

Documentation for your consideration
Viking Knit (aka Trichinopoly chain)



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Introduction

Trichinopoly chain, and chains like it, has been found from a variety of cultures and times however for this entry I'm focusing on Viking Age Scandinavia and the lands visited by the "Viking" people. This chain was used for a variety of decorative (and sometimes functional-decorative) purposes; not just jewellery. The production of the chain was likely only possible after the development of wire-drawing techniques, and once wire was produced, this chain could have been produced with limited tools. The technique is notably similar to the Viking Age textile craft of nålbinding.

My chain is made of purchased silver-plated copper wire, which I made into chain. For the necklace on display, I also made the links from a heavier gauge of silver-plated copper wire and assembled the main pendant from purchased materials (Czech crystal, metal foil, split ring), while the other (temporary) pendants were purchased. My tools were largely store-bought with the exception of my draw-plate which was made from purchased wood.

Description of entry

For my entry I'd like to present a Viking Knit necklace inspired by, but not a reproduction of, the Hämeenlinna necklace from Finland dated to between 800 and 1050 supplemented with a variety of other Viking Knit pieces to illustrate variations in the possibility of this technique.

Viking Knit in period

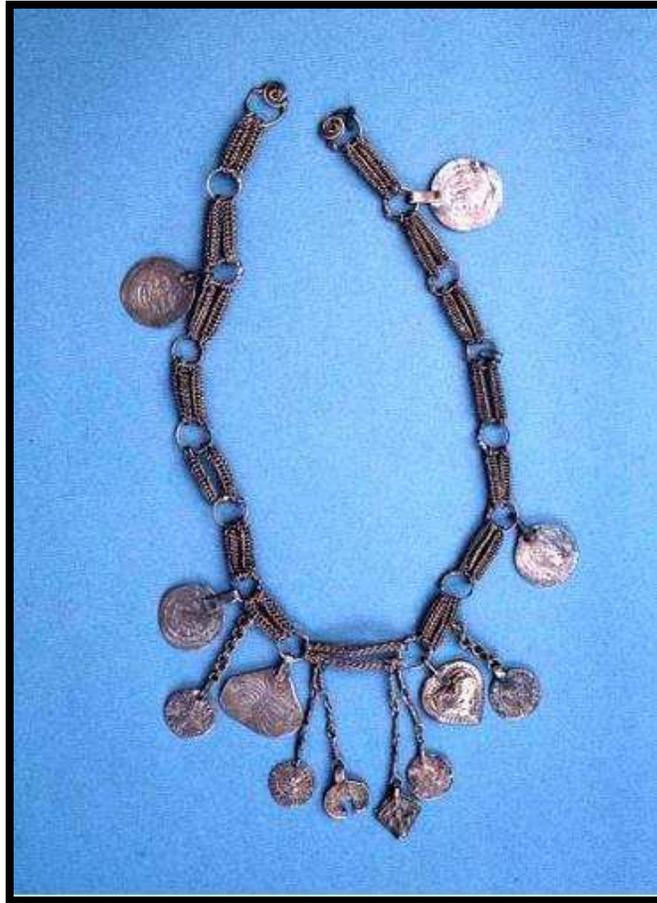
The technique for making this kind of chain was known to and used by Viking Age Norse, but similar wire weaving has also been found in Greek, Roman, and Byzantine as far back as the 1st century BCE. Archaeological examples have been found in sites in Scandinavia and lands visited by Viking Age Norse, dated back to the Viking Age. (*Source: Lady Freygerdr in storrada Halladottir*)

Along with looped and forged wire chains and twisted wire, Viking Knit was used for jewellery, to trim clothing, and to make other decorative objects. Lady Freygerdr in storrada Halladottir notes that most of the finds of Viking Knit chain has been found in hoards, rather than grave finds or settlement areas.

Notable finds

There are a number of finds that I'd like to share with you from lands visited/occupied by Viking Age Scandinavians. While my current interest rests largely in jewellery, I hope to illustrate that the use of this chain was more than just for jewellery, but for a wide range of decorative (and possibly dual-function decorative and practical) use.

Hämeenlinna necklace



The Finnish Hämeenlinna necklace is made with silver, and has been dated between 800 and 1050. (Shown to the left.) It is regularly housed at the National Museum of Finland (<http://www.nba.fi/en/index>), which I unfortunately missed visiting in person when I was in Finland.

This necklace has coins as pendants that are listed as of Anglo-Saxon and Danish origins. Other pendants are listed as a flower motif, a crescent (lunula), a heart shape, and animals.

Lora-Lynn Stevens writes about the Hämeenlinna necklace referencing Tomanterä's work, stating that the necklace is from the 11th century, and that this is a complete necklace (suggesting that the necklace is to suspend from brooches, rather than being worn around the neck directly). She describes it as a "Danegeld" style where fragments are "gathered from multiple sources and displayed in a single piece quite possibly as a status symbol". She describes the construction as Trichinopoly chains joined together with rings from which hang a number of pendants. The photo shows that the dangling pendants are hung by two different kinds of chains as well; a Rolo chain and a link-and-bar chain, suggesting that the necklace was assembled into this final look on separate occasions or by different individuals.

In *The Viking World*, the authors elaborate that silver coins were frequently used as pendants in Norse jewellery, and were either "perforated or furnished with a loop for hanging on a necklace or chain assembly". They note that Arabian dirhams were particularly popular in Finnish examples, "which is evident from the fact that 'counterfeit' dirhams were manufactured specifically for

Reproduction coins are 'period'

In her review of the Hämeenlinna necklace, Eeva Jonsson repeated that "Islamic coins were especially popular as jewelry in Finland" and that imitations of these coins were used. She speculates that their popularity was due in part to their size and decoration.

use as jewellery hangings”. Additionally, they note that a large number of coins mimicking the “Byzantine silver miliarsion have also been discovered in Finland.” Based on the identical stampings, and rarity of certain types of these coins, they surmise that the coins were probably made in Finland.

