

16th c. Pleated Hemd

by Genoveva von Lübeck

genoveva.von.lubeck@gmail.com

Division II: Costume Single Component or Costume: 1451-1600

Documentation Overview

A reproduction of Dorothea Kannengiesser Meyer's *hemd* (smock) as painted by Hans Holbein the Younger in 1516 ¹, sans the goldwork trim. The *hemd* is made of high count linen, silk cord, and silk thread. All materials are natural and the garment is completely hand pleated and hand sewn. While Holbein's highly-detailed painting does not show the pleatwork beneath the gold trim, I have extrapolated a pattern based on the detail that is shown. Additionally, the rest of the garment is not visible in the painting, so I have surmised a possible construction method from other extant garments, utilizing the seam insertion method. The wrists are pleated in a honeycomb pattern for functionality, based on an extant shirt. Dorothea Meyer was the second wife of Jacob Meyer, Burgomaster (mayor) of Basel elected on June 24, 1516 ⁴, and as such, this *hemd* is ostentatious and intended for the wealthy wife or daughter of a powerful man.



Painting of Dorothea Meyer by Hans Holbein

My reproduction pleatwork hemd

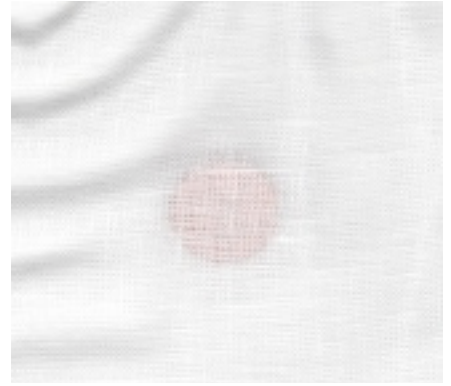
A Closer Study of Dorothea's Hemd

Studying the high-resolution image of Dorothea Meyer gave me a direction for reproducing her *hemd*. I see parallel folds of fabric that appear to be pleats with regular lines at perpendicular angles that appear to be securing stitches for the pleats. The securing stitches appear to cross over the top of the pleats in places, reminding me of stem stitches placed on the outside. Of note is the fact that the longer front pleats do not extend down the *hemd* all the way around -- only the front section is pleated down as far as it is. Yet it seems clear to me at the rest of the *hemd* is still pleated around the neckline (under the trim) based on the way the fabric is regularly gathered beneath it. Also, I do not think that the entire front piece of fabric of the *hemd* is pleated down, for if I draw a line from the end of the longer pleated section to her underarm, the angle is too drastic for period construction techniques (which I believe would have been rectangular⁶). Cords are placed on top of the pleats at regular intervals, joining and separating in a geometric pattern at the front top of the *hemd*. Tufts appear spaced regularly along the top edge, and tassels appear at the bottom of the cords which hang down over the gown's edge. Metallic threads seem to secure the cords together and to the pleats, but do not appear to be interwoven in the cords themselves -- the gold color appears where the cords are attached to the fabric and to one another, but not amongst the cords themselves (the lines you see in the cords are the shadows of the two-ply cordage, in my opinion). Much of this is subject to the viewer's interpretation, of course.



Hemd Materials

I used natural and, as much as my budget allowed, period-appropriate materials in the creation of this gown. The thread count on the linen is 55 threads per inch, which was the highest woven linen I could find at the time (I believe it would have been higher in period). I used white and gold silk thread, rather than linen, because it is stronger. The white silk cords were created by me from silk thread. I should note that I changed the color of linen from an ivory to a natural white because I look dreadful in ivory (and,



Fine linen used in the garment

frankly, I don't think it's Dorothea's best color either). The metallic thread proved more difficult, and I tried out at least 7 different metallic threads, from inexpensive polyester/rayon threads to pricier foil-wrapped-silk and real gilt threads. In the end, the thread I felt matched the extant examples of 16th century stitches was a simple DMC metallic thread (not floss)—it was more pliable and conformed to the braid in a more natural manner than other metallic threads I tried. Historically, a “silver-gilt” thread would have been used, which typically consisted of metal strips wound around a silk core⁵. The DMC metallic thread, upon close inspection, is a gold-metallic foil wrapped around a thread core, so it makes sense that it works well in this application.



