			x
15202		x		x	
15203		x			x
15204		x			x

The Krefeld Collection contains bonnets, which illustrate each of the elements discussed.

All elements discussed above can be seen in the collection of bonnets at the German Textile Museum in Krefeld. Table 1 shows the collection number as well as this variety of shape and surface design. All combinations are represented at least once.

The nine bonnets in the Krefeld collection are presented in this paper in three groups, following the category of their surface design: lace, S&Z, and polychrome. There are two bonnets in the collection featuring lace surface design, 00203 and 00204 (Images 1 and 2). We see the multiple decreasing happening at the top, making them triangular in shape. Bonnet 00204 has a brow band, and they both have drawstrings at the back of the neck and drawstrings at the top. Upon mapping the lace patterns, it became clear that these represent two different types of lace

Image 1

Krefeld 00203
Photo by Carol James

Image 2

Krefeld 00204
Photo by Carol James

patterns. Bonnet 00204 features a lace pattern where lace stitches occur only on even-numbered rows. Bonnet 00203 features a lace pattern where the lace pattern stitches occur every 3rd row, creating a different type of lace design.

These two bonnets 00203 and 00204, cover both the Lace category of surface design and the triangular shape of Coptic bonnets. The remaining seven bonnets are of the variety that is rectangular in shape. The first of these features the S&Z patterning, the remaining six feature polychrome surface design.

Bonnet 15202 features a red stripe and then a pattern of dots along the selvedge edges, a drawstring at the back, a browband at the front, decreasing near the crown, and a chain line finish. Looking initially at the back side of the bonnet (Image 3) it would seem to have a rather boring solid dark blue in the middle of the bonnet. Upon closer inspection, there are designs in the dark blue: rows of vertical lines and triangles have been worked in the blue thread.

The interlinking stitch in sprang yields stitches that lean one way at the top of the frame, and they lean the other way at the bottom of the frame. Alternating between the two leans within the same row, the maker of this bonnet used the differing leans of the stitch to create patterns. This is the technique used to create the triangles.

Image 3

Krefeld 15202 Verso
Photo by Carol James

Image 4

Krefeld 1520 Recto
Photo by Carol James

The vertical stripes are another story. The vertical stripe is a technique that I have seen in only one other bonnet.³

When the technician turned the bonnet over (Image 4), I was surprised to see red horizontal lines. These lines are made with a supplementary red thread, chained across the width.

Working to make a replica, I found by far the easiest way to insert this red line is by a two-step process. The first step is to leave a thread in the row where the chain will eventually be located. The second step, creating the chain, is executed after the cloth of the bonnet has been completed. The thread left in the shed of the first step will be manipulated into a chain, visible on only one side of the cloth.

I was surprised to watch the evolution of the cloth as I created these three chain lines. My original theory was that the chain lines prevented horizontal stretching of the fabric. I found the opposite was true. As I inserted the chain lines, the chain line stretched the fabric slightly in a horizontal direction. The blocking process (wet finishing) evened out the width of the bonnet.

What can be the purpose of these three chain lines? On this bonnet the lines can be found between motifs. My theory now is that the worker wanted to smooth over differences in width and elasticity between these diverse motifs. But this is speculation.

There are six bonnets in the collection that represent the polychrome surface design option. These designs are executed using two techniques, twining and double-cloth.

³ Kwaspen. *Sprang hairnets*, 83.

Twining implies the movement of exclusive thread pairs in the creation of the fabric. In sprang, when twining is used, the exclusive pairs always move slightly to the right or to the left (Diagram 3). Double-cloth implies two layers of fabric (Diagram 4).

Diagram 3

Diagram 4

The bonnet that is 00202 (Image 5) features a background in vertical stripes of navy, red, and green, augmented with diagonal lines of white and orange. The first few rows are worked in basic interlinking, and you see one pattern. When the twining begins a few rows in, the lattice of yellow and white appears. This lattice is formed by the use of the twining technique, where the white and yellow threads travel left and right.

Image 5

*Reverse face of Krefeld 00202
Photo by Carol James*

When the two mirror-image portions approach each other (Image 6), it gets to be difficult to carry on with the twining pattern, and it is a relief to switch into the vertical-line motif at the crown of the bonnet, a pattern that is more easily worked. The work gets sealed off with the chain line (Image 7).

Image 6

*Decreased room to maneuver at the middle.
Photo by Carol James*

Image 7

*Chain across to secure the work.
Photo by Carol James*

After removing the cloth from the frame, the worker attaches a woven band to the front rim of the bonnet (Image 8). This gives a firm binding to the front of the bonnet. Browbands are most frequently red and really deserve a study of their own. Drawstrings through the loops at the back of the bonnet allow adjustment to secure the bonnet to the head.