This is the artifact that I used as an inspiration point to create my entry, though I was not attempting to replicate it, as I do not yet have the detailed information I’d need for a reproduction.

For more about this necklace, and others like it, please see **Appendix 4**.

Man's cuff

Danr Bjornsson writes about an edging on an embroidered man’s cuff. While the embroidery is silver-wrapped thread, he identifies the edging pattern being similar to the nålbinding ‘Mammen Stitch’, but instead of being flat, it is cylindrical. He speculates that the chain might have protected the sleeve cuff on an area prone to wear, while still being decorative.



Peter Beatson provided more information about this cuff, stating that it is a 10th century men’s silk cuff found in a grave find from Uppland, Sweden. The cuff is made of (originally) red tabby silk with embroidery done in silver foil-wrapped silk, and the edge trim is described as “plaited silver wire”.

In a personal conversation with Diane Standen-Downie, she pointed out that this chain was not pulled through a draw-plate, and was

constructed directly on the fabric. She also noted that this chain only has 3 ‘ribs’ to it, a difference from the more common 5-rib chains.

As it was constructed directly onto the fabric rather than applied to it (in the way that tablet weaving can be made directly onto the fabric it will trim) that suggests it could not be made of loop-in-loop chain or spool knitting (discussed below) as possible alternate construction techniques. In order to confirm that it would be possible to construct this using the Trichinopoly technique I used for my featured project, I did a small sample of this technique, as seen in **Appendix 5**.

Trewhiddle scourge

A silver scourge of Late Anglo-Saxon Viking Knit chain (seen to the left) was found in Cornwall, England, and has been dated to 868. (*Source: British Museum*) The length of the chain is 56.5 cm and it includes a handle of a blue glass doughnut-shaped bead. It was part of a hoard of other silver items including strips of decorative silver “from a drinking-horn”, a buckle, coins, a goblet, coins, and hack silver.

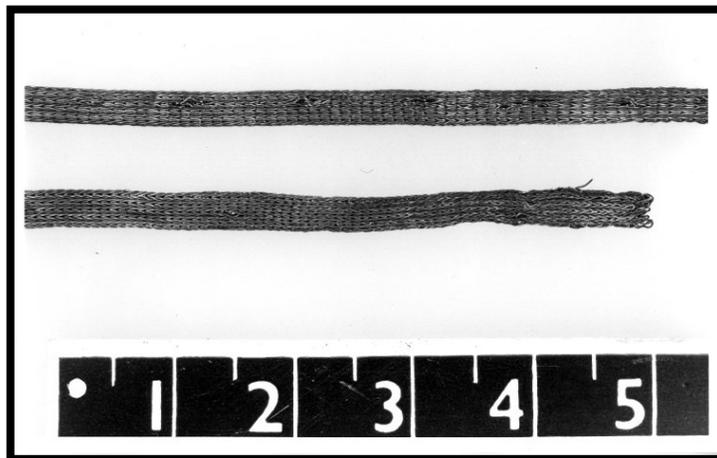


Unfortunately, the photos from the British Museum aren't close enough to confirm this is the same weave structure as the technique I'm using for Viking Knit, but much of the research I've read mentions this as one example of the period use of the chain, for instance it is referred to as Trichinopoly chain in both *Ancient & Historic Metals: Conservation & Scientific Research* and the *Oxford Handbook of Anglo-Saxon Archeology*, who describe it as a an

object of “ecclesiastical significance” and suggest that it's use “must have been symbolic of penance rather than actually painful”.

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Chain fragment



The next item is only a fragment of silver chain with no terminals on either end. This was found on an island in Scotland, and has been dated to the 10th – 11th century. The length is 46 cm, and it was found with coins and “three large rings” which makes the British Museum believe that this chain had been used as hack silver instead of being worn or used for its original purpose before being deposited. Many of the finds of Trichinopoly chain are like this – fragments without terminal ends, thus their initial use can't be clearly stated, though their value was dual-

purpose, for the decorative chain, and for the value of the silver.

The photo of this find is much closer, and the ‘weave’ of the chain is distinctly similar to the structure of the chain I've made – however much, much finer than anything I've made.

Ardagh chalice

The Ardagh chalice has two silver wire chains thought to be trichinopoly. (Source: *Medieval Archaeology* 392 – *Trichinopoly*) As the remarks above suggest, the same artisans may have made this object as the paten, and the National Museum of Ireland writes that while the form of the chalice “recalls late Roman tableware” “the method of construction is Irish”.

The notes specifically on the chalice unfortunately don't give much mention of wire weaving, looping, or braiding to indicate where the trichinopoly may have been used, and the photos on the website (as to the left) aren't quite large enough to see the detail. While the book “Treasures of Early Irish Art, 1500 B.C. to 1500 A.D.” has many very close photos, I could not identify the chain on the chalice.



Braham Norwick references the 1932 book by L.S. Gogan about the chalice and reports that Gogan suspected that the chain on the chalice was called Trichinopoly work, but no technical definition was found to categorize this, and that the decoration may instead be “a form of spool knitting or maypole type braiding”.

Pendant chains



One example of a Trichinopoly (unconfirmed) used as a necklace to suspend a pendant is from the Sejerø hoard. The hoard contained a number of Arabian and Western European coins with which to help date the find, and the National Museum of Denmark states that the hoard was buried in the second half of the 10th century.

Additional examples of Viking Age Trichinopoly chain (mostly for jewellery) can be found in Sunnifa Gunnarsdottir's document 'A Collection of Knit Wire Chains', linked in the bibliography at the end of the document. One of her examples includes a find from

Denmark; a soapstone mould from the 10th century for both a Thor's Hammer pendant and two crosses. This find she reports are from Trendgården in Jutland, as illustrated in 'The Oxford Illustrated History of the Vikings' by Peter Sawyer. Four Thor's Hammer pendants are shown in the photograph from the book, though none of them seem to be finished products for that specific mould. One of the pendants is shown on a Viking Knit chain, where the ends are finished by simply weaving the end of the wire into the chain, and a circle of wire is passed through the ends, and twisted back on itself after passing through the pendant to secure.