A portion of my personal sampler showing various gold thread examples

Materials Used in Making This Garment

What They Used	What I Used
Linen	Linen
Linen or silk thread	Silk thread
Silver Gilt Thread	DMC Metallic Thread
Cords (silk? linen?)	Silk cords

Exceptions listed above were made due to either the availability or prohibitive cost to obtain the period equivalent.

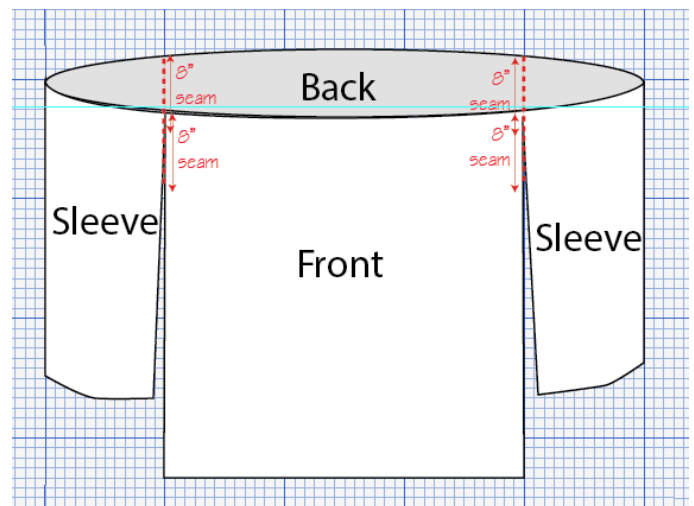
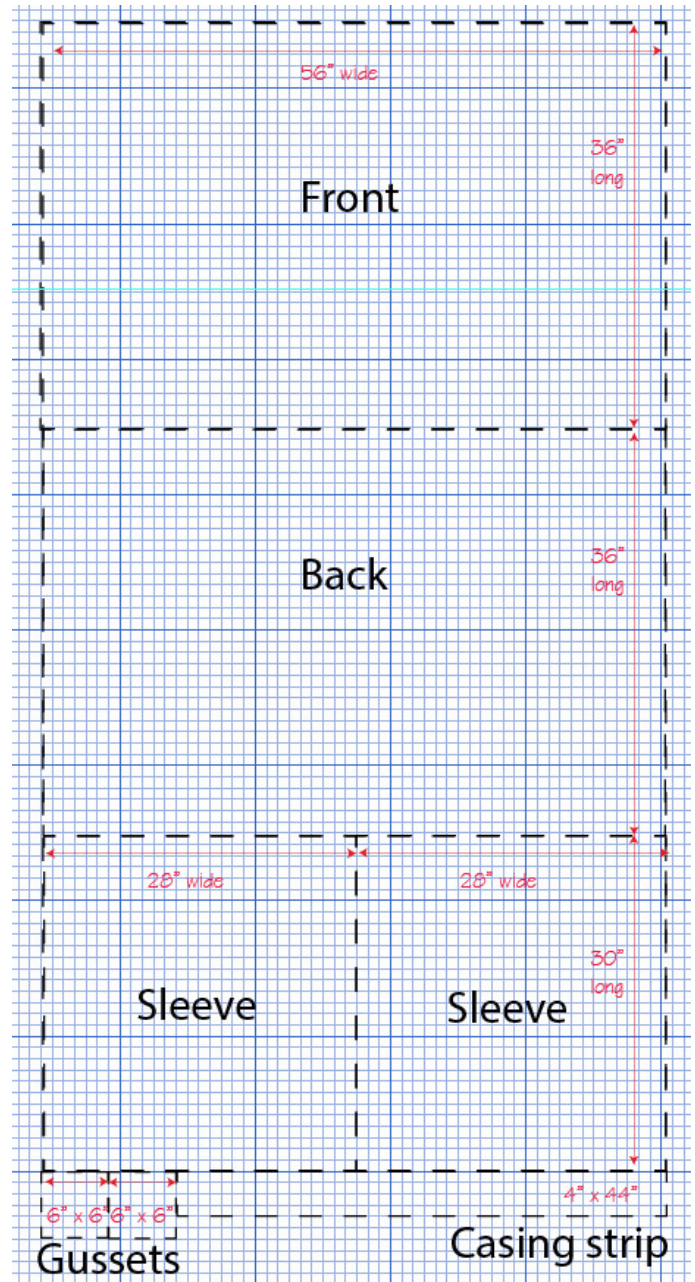
Hemd Construction