Image 8

*Attaching a woven band to the brim of the bonnet
Photo by C James*

Another fine example of the twining technique is 12729 (Image 9). Here we see diagonal lines: red-and white diagonal lines and green-and-yellow lines, crisscrossing. A look at the inside of

the hat (Image 10) reveals horizontal brown lines. This is an example of double-cloth. The idea is that threads divide into two groups. One group forms a layer on the outside of the bonnet, the other group forms an inside layer. At these places you have a hollow horizontal channel (Diagram 5).

Image 9

Krefeld 12729
Photo by Carol James

Image 10

View inside bonnet Krefeld 12729
Photo by Carol James

At the brim of bonnet 12729 all threads are visible, inside and out. Threads move in a relatively vertical line. Then for a few rows, the brown threads go to the inside, and the other colors to the outside of the bonnet. Then all colors are present side-by-side, and select threads are twined, giving us diagonal lines. This pattern repeats several times. At the top of the hat the patterns changes and we have a pattern of vertical lines at the top of the hat. This is the decrease where threads are taken in pairs. As a worker, I can tell you that this vertical-line pattern is far easier to do than the patterns in the rest of the hat. It comes as a relief, getting close to the apex, to return to this pattern when the working gets tight. The work ends in a chain line and drawstring that secure the work, preventing unraveling.

Diagram 5

Schematic of horizontal channels
Drawing by Carol James

Bonnet 12773 features a clever combination of twined diagonal lines and double-cloth (Image 11). There are vertical lines at the brim, and then the white threads begin to wander diagonally. This is the twining structure. When the white threads meet again, the dark threads come in front of the white and yellow, a kind of double-cloth for one row. Then we see all threads again, returning to single-layer cloth. On the inside of the hat (Image 12), at the place of the double-cloth, the dark threads disappear and we see only white and yellow. The worker was clearly skilled at several structures, and combined them to form this pattern.

Image 11

Krefeld 12773
Photo by Carol James

Image 12

Replica of 12773 by C James, opened to see the inside
Photo by Carol James

Bonnet 15204 again combines twining and double-cloth. There is a pattern of vertical lines at the brim, and then the yellow and green form a lattice as they twine back and forth (Image 13).

Image 13

Krefeld 15204 and author's replica, photographed side-by-side in the Krefeld Museum.
Photo by Carol James

Image 14 features the bonnet replica in the making. The vertical stripes appear at the top, then there is an area of double-cloth, and then the twining pattern.

Image 14

*Replica 15204 in progress: view of vertical lines at the top, then area of blue double-cloth, then twining pattern.
Replica and photo by Carol James*

The red and white threads appear and disappear from the outside of the bonnet. This bonnet again reinforces the need for replicas. The historic bonnets are too fragile to handle. Curators familiar with this motif were very surprised to handle this bonnet, as the red-and-white threads on the inside are loose, only occasionally attached to the hat. Image 15 reveals the manner in which the red and white bits can be separated from the bonnet inside.

Image 15

*Design element easily separates on the inside of the replica bonnet.
Replica and photo by Carol James*

Bonnet 12774 again combines twining and double-cloth (Image 16). There is a pattern of vertical lines at the brim, and then the yellow and green form patterns cycling through small chevrons, boomerangs, and medallions. The pattern does not completely reverse on the inside of the hat (Image 17). These boomerangs and medallions are examples of twining, carefully arranged to create these shapes.

When working on 12774, I discovered a very clever innovation used by the makers of this hat. The double-cloth has a problem in that only half of the threads are at the front, half at the back. The cloth wants to be either narrower or else quite loose at this point in the hat. When working on 12774, I realized that the original artisans had devised a simple solution to this. On bonnet 12774 there is a denser, over-3 stitch used at the point of double-cloth. This allows for increased opacity, better obscuring the lower layer.

Image 16

Krefeld 12774
Photo by Carol James

Image 17

View inside Krefeld 12774
Photo by Carol James

The bonnet that is 15203 (Image 18) has a structure that was a bit of a surprise to me. Looking at it I saw 1950s-era polka dots. Comparing outside against inside (Image 19), I assumed that this is double-cloth throughout. There is an initial set of red and green threads, then they divide, half to the inside of the cloth, half to the outside. I assumed that the pattern is created when threads switch sides, depending on the pattern. I made up a sample and found this is not the case, the number of dots with respect to the number of lines at the brim does not match up.