Tara Brooch



Many sources I read referred to the Tara Brooch as having a small piece of Trichinopoly chain on it, however the book “Treasures of Early Irish Art, 1500 B.C. to 1500 A.D.” appears to have the best photos of the brooch and its chain, and the chain is not particularly visible in most of the photos. The authors discuss the chain briefly: “The broken plaited wire still attached to one side may be no more than a safety chain or may indicate that this surviving brooch is one of a former pair”. The brooch is dated to the eighth century, and was found in County Meath (not the more popular Tara for which it was named, probably as a marketing technique). They list the materials of the brooch as “silver, gilded, with added amber, gold, glass, and copper” however the chain looks distinctly silver in colour compared to the brooch.

The chain is attached to the brooch with a stylized animal-head terminal, “hinged to an ovoid plate”. If the chain was a safety chain, then it may have been a decorative-functional purpose, however if there were two brooches, and the chain was strung across them, it may have been more decorative.

Alternate chain period chain styles

In addition to the Trichinopoly chain there are also other chain styles which are period for the Viking Age in Scandinavia and other lands where the “Vikings” visited.

Loop-in-loop chain



Tightly made loop-in-loop chain is sometimes mistaken for Trichinopoly chain as it looks very similar; “without a jewellery loupe, (it’s) very hard to distinguish from Trichinopoly chain.” (Source: Julia McGowan) Loop-in-loop chain is made “of a series of fused links that have been bent together” and is “not made from a continuous piece of wire like ‘Viking Knit’ is”. Julia goes on to add that loop-in-loop chain is much older than Viking Knit, and more widespread. Lora-Lynn Stevens explains that loop-in-loop is a solid chain made of essentially “elongated jump rings” whereas Viking Knit is a hollow chain made of a “continuous (albeit pieced) wire”.

To the left is a detail photo of a gold torc found as part of the ‘Winchester hoard’. The British Museum describes the hoard as from the Iron Age, found in Hampshire in southern England. The hoard included brooches and a bronze

bird-head-shaped handle from a bowl. They go on to compare this torc to others from the Iron Age as “many small gold rings which have been bent into loops and threaded together in a fluid ‘rope’” similar to

many modern gold and silver chains. In contrast, most torcs made from this age are rigid, made from twisted wire.

A related article discusses how the clasp of this torc was made; the granulation method used to embellish the clasp was used by goldsmiths in ancient Greece and Rome, however there is no evidence to suggest that Iron Age jewellers in Great Britain made work like this. The chain-making technique again is larger and thicker than most of the chains made in Greece and Rome. The British Museum goes on to speculate that perhaps this item was made of Roman gold from a Roman jeweller, and was brought to the UK – “perhaps (as a) gift from Rome to a sympathetic British chieftain”.

I have more information about loop-in-loop chain in **Appendix 1**.

Additional chain types

While the loop-in-loop chain is frequently mistaken for Trichinopoly chains, there are also other chain styles which can be dated to the Viking Age and placed in areas where the Vikings settled or visited. I have included these in **Appendix 1** to simply this document.

Distribution of Viking Knit finds

Distribution by time

Lora-Lynn Stevens writes in her ‘A Resource Journey: Trichinopoly Chainwork: Is it Viking Chain Knitting?’ that the majority of Viking Knit finds cannot be dated with certainty, however that the earliest finds have been dated to the 9th century. Other articles I read suggested that the earliest finds are from the mid-eighth century. Rough dates however can be attributed to Viking Knit finds which are accompanied by coins; Lora-Lynn Stevens notes that one coin hoard which also contained Viking Knit fragments were dated to the end of the 10th century to the end of the 11th century. These dates put the distribution of Viking Knit to within the Viking Age which is generally agreed to be 793 CE to 1066 CE. (*Source: Wikipedia*)

Viking Knit was not a technique abandoned after the end of the Viking Age either, Lora-Lynn Stevens mentions one find dated to the 15th century; a crucifix from Drammen, Norway. She quotes a description:

*“The chain is of relatively thick strongly drawn wire and has five rows.
At the ends of the chain are filigree ornamented gilded mounts joined to a U-shaped holder.
The artefact is an encolpion crucifix”.*

In the book ‘Ancient & Historic Metals: Conservation and Scientific Research’ the authors state that jewellery similar to Norse Trichinopoly chain can be seen also in jewellery “from medieval Southeast Asia, and the technique has been used there ever since”. This kind of chain is also found in other parts of the world before the 9th century, though my focus for this document is on finds from Scandinavia.

Distribution by location

As mentioned above, the majority of Viking Knit finds have been recovered from hoards, rather than grave sites or settlements. This might suggest that finds represent more than just where the chains were worn or used for decoration originally, but also that they might have travelled through transactions, used alongside hack silver as a method of payment.

Lora-Lynn Stevens a map from Leena Tomantera’s “Braid, weave and ‘foxtail” showing the geographical distribution of Viking Knit pieces in the 1100s. The map illustrates the majority of finds in modern-day Norway, Sweden, Denmark, Finland, and Estonia with a few notable finds elsewhere in Europe. Additional finds dated to other years show the spread of this technique into the United Kingdom where Viking Age Norse also visited and settled.

Distribution by gender

With the majority of Viking Knit finds coming from hoards, rather than grave sites, establishing Viking Knit chains as a male or female gendered item is challenging.

- Hämeenlinna treasure necklace - Lora-Lynn Stevens notes that this appears to be a woman's treasure, as it includes items similar to other items presumed to be used largely by women. If the necklace is indeed complete, then it would have hung from the brooches commonly associated with female dress, and the inclusion of the crescent-shaped pendant further implies the owner being female, as this is a common symbol for female fertility and protection. Grave finds of other similar necklaces also suggest them being worn by a woman.
- Ballinaby pin & chain – Lora-Lynn Stevens a statement from another researcher who stated this object came from the grave of a man and woman. With this, the pin itself cannot be distinctly assigned to neither male nor female gender use.
- Birka chain – a long chain from Birka was found “with oval convex brooches” as noted in Lora-Lynn Stevens document. These brooches are usually associated with female graves.
- Pendants – Lora-Lynn Stevens writes that Viking Knit chains have been found with pendants. Thor's Hammer, and axe-head pendants are typically associated with men, and she also refers to a crucifix pendant with a chain, also gendered to a male grave.