This is a deceptively simple shirt construction, created based on my experience with period cutting methods, extant garments, and study of the Holbein painting. The shirt is constructed of four rectangular panels (front, back, and two sleeves), plus a gusset under each arm (as shown to the right). The four panels join one another in a circle, creating a large neckline to pleat down to the required size (as shown below). And like several extant garments (including the 1575 garment⁶ in the Boston Museum of Fine Arts), the shirt has neither shoulder straps nor armscye; the sleeve tops become part of the neckline. There are gussets under the arm, adding extra room where it is most needed. The shaping of the shirt is the result of the pleating.

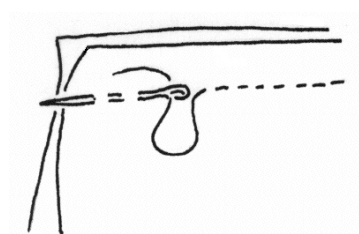
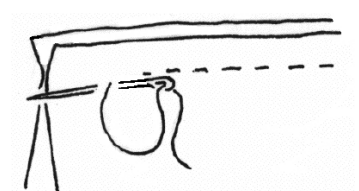
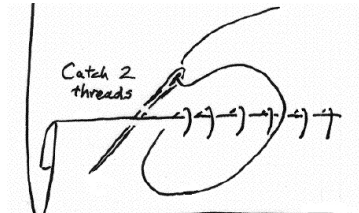
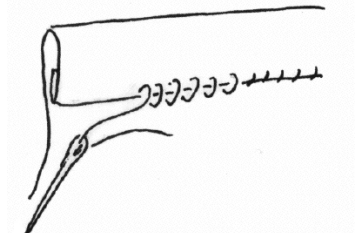
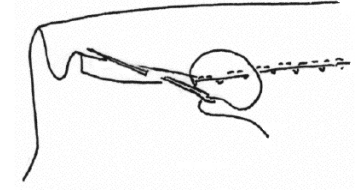
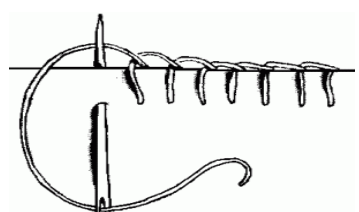
I chose to cut the sleeves at 28" (71cm) wide, which is the loom width for this period and place. The front and back are twice this amount (56"/142 cm) wide (but as I have access to modern 55" fabric, I used the full width of it rather than piecing it). Not only do these measurements make sense, but they were appropriate for my size, too. This resulted in a *hemd* that measures about 110" (142 cm) around the hem and about 162" (410 cm) around the neckline before pleating (43"/110 cm after pleating). This may seem like a lot of fabric, but that is just about what is needed for the number of pleats in Dorothea's *hemd*.

Length is on the short side, as I sometimes kirtle my skirts up (in a period fashion) and the *hemd* should not show.

To prepare for this project, I first made a "simpler" pleated shirt using this pattern so I could wear and evaluate it. That shirt took several months to pleat, but it provided very helpful information, like the necessity of underarm gussets despite the volume of material.



