Tight-fitting Clothes in Antiquity and the Renaissance[1]

Dagmar Drinkler

Abstract:
A great number of ancient works of art depict figures who wear tight-fitting and strikingly patterned garments, particularly hose. These elastic textiles that cling to the body cannot be reproduced by any of the weaving techniques known to us. And there is no evidence that the textile technique of knitting was already known in antiquity. So the garments must have been made in a different technique. By reproducing samples of textiles it can be demonstrated now that it is possible to make elastic garments in a special kind of plaiting, the so-called sprang technique. All patterns found in depictions of such garments can be reconstructed easily and efficiently. So far sprang has mainly been connected with hairnets and caps. Comparing model and reconstruction proves the practicability of translating the pictorial sources into actual textiles by this technique.

Content: The Reconstruction of tight-fitting clothes after models from Greek vase painting and polychrome sculpture / The sprang technique / The Patterns of the tight-fitting hose and their execution in sprang / Producing hose / Sprang in the Renaissance / Striped hose / The shoes worn with the striped hose / Conclusion

The Reconstruction of tight-fitting clothes after models from Greek vase painting and polychrome sculpture

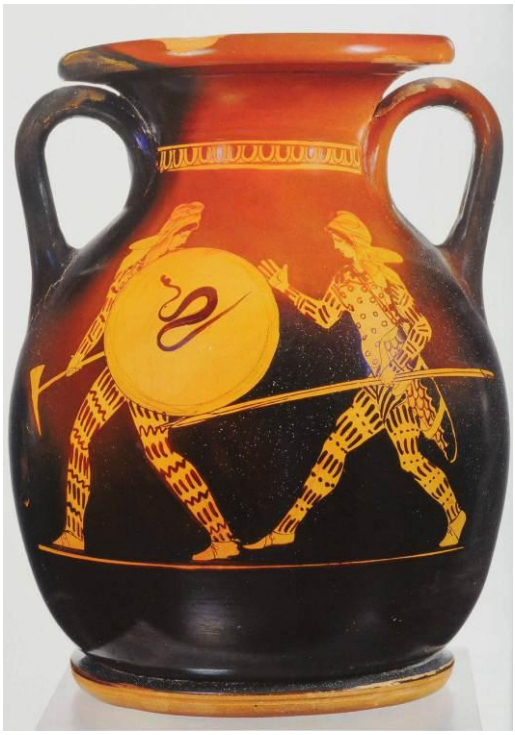

Fig. 1: Pelike 2351, 440-435 B.C. Munich, Staatliche Antikensammlungen.

From the fifth century BC onwards depictions in Greek Art show Greeks in mostly aggressive confrontation with individuals or groups of people, the enemies standing out by their tight-fitting hose or often even “suits” that cover the entire body. These garments characterize “foreigners” or “strangers”, which refers to the Scythians and the Persians as well as the mythical Amazons. The Greeks themselves never appear in this dress. Especially Greek vase paintings depict tight-fitting clothes (fig. 1), but also sculptures like the representation of

Paris as archer from the western gable of the Temple of Athena Aphaia (fig. 5), today in the Glyptothek in Munich, or the so-called Persian horseman in the Acropolis Museum in Athens (fig. 8).

The question remains how these tight-fitting clothes were produced. Hardly anything is known about this. The ancient historian Herodotos merely reports that the Scythians and the Persians wore leather breeches. In Scythian graves in the Altai Mountains (Siberia) only felt stockings have been found. The elastic textiles that cling to the body cannot be reproduced by any of the weaving techniques known to us. And there is definitely no evidence for knitting in those early times. Other techniques, like e. g. needle binding produce stretchable textiles, but they lose this quality when patterns are worked in.

The sprang technique

A way of fabricating elastic textiles is the so-called sprang technique, whose existence can be verified for the time around 500 BC. The archaeological finds consist mainly of hairnets made in sprang, dating from pre-Christian times. The earliest hairnet was excavated from a grave near Aarhus (Denmark) of the Bronze Age. Archaeological finds all around the world have provided evidence for the use of sprang throughout all epochs of cultural history. It was only with the growing industrialisation of textile production in the beginning of the nineteenth century that the sprang technique fell into oblivion.