Despite the limited grave finds noted, I believe that this chain was not used exclusively by one gender over another, however it's possible that some of the graves were miss identified, as assigning gender to Viking Age Norse graves I've been told is quite difficult. It would appear that the use of this chain however, may have had a particular purpose different between male and female Scandinavians.

Period Construction



The 'stitch' for Viking Knit is similar to some of the stitches used in nålbinding – the textile technique similar (in a way) to knitting that the Viking Age Norse used to make mittens and a variety of other (sometimes not agreed upon) items.

The photo to the left I took at the Iceland National Museum of a mitten made with nålbinding (aka naalbinding, aka needle coiling). It is “of early medieval date” and was unearthed in Eastern Iceland.

Although I may refer to the construction method as 'weaving' or 'knitting' for convince, it's notable that the construction is not woven or knitted like we understand weaving/knitting. Rather, it's looped in on itself to create a flexible chain.

Wire production

Wire drawing

There are a number of different methods for wire production: hammering, block twisting & drawing. Hammering doesn't produce wire thin enough for Viking Knit according to Julia McGowan, a metalworker from Australia who specialises in fine silver artwork using primarily ancient techniques. She explains that block twisted wire is also unsuitable for Viking Knit as it comes apart with bending, thus suitable wire for Viking Knit is only produced by drawing. She references an article which explains that the earliest draw plates found from Western Europe have been dated to the mid-eighth century, and the earliest examples of work using drawn wire in Scandinavia has been dated to the late eighth or early ninth century. Julia

summarises that Viking Knit “only really became a possibility with the advent of wire drawing in the mid-eighth century, and would not have been possible before then”.

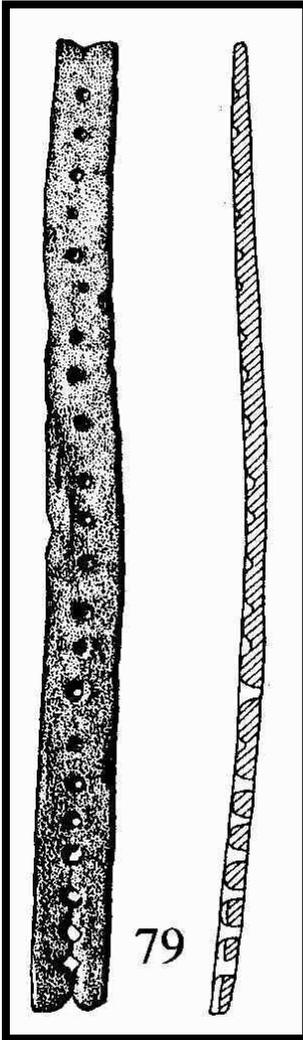
Wire drawing however, has roots far further back than the eighth century; evidence has been found dating back to “the third millennium BC” showing the use of wire drawing in gold ornaments and fine chains from Troy. The evidence is in the patterns that drawing leaves on the metal, rather than a find of the drawplate itself. Ancient Greek, Roman, and Egyptian jewellery also shows evidence suggesting the technique of wire drawing was practiced, (Source: *Diane Lee Carroll*) though no finds earlier than the late-eighth century have been found in Scandinavia.

The authors of ‘Ancient & Historic Metals: Conservation and Scientific Research’ agree that the even, round length of chain produced by Trichinopoly looping was only possible through the use of wire drawing in Europe.

Gosta Berg describes the process of wire-making during the Viking Age as: “*The wire was pulled by hand, lubricated by some sort of grease, a method later replaced by the use of hand-driven wheel*”.

Created by a silversmith

After drawing, it is likely that wire would be annealed to avoid breaking. Annealing (heating the metal to a material-specific temperature and letting it cool) makes metal more durable and flexible, while work-hardening wire makes it stiffer and more brittle. Danr Bjornsson suggests that wire would have been annealed after being drawn through each gradually smaller hold in the draw plate, as it would have become “harder as its diameter was reduced”. He notes that wire could have been made round, square, “or any other shape required by the silversmith”.



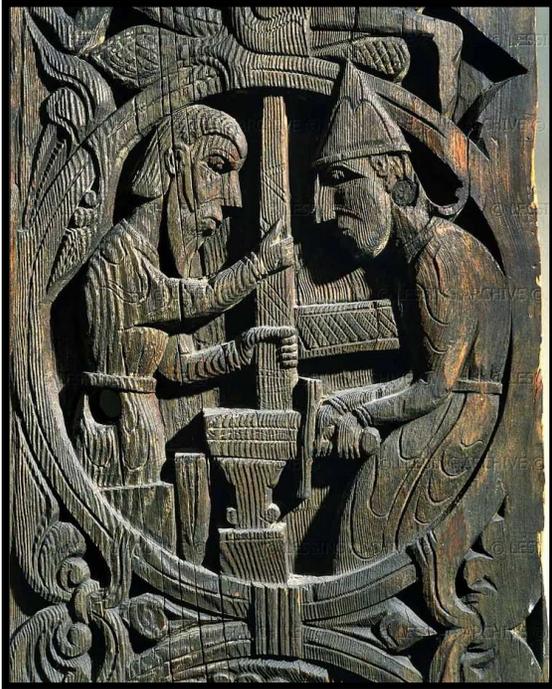
The statement made by Bjornsson indicates that wire production would have been done by a specialist – a silversmith or specific craftsperson specializing in metalwork. This indicates that while the chain production may have been done in the home, the production of the wire used would have been done outside of the home by a specialist.