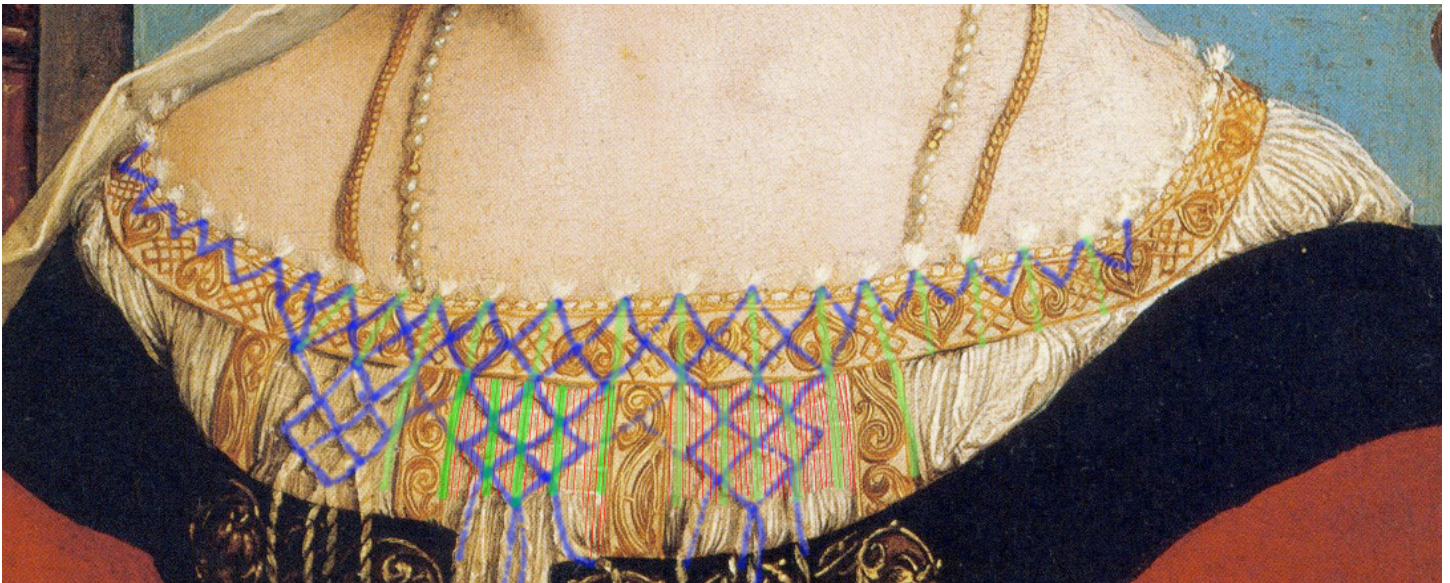
Construction Stitch List

Stitch Used	Diagram
Straight (running) stitch	
Back stitch	
Hem stitch	
Whipstitch	
Slipstitch	
Blanket stitch	

*Note: Credit to Master Henry Kersey for teaching hand sewing techniques and tips.
Stitch Images Credit: <http://www.ia470.com/wardrobe/stitches.html>*

Hemd Pleating

This *hemd* is all about the pleating, which is where I placed my greatest attention and care. After studying this painting for several years, and writing a research paper on pleating techniques (see appendix A), I've come to the conclusion that Dorothea's *hemd* is pleated with roughly 6 pleats per centimeter. This measurement is calculated by comparing the painting with the average distance of a woman's collarbone to determine a scale, and then pleats were carefully counted. One may not think that the Holbein painting is detailed enough to count pleats, but I found that the pleats were quite uniform and corresponded perfectly to a grid based on the tassels and silk cords. This, of course, makes charting a pattern sound simple, and it was anything but simple. I found it incredibly complex, but in the end, it all made sense. Here's a preliminary graphic of Dorothea's *hemd* pleat pattern:



I was able to determine the number of pleats from the painting. I determined how far apart each pleat should be set by using the formula (see below) that I developed during my research. A 4400 mm piece of 0.4 mm thick fabric that will result in a 1100 mm piece must have pleats set 1.6 mm apart. $[((4400/1100) / 2) - .4 = 1.6\text{mm}]$. A 4400 mm piece of 0.4 mm thick fabric with pleats every 1.6 mm will yield a finished piece that is 1100 mm wide. $[(4400/ .4 + (1.6 * 2)) = 1100 \text{ mm}]$. To determine how far apart to set my gathering stitches, I knew I would need 6 pleats per centimeter, and my neckline would 110 cm when pleated, so I determined I need 660 pleats.

$$\frac{x}{(z+(y2))} = \text{length of finished product [alternate notation: } [(x / (z + (y * 2))) = a]$$

$$\left(\frac{x}{2}\right) - z = \text{space between each stitch [alternate notation: } [((x/a) / 2) - z = y]$$

Where x = width of fabric (before pleating);

y = stitch size (how much fabric per fold);