Originally “sprang” is a Swedish word, which can be translated as “open work”. For several decennia this term has been used solely for the technique of plaiting with stretched threads. In sprang parallel threads are stretched around a frame and then twisted, interlinked or intertwined by lifting or lowering these threads. This produces a kind of network. To understand the elastic quality of sprang it is necessary to explain the difference between sprang and a woven textile. A woven fabric is based on two systems of threads that are positioned at right angles. The vertical system is called the warp, and the horizontal one is called the weft. Only the interaction of warp and weft produces a woven fabric. In sprang however the textile structure is made without a second system of threads, by only interlinking or intertwining the vertically stretched threads. Consequently these threads are not positioned at right angles but diagonally. A crucial point in sprang is that the stretched threads are not a set of single threads like the warp used in weaving. Sprang is produced by a continuous thread that is placed around a rod at the upper and lower ends of a frame respectively. Through this method the threads are divided into two layers, one in front of the rod and one at the back. The threads are under constant tension. The distance between the two rods is determined by the length of the finished textile plus the plaiting-in of the threads, which is about 30 per cent. The threads have to be available in their complete length at all times, which means they cannot be wound up like warp threads.

A prerequisite for stretching the threads in sprang is a stable device that can be fixed, with the possibility of relaxing the tension in the course of working because the threads are plaited in to a high degree in length. A simple frame construction is sufficient. For working sprang both hands are needed and also at least two rods for separating or fixing the two layers of threads respectively. With the left hand the threads of the two layers are kept apart, while the right hand picks up the threads one after the other, with the fingers twisting, interlinking, or intertwining the threads. This is done by picking up a thread from the reverse and then pushing a thread from the front to the back (fig. 2). This means that always one thread from the front and one thread from the reverse work together. Each row is worked separately.

Fig. 2: Picking up a thread from the reverse and then pushing another thread from the front to the back. © Staatliche Antikensammlungen und Glyptothek München. Photo: Renate Kühling.

A crucial point in making a pattern is the arrangement of threads in different colours when stretching them around the frame in the beginning but also the fact which two threads are manipulated together (fig. 3).

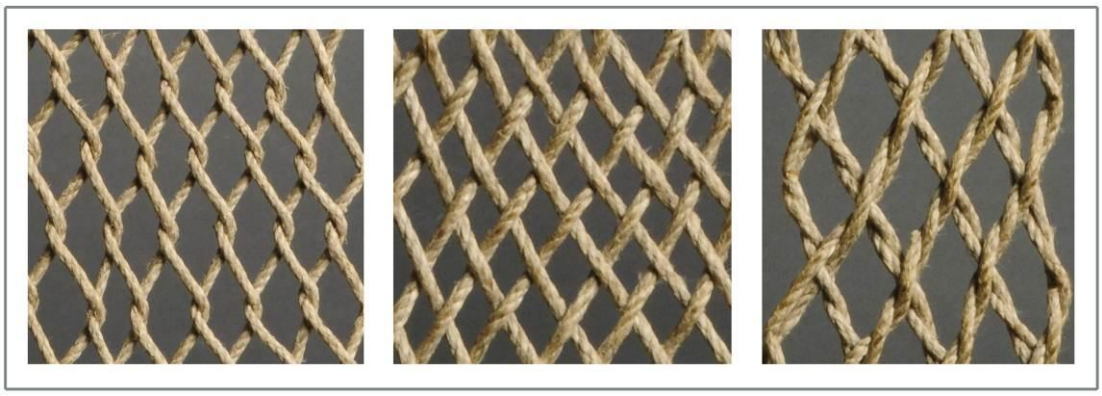

Fig. 3: Different plaiting structures: interlinking (left), interlacing (middle) and intertwining (right). Photo: © Drinkler.

Every time after finishing one row the twisted threads have to be fixed by inserting a separating rod. Then a second rod is inserted and pushed to the opposite end of the stretched threads, thus producing a plaited textile at that end as well. However its structure is a mirror image, which means that the diagonal ridge is in S-direction at one end and in Z-direction at the opposite end of the piece.