Period tools

Nerissa Hymers pointed me in the direction of the Mastermyr Chest, a tool chest found in Sweden dated to the Viking Age. Included in this chest were two unfinished draw plates (#79 & #80) for the production of wire, along with tongs, shears, and other metal-working equipment that may have been used in wire production. To the left is an illustration of drawplate #79 from the Mästermyr Images Library. They describe this draw plate as incomplete, with some punch-holes that have gone all the way through, and some that have not yet. It is worthy to note that these objects may have also been used for punch decoration on metal objects.

Another wire-drawing tool has been discovered from Birka. Originally recorded as a file, this iron tool has 7 holes which are reinforced by a softer iron. Birgit Arrhenius describes the draw plate as made from “seven layers of iron plating welded together”, a technique to give the object strength. She goes on to write that this was the first tool found in a Nordic find which could be used for drawing top-quality gold and silver, the kind of quality used in filigree work or textiles that “played a prominent part” in finds at Birka.

Materials



Viking Age jewellers and metalworkers had a variety of metals to work with. The Mastermyr Chest included tools specifically for working with iron, but the chest also included an “unworked cake of brass” and tools for the production of copper materials as well. Gosta Berg speculates that other tools found in the chest were also likely used for casting of either bronze or copper. Other tools in the chest may have been used to work with either copper or silver.

(Photo to left from the Hylestad stave charge in Setesdal, Norway, depicting the legendary Sigurd wearing the helmet with Regin forging the sword Gram)

As for chains themselves (of various techniques and styles) Jane Kershaw includes two chains in her examination of the Birka grave 464, and although she doesn't describe the style of the chains themselves, one she notes is silver, which connected a woman's two large oval brooches and a third equal-arm brooch, while a second chain made of bronze was used to suspend a pair of shears along with a small

knife. She also notes an English find of Scandinavian design, which included the remains of an iron chain. Like her other examples, she does not note the method of creating the chain, only what the chain was made of.

The Swedish Historical Museum shows chains (kedja) made of:

- Bronze (brons) – Birka Grave 9, 24B, 29, 47, 117, 127, 134, 153, 158, 212, 349, 352, 385, 391, 419, 456, 479, 483, 485, 494, 507, 517, 526, 552, 645, 649, 837, 849, 968, 1035, 1081, 1105, 1158
- Iron & Bronze – Birka Grave 104, 115, 935, 965
- Iron (järn) – Birka Grave 125, 151, 462, 511, 731, 834, 844, 902, 966, 1125B, 1130
- Silver – Birka Grave 464, 550, 645, 854
- Copper alloy (cu-leg) - Grave 739, 997, 1010, 1026, 1046

While some of these chains were clearly not done with the Trichinopoly technique, others looked as though they may have been, or one of the other chain techniques which result in a similar appearance to Trichinopoly chain. It still gives a very broad idea of the common chain materials from one location. The graves with silver chain appeared to be the “richer” graves with many grave goods, however there were also graves with bronze chain, which also had a number of grave goods including silver items (grave 968 for example).

While referring to Leena Tomantera's “Braid, weave and ‘foxtail’”, Lora-Lynn Stevens writes that Trichinopoly chain itself was found made of copper, silver, or bronze wire, though she does not indicate the location of the finds for further investigation and confirmation.

Wire gauge

In a conversation with Diane Standen-Downie, she inquired as to the most common gauge of wire used for Trichinopoly in period. My research thus far hasn't uncovered this, though I have found references to other wire and metal work from the period.

- From a horseman’s grave, braid made of thin thread ‘encased in silver’ was used to trim a cap or hood, and to trim a short-sleeved tunic. The diameter of the silver-thread on the on the headpiece was 0.05 mm (24 gauge), while the tunic’s trim was made of silver-thread about 0.2 mm (32 gauge) in diameter. (Source: *Forn Vännen*) The trims are described as “braided ribbon” and “looping” to create a tape, so I do not interpret this as Trichinopoly, though it does describe the thinness that Viking Age artisans could work silver.
- In Viking Embroidery Stitches and Motifs, Carolyn Priest-Dorman writes about the “ösenstitch” as a “closely-spaced mesh stitch” which created strips of tubing from wire that was approximately 26 gauge. This stitch was used to form metallic trim, along “three-dimensional shapes such as teardrops”. She indicates that these “finished wire constructions were sometimes sewn to garments as ornaments”. Carolyn’s description of this stitch sounds remarkably like Trichinopoly, and she notes that this ornamentation came into popularity in the ninth century and is represented by finds at Birka, Sweden, illustrating an eastern influence. (She notes Kievan Rus, Byzantine, or Slavic origins.) Even if this embellishment was not Trichinopoly chain or a version of it, it at least illustrates a common wire gauge used for embellishing clothing in the ninth century.
- In Natasha Eniosova’s article in *ArcheoSciences: Revue d’archéométrie* on a Viking Age brooch found in Russia, she gives specific dimensions for the materials used to create stylized animals on the brooch. The wire in particular, she reports, has a diameter of 0.4 mm, which is equivalent to 25 or 26 gauge (Source: http://en.wikipedia.org/wiki/American_wire_gauge). The brooch is in the Jellinge art style from the tenth century. Additional wires used on this brooch are 0.7 mm and 0.95 mm, equivalent to 21 and 18/19 gauge respectively. The brooch is gold-plated, with a base made of silver alloyed with copper.

Chain production

I haven’t found any documentation to conclusively answer the “how did they do it?” question. Theoretically if Viking Age Scandinavians used wooden rods to form their chain, the wood would have decomposed along with much of the other wooden material no longer left from the Viking Age. (For example lucets and whip-cord bobbins, both of which have limited archeological support.) While wire draw plates have been found, there are few other tools needed that might be found to support the construction method I’ve outlined above.

In the aforementioned map of distribution of Viking Knit chains and fragments from the 1100s, from Leena Tomantera’s “Braid, weave and ‘foxtail’” via Lora-Lynn Stevens, there is a comment that did sound interesting to support a dowel used as a form to make the chain. When noting archaeological finds, the author writes “braiding around a rod”. I can presume this may mean a semi-completed chain before being removed from the form and pulled through a draw plate, still on a form of some sort, presumably to have survived, made out of metal. (Or possibly bone or horn?) Unfortunately I have not yet been able to find Tomantera’s work through my usual research channels.