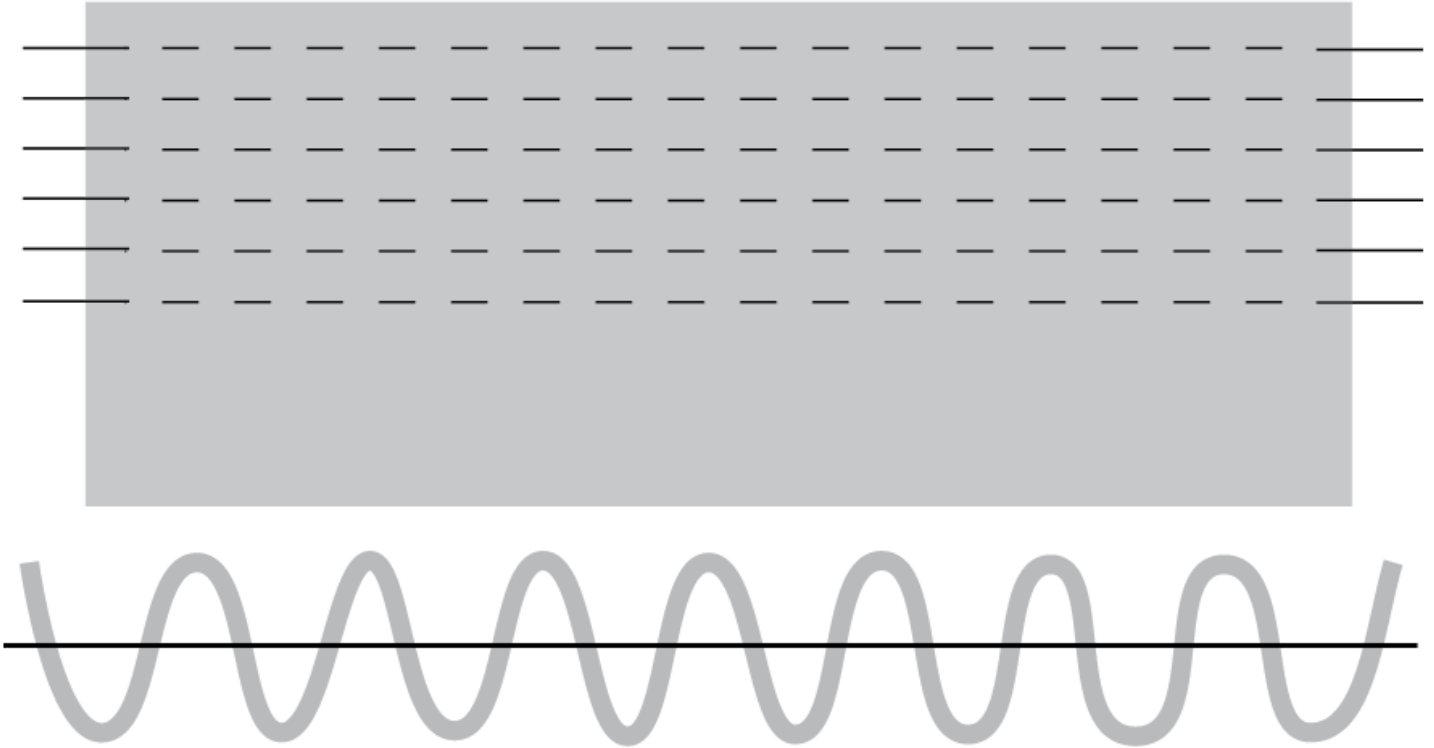
z = thickness of material (measured with calipers); and

a = finished product.

Each pleat requires two equal-distant running stitches (to gather), which means 1320 running stitches spaced out over 440cm results in a running stitch every 3 mm. I then created a template with dots in a grid every 3.3 mm to use for marking positions for each running stitch. In period, one would not have used a formula for determining pleat spacing, but as I am attempting to recreate her specific garment, it was necessary (and it worked).

Pleating (continued)

I stitched three rows of running stitches (1320 stitches in each row), plus four additional rows in the front 27 cm of the *hemd*, as Dorothea's painting indicates a longer pleated section there. The linen was squared up and pleated in sections with doubled and waxed silk thread. I pulled and gathered the material as a I stitched, using water to make the linen more pliable during gathering.