Both sections of the sprang textile grow towards each other. At the end of the working process the threads that are not plaited yet become very short so that they cannot be twisted with the fingers any more. Now to finish the sprang textile the threads must be fixed in their position in the middle of the piece to ensure that it cannot unravel when taking it off the frame. It is possible to insert a horizontal thread there, but this does not have a favourable effect on the elastic quality of the textile. The other possibility is to link the threads by chain stitches in crochet. This method creates a continuous textile with strong borders and a relatively compact, visually contrasting middle section.

The simple, schematic drawings that show the interlinking of threads in sprang (fig. 4) can be found in every publication on this topic. They suggest a loose and open-work structure because the textile is always shown as if under tension, to explain how every single thread is

positioned in the course of working. When relaxed however, sprang textiles very often have tight and compact surfaces that have ridges similar to a woven twill. The extent of elasticity in sprang is related to the material used (e. g. wool, linen, silk, or cotton), the thickness of the threads and the twist angle, and finally the method of working.

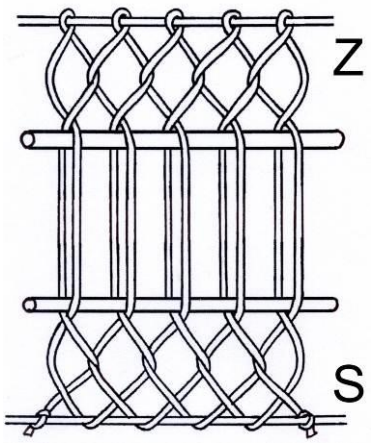

Fig. 4: Schematic drawing of sprang work by Drinkler after Collingwood. The diagonal ridge is in S-direction at one end and in Z-direction at the opposite end of the piece. Photo: © Drinkler.

Having produced samples of textiles, it can now be shown that the tight-fitting clothes with the striking patterns found in ancient art, can be fabricated in sprang. Depictions on Greek vases indicate that the ancient Greeks knew this technique. The vases show women holding a frame with a zigzag-patterned textile on it.[2] It can be assumed with certainty that these are frames for sprang, on which the headwear of Greek women was produced.

The Patterns of the tight-fitting hose and their execution in sprang

All patterns found in depictions of such garments in Greek Art can be reconstructed easily and efficiently in this technique by various methods of working: single-layer, two-layer, or multi-layer sprang. It is also possible to create a pattern by alternating between single-layer and two-layer sprang.

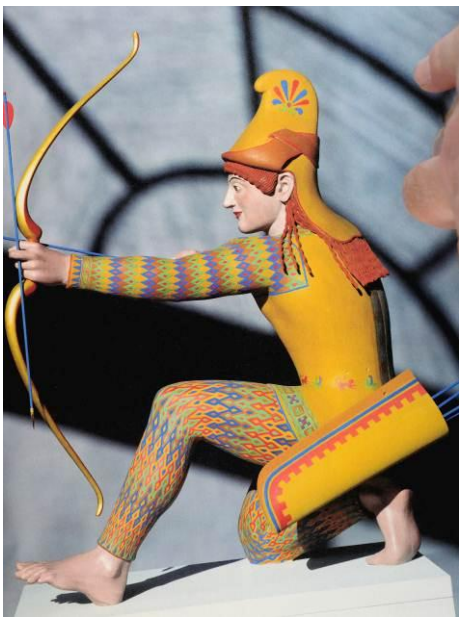

Fig. 5 Colour reconstruction of Paris as archer from the western gable of the Aphaia-Tempel, approx. 490-480B.C. by V. Brinkmann 2003, Munich, Glyptothek.
© Staatliche Antikensammlungen und Glyptothek München. Photo: Renate Kühling.