Number of ‘ribs’

In my discussion with Diane Standen-Downie and Nerissa Hymers I learned that the most common number of “ribs” used in Viking Age Trichinopoly was 5 – with fewer surviving examples with 3 and 7 ribs respectively. Hymers noted that the numbers 3, 5, and 7 had cultural significance during the Viking Age, stating that they were numbers of power and protection. I have tried both 5 and 8-rib chain, to learn if the technique relies on an odd number of loops in the jig; it does not.

Braham Norwick references J. Anderson’s work in 1876 detailing the Croy Hoard which included a band of ‘knitted’ fine silver wire, “which resembles modern trichinopoly work” and is connected to both the Cuerdale and Largo Hoards. He notes that the Croy Hoard included a coin of the 8-9th century King of Mercia. Braham quotes Helen Bennett from the National Museum of Antiquities in Scotland that a chain found from a Viking grave in Islay, Balinaby as identical in structure to the Croy Hoard chain. The Islay chain had “6 ‘stitches’ per round”, while the Croy find had “16 ‘stitches’ per round” and were both constructed by “the loops (being) drawn through the two preceding rows”. She stated that the Croy Hoard example with its 16 stitches per row had 7 stitches and 16 rows per centimeter, while the Islay grave find had nearly 7 stitches and 7.5 rows per centimeter.

Chain width

In a conversation with Diane Standen-Downie, she inquired as to the most common width that Trichinopoly was drawn to in period. As of yet I haven't discovered this, as finding detailed information about the measurements of finished pieces has, as of yet, eluded me.

Jewellery production

If the making of the wire was likely left to a metal-working specialist, what about the person who made the chain itself?

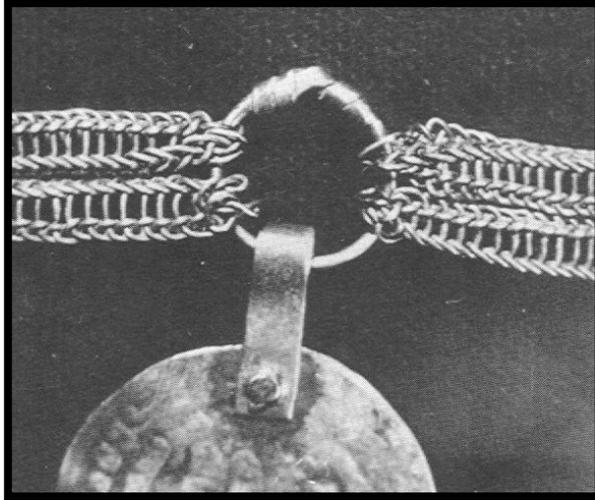
While the Mastermyr Chest did include a piece of chain (albeit not Trichinopoly chain) there is a find from Viking Age Iceland which suggests the specialization of a jeweler. In the Norwegian Archeological Review, writer Gavin Lucas writes about a burial at Sílastaðir, which a researcher M Hayeur-Smith says could be a jeweler, “based on certain grave goods including a jasper flake and fire-starter; silver wire, foils and coins (as scrap or stock); and an iron punch for chasework; and possible lump of wax (for casting)”. There is no notation of the gender of the grave's owner however, though this may support the idea of a farmer who worked on jewelry production while the livestock grazed in the area.

In the area designated as one of several buildings at Pálstóftir in Iceland, there was “clear evidence for craft activities occurring at the site”, “conceivably these may all be part of the same craft: jewelry making.” Occupation at Pálstóftir has been dated to between 940 and 1070, but interestingly enough, the area is described as a ‘shieling’ – an area outside of the normal residence, used while animals are out to pasture in the warm months. The evidence found at Pálstóftir includes a fragment of a crucible, copper alloy spillage, an iron punch, a copper alloy stud, a fitting, a pair of perforated coins, and a glass bead. (*Source: Gavin Lucas*) This shieling was not unique in being the site for multiple purposes, Gavin also mentions a site (Svolset) in the mountains of southern Norway where Viking Age textile production, and iron-working took place alongside livestock support. Another Viking Age site in the Faroe Islands (Argisbrekka) shows evidence of weaving, spinning, and smithing alongside livestock support. While the jewelry-making evidence found at Pálstóftir does not suggest gender, it too suggests that jewelry-making was a craft that an individual might specialize in, as an additional occupation to farming. It's notable however that the economy and culture of Viking Age Iceland and the Faroes was probably quite different from mainland Europe.

In contrast to the Icelandic finds of jewelry-making, in Jane Kershaw's book *Viking Identities: Scandinavian Jewelry in England*, she notes that the clustering of Scandinavian brooches in and around Danelaw (currently English) towns suggested that “urban centers played a key role in the production” of Scandinavian jewelry. Multiple brooches have been found made from presumably the same molds being used, and subsequently the mass-produced product was distributed across Denmark, Jutland, and the Danelaw. She also notes however that there is considerable evidence suggesting that metalwork and jewelry-making was practiced both in the countryside and urban areas in the Danelaw, noting an “undecorated and miscast single trefoil lobe” from south Norfolk with a pin made in the style of Anglo-Saxon jewelry. This might suggest that while mass-production happened in the urban areas, finishing, repair, and smaller-scale production may have been done in rural areas.

While I have yet to find a distinction between who made the chain and who made other jewelry, I found the information about jewelry production interesting, and thought it might shed some light on the possibilities of who made the chain in period.

Period finishing



While referring to Leena Tomantera's "Braid, weave and 'foxtail'", Lora-Lynn Stevens "*generalises that ends and closures of trichinopoly chains are not terribly decorative. It appears that more often than not artistic attention was paid to the elements that hold the chain closed (referred to as terminals and findings by jewelers). She cites examples of plain ended chains. In some, the connecting ring threaded through the first and links to join chains together. Longer neck chains appear to be usually capped off by cones of metal. Some display a bit of decorative wire braid wrapped around the chain where it joins the cone.*"

Stevens goes on to note some existing fancy terminals, including animal-head terminals

which are occasional found, and the spiral closure found on the Hämeenlinna necklace. Above/left is a detailed photo of the Hämeenlinna treasure necklace from Medieval Textiles.org. This shows a large ring that passes through the ends of four chains (and a pendant) and is twisted/wrapped closed. It appears that the ends of the wire have been flattened before twisting. The chains are not finished themselves, beyond wrapping the end wire back into the chain.