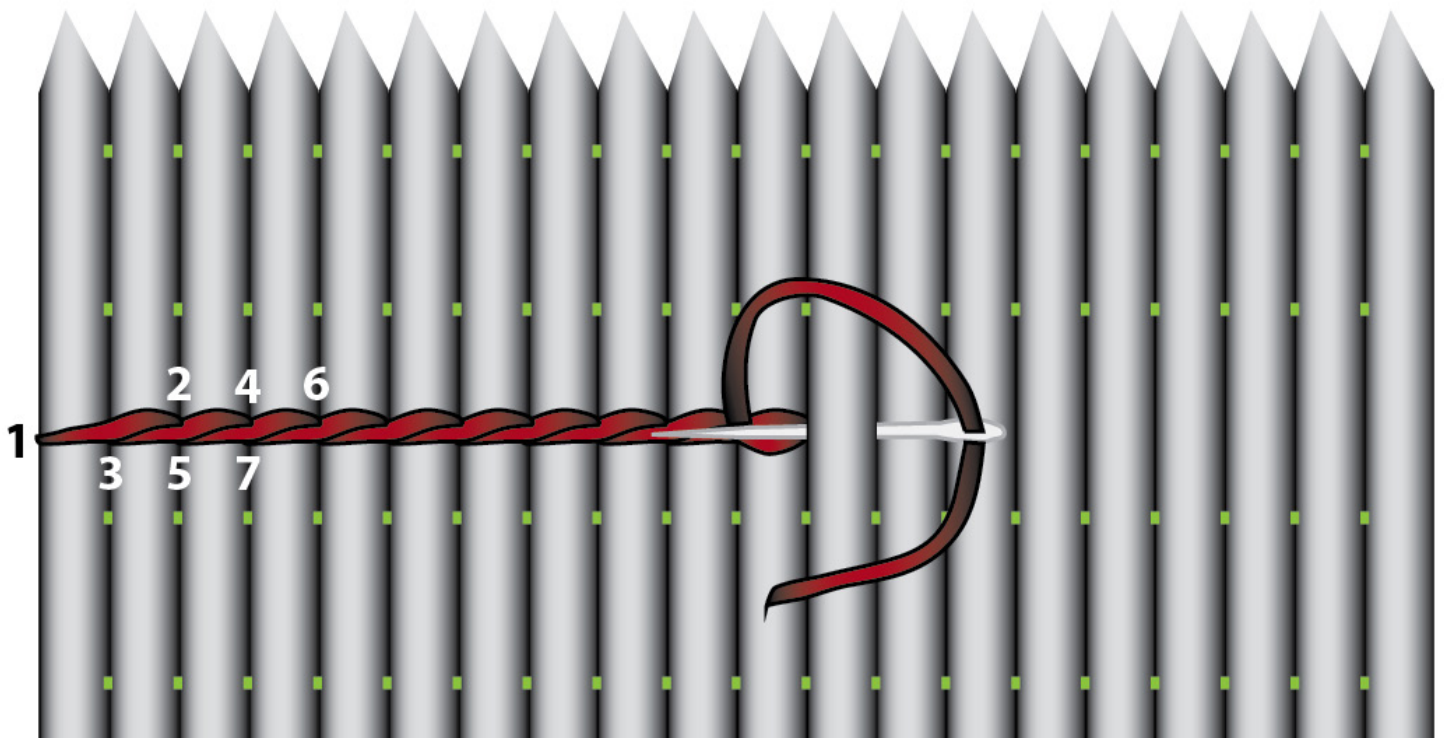
After gathering all the materials into 110cm, I carefully spaced each pleat out so they were all about the same distance, then I sewed a linen band along the top edge to secure each pleat before further work. The use of a casing strip is documented in several extant pieces, including the shirt at the Boston Museum of Fine Arts as well as the textile finds at Castle Lengberg⁶.



Pleating (continued)

In one Castle Lengberg find, the strip of fabric (casing) was equally broad on both the inside and outside (Find 430.02). In the remaining Castle Lengberg finds the casings were broader on the inside and narrower on the outside. I chose to make my casing narrower on the outside so it would offer more inside protection and stability for the pleats. Each of the 660 pleats were whip stitched to inside and outside of the casing.

I then further secured every other row of pleating with a stem stitch. A stem stitch is the simplest and most basic way of securing pleats. The stem stitch is seen on the 1567 Nils Sture shirt sleeve (Arnold, 21), as well as on all of the pleated textile fragments in the Castle Lengberg cache (Nutz, 85). In all cases this stitching was on the underside of the shirt—0.6 cm above the edge of the band on the Nils Sture shirt, and 0.5 cm to 2.5 cm above the edge casing in the Castle Lengberg finds.