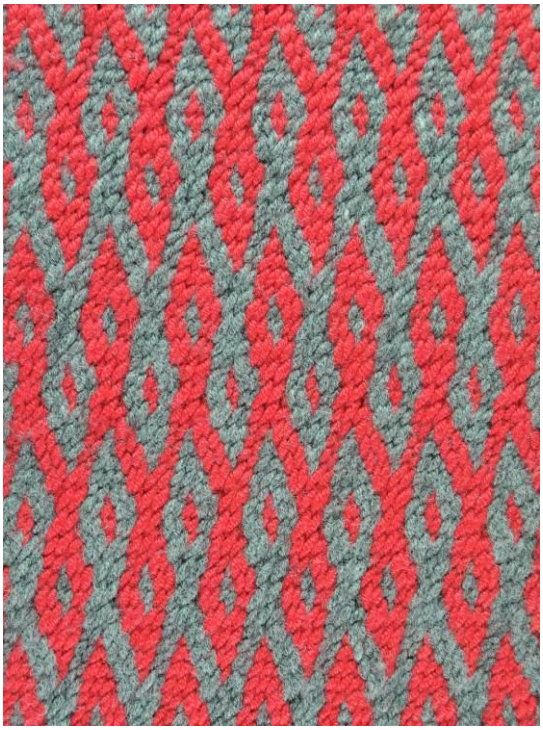

Fig. 6: Double zigzag pattern as found on the Paris sculpture in one-layer sprang. © Drinkler.

The pattern of the textile is determined by the arrangement of threads in different colours that are stretched around the frame before starting to work. Single-layer sprang is suitable for stripes, small zigzag and rhomboid patterns, which look the same at the front and the reverse. A variation of this is the double zigzag pattern that can be found on the sculpture of Paris (figs. 5-7)[3]. In two-layer sprang, following the pattern, the threads of one colour are placed over the threads of the other colour, thus producing two layers that are not connected.

Fig. 7: The double zigzag pattern in a two-layer sprang. The hose are complete, while the top consists of two separate sleeves and a felted waistcoat.
© Staatliche Antikensammlungen und Glyptothek München. Photo: Renate Kühling.

As the threads move diagonally in plaiting, patterns with diagonal lines can easily be created and are especially suitable for sprang. By interchanging the layers a coloured pattern can be obtained. When working like that with only two colours the pattern is in opposite colour scheme on the reverse. If the second layer is worked in several colours a diamond pattern in different colours can be obtained.

Fig. 8: Colour reconstruction of so-called Persian horseman in the Acropolis Museum in Athens, about 490 B.C., by O. Primavesi 2008, © Dieter Rehm, Munich.

A variation of this is the in the colour reconstruction of the so-called Persian horseman (figs. 8, 9).

Fig. 9: Two-layered sprang with long lozenges pattern as found on the Persian horseman. © Drinkler.