The Tromsø find (left) also gives an indication of how Viking Knit chains were finished. Although I haven't seen academic analysis of this find to state whether it is loop-in-loop or Trichinopoly chain, the chain is silver, while the animal heads are brass according to NRK Troms, a Norwegian news website.



I haven't found any reports on how the two parts are secured together, though I presume it's a metalworking technique like soldering for the join.

The graphic to the left is from the ScienceBlogs.com website, which describes the animal heads as being in the Urnes style, and indicates that the hoard find represents a number of generations; a round brooch from the mid-tenth century, with the animal-head chain dated from about 1100. The author, Martin Rundkvist, suggests that the hoard was probably hidden in early 12th century, which is after the generally accepted end of the Viking Age.

Another example of the animal-head terminal on the end of a chain is the silver chain and terminal from Lot 106 (106714) from Gotland (Sigsarve) as seen in the Swedish National Museum online database. This appears to be a bird-head terminal, though I again suspect this chain is loop-in-loop.

Additional areas for research

There are a number of topics which have arisen in my research thus far which may be interesting or useful to learn more about to further my understanding of this technique and its place in Viking Age Scandinavian & Baltic countries. These include:

- Further research confirming the number of 'ribs' common on period chain
- More than one reference confirming the find of a dowel upon which chain was in the process of being made
- Confirmation on the most common gauge of wire used in period for Trichinopoly
- Information on the method of connecting or adding new wire into a chain while in production
- Information on the width of the chain found in graves or hoards

My construction methods

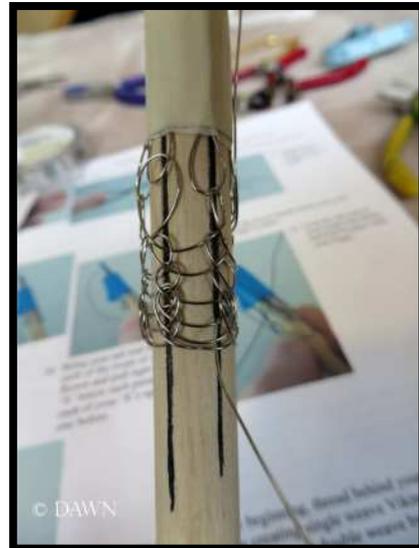
Materials & tools needed

- **Dowel** (about 30 cm +/-). Any long, slim cylindrical object will work, though it should be long enough to hold comfortably and form chain on. It doesn't need to be as long as your finished chain. I suspect a softer wood form would be easier to work with than a hard, unyielding metal form. The diameter of the object does affect the finished size and density of the chain to some degree.
- **Tape**. This is my (obviously modern) tool for convince, though a piece of wire could accomplish the same task.
- **A nail, awl, pin, or (modern) small crochet hook**. This is mostly to get into tight spots and is handy, but not essential. A stiff piece of work-hardened wire would also likely work.
- **A draw plate/board**. This is used to tighten the looped chain, and is just a board with a series of gradually narrowing holes. I use a wooden draw plate which is easy to make, though metal workers would have likely used a more sturdy & durable metal one. This is similar to the drawing board used to make wire itself, though the holes are significantly larger.
- **Wire**. A variety of wires are possible to use, though the wire should be soft and easy to manipulate for easiest construction. Making the chain does work-harden the wire a bit.
- **Pliers**. These are handy, but not essential. I found I used a regular pair of needle-nose pliers, and a pair of very fine needle-nose pliers. I also found flat, nylon-head pliers very useful for straightening kinked wire when working with copper or (not period) steel. Silver wire didn't require these for straightening.
- **Wire cutters**. Are essential.
- **Any finishing items**. Clasps, end caps, and hooks to finish the design. I've also done items for mundane wear with beads, gems, cord, and pendants.

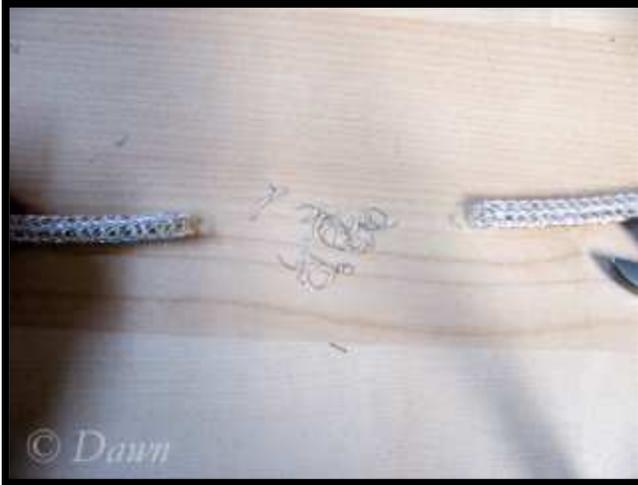
Technique

It's difficult to explain how to construct Viking Knit chain in words, so I'll outline the steps as best I can.

1. Make a starter jig of wire. I've used a different colour wire when possible so that it's easy to identify the chain from the jig (thus the jig can be re-used over and over). The jig looks like a 'flower' of loops, and once made it caps one end of the dowel. Hold the jig on the top of the dowel with tape (temporarily). Alternatively if you don't want to use tape, wrap a small piece of wire around the jig to hold it in place. Either way, make sure you leave the loops open and accessible and space the loops evenly around the dowel. I find folding the 'petals' up away from the dowel can help with the first few loops.
2. Cut a length of wire about from your fingertips to your chin or shorter. Longer lengths become challenging to use – kind of like embroidery with too long of a thread. Make a loop through one of the 'petals' and hold the short end with your non-dominant hand tight to the dowel, while looping the long length around the next petal.
3. Continue looping onto all of the remaining petals until you come to the original join, and then loop into the crossed wire from the previous loops. For "single knit" you basically just keep going with this technique, adding in new wires as needed, until the approximate length of chain is accomplished – keeping in mind that the draw board will help get more length out of what you've looped.