Stem stitch through and over the tops of pleats to secure them. Start at 1, go in at 2, pass back through the center of the fold, then come up at 3. Repeat across the width of the fabric.

(For reference, the gathering stitches are shown here as the green between the folds.)

Illustration designed and copyrighted by author

Note that the stem stitch thread is a departure away from the painting of Dorothea. Her stem stitches appear to be in the same off-white color thread as her fabric. I chose gold metallic thread because I wasn't making the goldwork trim at this point, but I felt a shirt of this complexity required some gold finery. I chose to place the gold stem stitches on every other row (on the outside as her stem stitches appear to be), and then further secured the pleats with a row of white silk stem stitches on the inside (which is more like those found in the Castle Lengberg finds). My persona could afford a bit of gold, but quite not as much as Dorothea.

Pleating (continued)

I also pleated the wristbands of the sleeves and secured them in place with the honeycomb stitch. The honeycomb stitch secures the folds by anchoring them to one another in staggered and interlocked rows, which results in a pattern of folding that is reminiscent of a bee's honeycomb. It would be more accurate to describe this stitch as a row or grid of diamonds. The honeycomb stitch is seen at the wrists in an extant garment from Alpirsbach⁸ (see below).



Honeycomb pleatwork in this Alpirsbach find (Cat. 29).

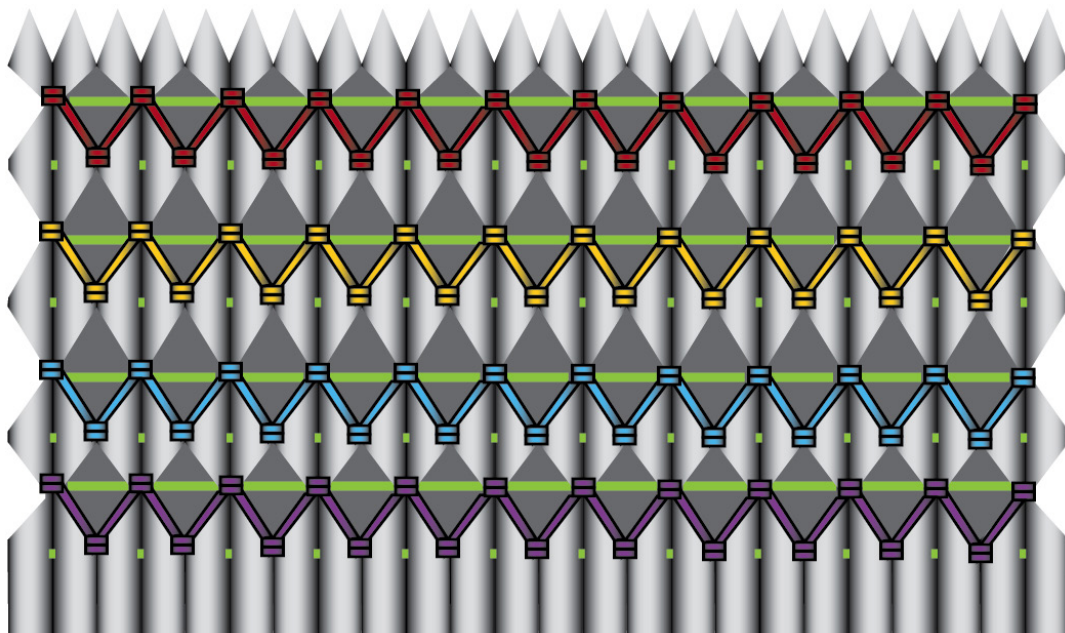


Figure 28. This front-view of honeycomb stitches shows the stitches and threads before the gathering threads have been removed. Each thread color indicates one continuous stitch, alternating between two rows, as this allows for elasticity. It should be noted that the thread that is carried between the alternating rows is actually on the back-side of the fabric. Illustration designed and copyrighted by author

Silk Cording

I made the silk cords that are attached to Dorothea's *hemd* by hand. After much trial and error (and a lot of silk thread), I got the right thickness and twist (80 silk threads per cord). I placed the cords on the front of her *hemd* in tied loops (I got this idea from the portrait, because the two-ply twists of her cords alternate, implying they are looped at some point). I then cut off the tied loops at the top to form small tassels, as in the painting. The cords under the goldwork trim could not be seen, but it was clear something was there because of the continuance of the tassels. So I studied the design and made a similar yet smaller pattern around the rest of the neckline to match. It makes for a nice, and unique, effect. This took about 8 hours.