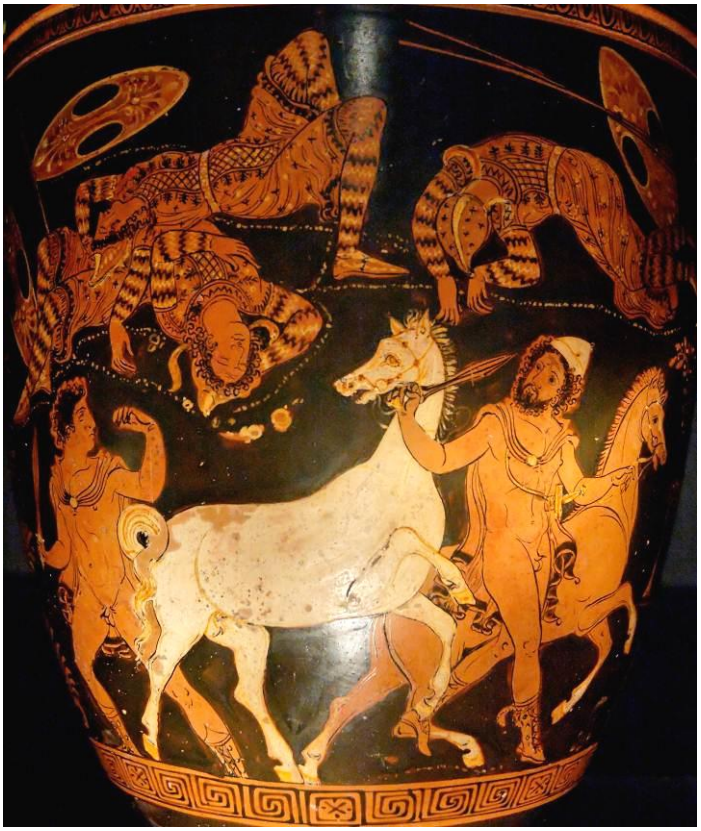

Fig. 10: Situla, about 360 B.C., Neapel, Museo Nazionale Archaeologico. © Jastrow (Wikipedia, free domain).

In three-layer sprang a third colour is simply added when stretching the threads around the frame in the beginning. Thus front and reverse will show one colour respectively, while the third colour is hidden in between (figs. 10, 11).

Fig. 11: Zigzag pattern in a three-layer sprang. © Drinkler.

By interchanging several layers all patterns of ancient dress depicted in works of art can be created.

When using the same thread material a piece of two-layer sprang is twice as thick and heavy as a piece of the same size in single-layer sprang. With the use of finer threads labour does not increase linearly but exponentially because more threads have to be placed around the frame. There is also the possibility of making a pattern by alternating between single-layer and two-layer sprang. However, this requires some more threads in width than in single-layer sprang because the elasticity is reduced a little.

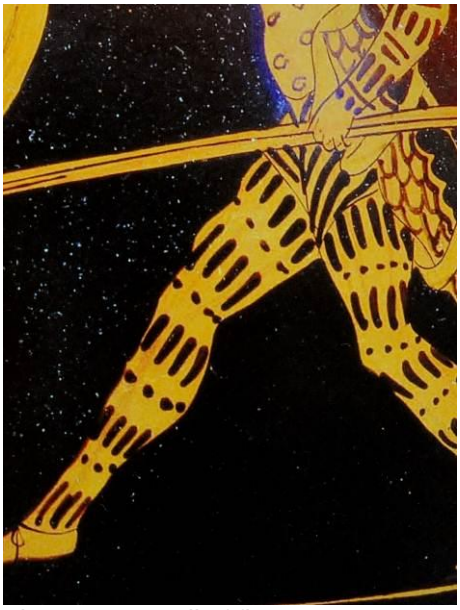

Fig. 12: Detail of fig. 1.

If in a horizontal row there is only one colour the threads of the other colour are all in the reverse layer. To create a pattern both colours are united in one layer. This method causes uneven borders. So in hose there are horizontal stripes that are more solid than the rest of the textile (figs. 12, 13).

Fig. 13: Uneven border in one- and two-layered sprang alternately. © Drinkler.

Producing hose

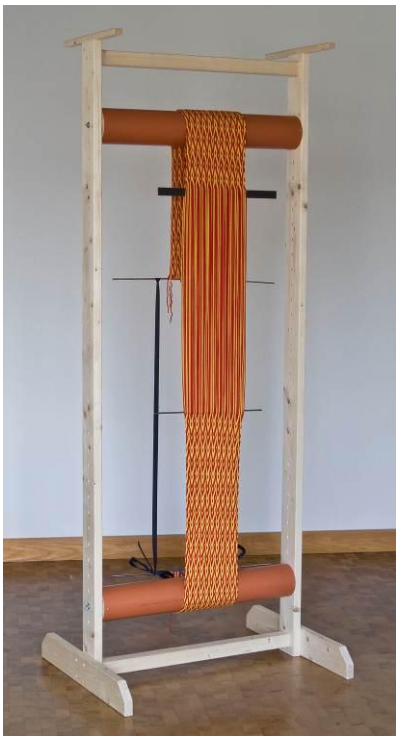

Fig. 14: Frame construction for producing hose.
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To produce a pair of hose both legs are worked in one sprang piece. Taking into account the shrinkage of 30 % the length of each thread section had to be about 360 cm in the beginning. So a frame was constructed of two meters in height and 80 cm in width, with the threads placed around two pipes with the diameter of 20 cm each at the top and the bottom of the frame (fig. 14). The sprang piece was finished in its middle section. The threads were cut and knotted immediately to keep the waistband of the hose elastic. Then the vertical seams of the legs were joined and the hose were sewn together. By following the plaiting with the sewing thread the seam is not visible in the end (fig. 15).