Rather this is single layer cloth. Alternating with double-cloth, as described (see Diagram 5). The astonishing thing is the manner in which the finished bonnet behaves. The very frequent

alternating between single layer and double-cloth results in an elastic cloth that has very interesting resistance to sideways stretch. You can feel the difference, comparing the hand of bonnets 00202, 203, and 204 with the feel of this bonnet. Bonnet 12774 features similar give yet resistance to sideways stretch.

Image 18

Krefeld 15203
Photo by Carol James

Image 19

View inside 15203
Photo by Carol James

Not quite explained as yet is the chain line near the brim. This occurs in several of the bonnets. What can be the reason for this feature? As discussed with bonnet 15202, the chain line is perhaps used to even out areas of disparate width. I find that one result of making this chain is

Image 20

The work to create the chain line 'shrinks' the initial loops, creating a firmer edge.

Replica and photo by Carol James

that it shrinks the initial loops (Image 20). This creates a much more firm border to which the browband can be stitched. In view of the fact that this chain line is almost always located within a few rows of the edge, I am assuming this could be a reason for the chain line. Bonnet 15204 has a chain line with an additional red chain line worked down the middle (Image 20). Might the purpose of this second red chain line be to enhance the take-up of the first chain line? This same bonnet 15202 also has a chain line at the back brim, a rather unusual find. This bonnet has neither browband nor drawstring. There is, however, a bit of red cord through the loops at the front (Image 21), which could indicate that browband and/or drawstring have been removed. The chain all around the brim, front and back, can in itself give a certain amount of stability to the brim.

Image 21

*Krefeld 15204 view of chain lines near the brim.
Photo by Carol James*

More puzzling yet are the selvedge motifs. Of the wide variety of patterns seen and noted in these bonnets, there are but six or eight ‘border patterns’ that is, designs at the selvedges of the cloth described by Petra Linscheid and Anne Kwaspen.⁴ There are far fewer patterns seen at the selvedges than patterns seen in the body of hats. The Krefeld bonnets feature four of the six different selvedge motifs. We have dots on three of the bonnets (Image 22), we have a lattice and a chain line (Image 23), and the remaining two bonnets have no pattern (Image 24). I am curious as to the need at all for these selvedge patterns. There does not seem to be any structural reason for these selvedge patterns. The reason must lie within the artistic license of the maker. The bonnet designs in the Krefeld collection are not unique. For each of these bonnets there are several similar bonnets in other collections. I refer you to a Petra Linscheid’s excellent book *Frühbyzantinische textile Kopfbedeckungen* (Early Byzantine Textile Headcoverings), which describes many of these bonnets, and includes photos.⁵

⁴ Petra Linscheid, *Frühbyzantinische textile Kopfbedeckungen* (Reichert Verlag Wiesbaden, 2011) 28-29; Kwaspen, *Sprang hairnets*, 88-89.

⁵ Linscheid, *Frühbyzantinische textile Kopfbedeckungen*.

Image 22

Selvedge Motif: Dots
Replicas and photo by Carol James

Image 23

Selvedge Motifs : Chain and Lattice
Replicas and photo by Carol James

Image 24

Selvedge Motif: Plain
Replicas and photo by Carol James

As to the overall shape, note that other options exist for making sprang bonnets, options NOT used by these ancient Egyptian workers (Images 25-26, Diagrams 6-7). Some bonnets in Scandinavian finds feature a chain line around the center of the bonnet.⁶ Peter Collingwood's book features a photo of Moravian women making t-shaped bonnets two at a time⁷. The Coptic bonnet makers had a set idea for the shape of the bonnet, and stuck to it.

Image 25

Scandinavian shape bonnet
Photo and bonnet by C James

Diagram 6

Scandinavian bonnet schema
Drawings by C James

⁶ Margaretha Hald, *Ancient Danish Textiles from Bogs and Burials*, (Copenhagen: The National Museum of Denmark, Fyens Stiftsbogtrykkeri, 1980) 31-32.

⁷ Collingwood *The Techniques of Sprang*, Plate 1.

Diagram 7

Modern "Stocking Cap" schema
Drawings by C James

Image 26
doi:10.32873/uu1dc.tsasp.0036

Modern Stocking Cap
Photo and bonnet by C James

When looking for extant examples of historic sprang, Coptic bonnets have much to offer. The variety of surface design seen on these bonnets provides a rich source of ideas for modern textile artists. The collection in the Textile Museum in Krefeld contains a set of bonnets that represent the wide diversity found in Coptic bonnets. Anyone looking to explore the genre would be well advised to visit Krefeld to study these nine bonnets.

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