Seams

I cannot see Dorothea's seams, but I infer that a *hemd* so complex and ostentatious would probably have amazing seams, too. So I finished each panel (front, back, sleeves, and gussets) with a blanket stitch in an onion gold silk thread, and then stitched all the pieces together using the seam insert technique seen on many fine 16th century shirts, including several in *Patterns of Fashion 4* (Arnold). This took about 20 hours.



Tools

I used a pleating frame, which was an idea that I got in the midst of this project and is based on a woodcut of a woman pleating. Gregor made it for me. It was useful for stabilizing the fabric while working on it, because if you pull stitches too tightly while pleating, you can end up with a distorted pattern. I also used an awl for marking my fabric before stitching, similar to the prick and pounce method of marking fabric for embroidery—it worked well!



Persona

This gown was constructed for a burgomaster's wife or daughter in early 16th century Germany. This would be a wealthy woman who could and would display her status and wealth on her person through the extensive use of silk and gold. This matches the persona of my Genoveva von Lübeck personality in the SCA, who is a burgomaster's daughter.

Notes

I did not apply the goldwork trim because I wanted this project to be focused on the beauty of pleatwork. Additionally, I'm not sure a linen *hemd* with such fine goldwork is practical for me, as I suspect it would require the removal of the trim each time it is washed. I may yet add it in the future, and I have already determined the method, materials, and pattern of the goldwork.

References

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Additional Reading and Reference Works Related to Pleatwork

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Additional Photos

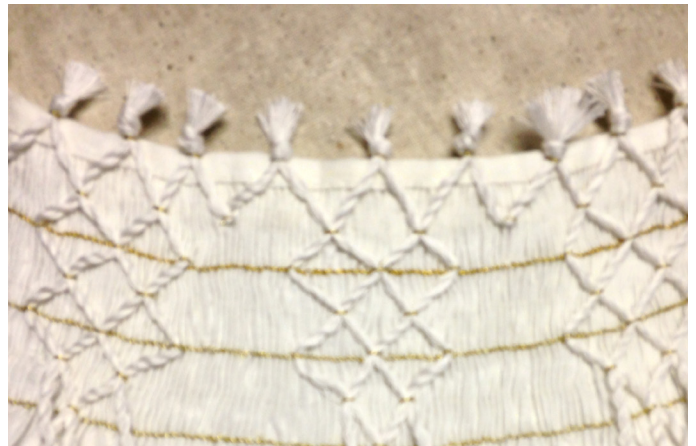
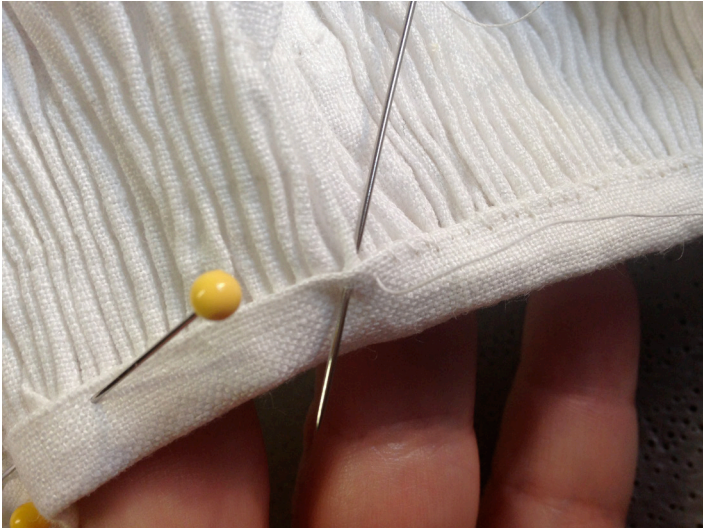


Photo Tutorial

I love sharing and helping! A step-by-step photo tutorial of the creation of this garment is available on my blog at:
<http://germanrenaissance.net/dorotheas-pleatwork-hemd-smock-with-cord-tufts-and-tassels-pattern-gathering-tutorial-part-1/>