Fig. 15: Pair of hose worked in two-layered sprang in two colours. © Drinkler.

Although no upper garments have been reconstructed so far it is possible to produce them, using the same method. Depictions of such garments clearly show that the sleeves were mostly set in separately. In rare cases no seam is visible at the shoulders, which indicates that it is a continuous sprang piece from hip to wrist with a low V-neckline.

The production of tight-fitting garments as described here cannot be proven by surviving examples from antiquity. However, there is no doubt that the sprang technique was known to the ancient Greeks and that all patterns of the elastic textiles depicted in ancient art can be executed efficiently in sprang.

Sprang in the Renaissance

During the following centuries sprang was primarily used in Egypt by the Copts for their headwear and in England and Norway for leggings and gaiters in the Viking age. But is was not until the end of the fifteenth century that depictions of women in front of sprang frames as well as of headwear in sprang reappeared in fine art. From the beginning of the sixteenth century there is a wide range of women shown in front of a vertical frame.[4] Mostly it is even the Virgin Mary who is depicted in this position. Only rarely do the women hold a shuttle in their right hand for inserting a weft. But in most cases always the same position of the hands occurs that is so typical for sprang (fig. 2). Mostly this work is described as “weaving”, or, if the author was not really sure, it is called “women’s handwork”.

Striped hose

From Burgundian court fashion developed the tight-fitting, one-piece pair of men’s hose during the fifteenth century. Written sources tell us that these were made from leather, wool cloth, or linen fabric. To achieve a perfect fit around the leg, hose made from these hardly elastic materials were produced with vertical back seams and gussets for the bottom. These hose either had two legs of the same colour or each leg in a different colour. Towards the end of the fifteenth century tight-fitting, coloured hose with vertical stripes for men appeared. This fashion can be seen in panel paintings, sculptures, and graphic art only between around 1490 and 1530. The men who are depicted wearing these colourful, striped hose are almost always outcasts of society like hangmen and torturers, also the torturers of Christ.

Here again the question remains how these garments were made. Hose sewn together from strips of coloured fabrics are conceivable but such a perfect fit without any creases can hardly be achieved by this method. Another possibility in these times would have been knitting, but working vertical stripes is rather cumbersome in this technique. The easiest way to create a coloured pattern in knitting is to work horizontal stripes, which never appear in fine art of those times. In sprang however vertically striped hose can most easily be produced. The threads are stretched around a frame in the desired colours and width of the stripes and then worked in single-layer sprang by simple interlinking.

In paintings from this age, e. g. by Lucas Cranach the Elder[5] and Hans Holbein the Elder[6] a second type of hose can be observed: simple vertical stripes from the toe up to above the knee, then continuing in alternating colours and different patterns. These patterns can also be created in the sprang technique. For changing the pattern in the top section of the hose a second layer of threads has to be added to the sprang piece by simple threading. But it is much easier to work one row of chain stitch in crochet, in which the additional vertical threads can be inserted. This method creates a thin horizontal line, which is usually not visible in depictions of hose. But there is one case where such a line can clearly be observed: It is a pair of hose worn by a man on the left side panel of the altarpiece of Gerolzhofen by Tilman Riemenschneider (figs. 16, 17).

Fig. 16: Left side panel of the altarpiece from Gerolzhofen by Tilman Riemenschneider, ca. 1515, Munich, Bayerisches Nationalmuseum, acc. no. MA 1963. The executioner is wearing tight-fitting hose with vertical stripes along the legs and diagonal stripes at the bottom. Photo: © Jeanine Walcher.

The sprang sample made for comparison shows that when stretching it, the single-layer sprang in the striped legs is less elastic in horizontal direction than the two-layer sprang in the top section. This quality is not only an advantage for fit and comfort when wearing the hose, but the two-layer sprang is also less transparent at this delicate part of the hose.

Fig. 17: Vertical stripes in simple interlinking sprang and in the upper part diagonal stripes in a two-layer sprang. © Drinkler.

Dress history has given a lot of attention to the strikingly patterned hose of a gondoliere in a Venetian painting by Vittore Carpaccio (fig. 18). The upper section of the hose shows a trompe l'oeil cubic pattern, which can be produced in two-layer sprang in two colours.

Fig. 18: Detail of the painting "The Miracle of the Relic of the Cross at the Ponte die Realto" (tempera on canvas) by Vittore Carpaccio, dated 1494, Venice, Gallerie dell' Accademia. Photo: © Matthias Weniger.

The third colour that is necessary for the three-dimensional effect is created by a blend of the two colours. When working the sprang sample the third colour was obtained by two-coloured hatching (fig. 19), but also other patterns can be used for a similar effect.

Fig. 19: Sprang work of the trompe l'oeil cubic pattern, which can be produced in two-layer sprang in two colours. © Drinkler.

The shoes worn with the striped hose

It is striking that when the striped hose and stockings came into fashion, the shape of the shoes changed at the same time. The long pointed poulaines were replaced almost without exception by square-toed shoes worn with the striped hose. These so-called cow-mouth shoes were probably much more comfortable but this seems to be only one aspect of this new fashion. Hose produced in sprang are provided with a square end of the foot without a shaped toe-cap, which consequently requires a square-cut shoe. So far historiography has not explained the origin of this shoe fashion sufficiently. But worn together with sprang hose the square-toed shoes with very wide openings would cling to the feet.

Conclusion

Whether striped hose in the Renaissance were produced in sprang cannot be proved, as is the case with hose in antiquity, because of the lack of extant garments. But the parallels are rather striking: In both epochs there are depictions of women working on small frames, on which hairnets and caps can be produced in sprang. There are no hints at the fabrication of entire hose.

The wearers of the hose in ancient art are generally not the Greeks but foreigners like the Scythians and the Persians. In the Renaissance the wearers of striped hose are in the beginning only outcasts or criminals, including the soldiers who brought Christ to the cross.

Written sources do not mention anything that could be related to hose being produced by plaiting. The German dictionary of the Brothers Grimm makes clear that the words to describe textile techniques like knitting, netting, knotting, or plaiting, cannot clearly be separated from one other. The term “knitting” (“stricken”) was generally employed for the production of meshwork. But how this was achieved remains unclear. No tools or devices, let alone knitting needles, are ever mentioned in the early texts. Since nothing has been known so far about the origin of knitting, possibly in the early days the notion of knitting included the sprang technique.

Hopefully this article will give a new stimulus to textile and dress research to prevent the earliest and simplest method of creating a flat textile, namely plaiting with its special technique of sprang, to fall into oblivion again. Instead it should be given back its adequate significance among the other textile techniques.

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[1] Abbreviated version of the following article: Drinkler, Dagmar: *„Enganliegende Bekleidung in Antike und Renaissance“*, in: Zeitschrift für Kunsttechnologie und Konservierung (ZKK), 2010, issue 1, pp .5-35.

[2] Cf. Pyxix acc. no. CA 587, about 450 BC, Paris Louvre.

[3] The double zigzag pattern on the Paris sculpture can only be traced as a weathering relief because there are no remnants of the original pigments. The sculpture of Paris as archer shows the elasticity of the pattern. At the thigh the pattern repeat is clearly shorter than at the ankles. This extent of stretching corresponds to a real braid in sprang. Unfortunately the coloured casts do not show the differences in the stretched material like the original does.

[4] Cf. Ms. Allem. 106, fol. 62r, Paris, Bibliothèque National.

[5] Cf. Katharinenaltrar, Gal Nr. 1906, Dresden, Gemäldegalerie Alte Meister.

[6] Cf. Painting „Basilica San Paolo fuori le mura“, acc. no. 5332, Augsburg, Staatsgalerie Altdeutscher Meister.