It's easy to cut too-long chain down to shorter lengths, but it's not an easy task to add new length once the chain has been drawn.



To use the draw plate, remove the chain from the dowel by gently sliding it up and off. Using the jig as a 'needle', thread the chain through the largest hole on the draw plate (it should be somewhat smaller than the diameter of your dowel). Continue threading the chain through subsequently smaller holes until the desired length and width is accomplished.

Trim the chain to the desired length and shake off the excess loops, before finishing the end as desired.

The photo to the left illustrates a chain being cut, and the minimal wire loss that occurs.

Featured necklace



For my featured necklace, I first looped a long length of chain using 24 gauge silver-plated copper, and then pulled it through my draw plate to make a 6 mm diameter chain. That I trimmed down into a series of 2 and 3 inch long lengths.

I first tried joining the lengths (in pairs) using rings of wire I made using the same silver wire, but the rings weren't strong enough or consistent enough for my preference.

To the left is a photo of the chain cut to length, ready for end-finishing, the wire lost to the chain cutting, and the twisted wire rings which were my first attempt.

I substituted in store-bought rings instead which I wasn't entirely satisfied with either. The photo of the necklace at this 'version 2' stage is below:



For my third and final attempt, I went back to my wire versions, and was more satisfied with these rings than the previous two versions. This time I used 18 gauge wire and spiraled/wrapped the wire back around itself like the original necklace. Not only is this more like the original inspiration, but it also feels far more secure than my other versions.

Compare the original in black and white, and a close up of my rings below:



While the original necklace has a number of coins and pendants, I don't have any good replicas of Viking Age coins at the moment so I substituted in some small metal circles for the time being, attached using silver-tone split rings to make them easy to remove. I added in a pendant in the style of the Gotland crystal; my version is made of Czech crystal and metal foil which gives enough weight for the necklace to hang correctly.

Photo below of my crystal pendant:



Future improvements

It's my intention to replace the metal circles with coins. I currently have reproduction coins on order, but at the time of writing they have not yet arrived. In the style of the necklace coming from many different places, I may also choose to add appropriate pendants in time as I acquire, make, or am gifted them.

The necklace itself will be worn suspended from two shoulder/chest brooches, once my Finnish costume is complete.

Trichinopoly samples & lessons learned

Wire types

The archaeological finds are mostly silver, however silver wire is expensive, so I've used alternatives to experiment with the technique, make lovely things, but not make a large investment in any one particular item at the moment. I've used a few different types of commercially available wire with some positives and negatives.

Silver wire – Sterling silver wire is soft enough to manipulate, but is reported to hold its shape well once formed. Fine silver wire on the other hand is easily manipulated when it is dead soft, but does not hold its shape well at stress points like clasps. When fine silver wire is half-hard or full hard, it is less easily manipulated, but more resistant to stress. (Source: http://en.wikipedia.org/wiki/Wire_wrapped_jewelry)

At the suggestion of James Prescott, I purchased a small amount of soft tempered ½-round fine silver wire as well, to see for myself how the material worked in comparison to less expensive methods. From my own experimentation I found that the silver wire was even “softer” and easier to manipulate than the copper wire (below). In fact, the silver wire was so soft, that instead of kinking, it seemed to fold at times; a challenge

that was even more difficult to correct. I found that the 21 gauge wire was so soft I could straighten it when it came off the roll with my fingers, and didn't need my nylon jaw pliers; which were very useful with the copper, brass, and steel wire (below).

Silver-plated copper wire, has the benefits of copper wire in terms of workability, availability, and cost, but has the appearance of silver which is more period-appropriate. It's far less expensive than silver filled



wire or silver wire, and the plating is less likely to come off through working with the wire than the coloured copper wire.

Evidence from Birka Grave #550 included a "spänne" made of "silver, förgyllning" – which Google translate says is a buckle (brooch) made of 'silver, gold plating'. That same grave has an oval brooch made of bronze, silver, with gold plating as well. This isn't meant to suggest that Viking Age Norse silver-plated copper wire, but it does give evidence of using multiple metals, including metals covered with other more expensive metals.

The photo to the left/above is of a 24 gauge silver-plated copper wire chain finished with lion-head pewter terminals and a large ring. The necklace also has two large-hole beads with a Greek Key design at the base of the terminals.

Copper wire is easy to work with, and much less expensive than silver or gold. For mundane wear or for learning, it's also available in a rainbow of enamelled colours. (Though the coating can come off, I was particularly warned away from the turquoise colour.) Additionally to the rainbow of colours, it's also available in a silver colour. It holds its shape quite well when worked.

Steel wire is another kind of wire I've used for Viking Knit. It is much stiffer than copper wire, and has a darker colour from the silver-plated copper. The stiffness of the wire makes it much harder to use, much more 'springy', and much more challenging to work tightly. It's not period-correct for the Viking Age, but I wanted to illustrate its use as well as an example of other wire types, as I used it before I did much research on period materials.

The chain to the right is made from stainless steel 26 gauge wire capped with pewter horse-head terminals.



Brass wire is a material I've only used once for Viking Knit, though Jen Haley suggests that brass wire is "difficult to shine or clean" compared to other metals, and is prone to snapping mid-way through the looping. In my own attempts, I found that it was stiffer than copper wire, and using short lengths of wire was easier to work with than long lengths. I also found it somewhat prone to kinking. I chose to try this technique with this wire as a substitute for bronze, which has a similar composition (albeit is harder to work with) simply to experiment with if what I had read about brass wire was true to my own experience.

Below is a photo of my brass wire chain attached to my silver wire chain, before going through the draw plate:



Gold wire, and gold-filled wire is not something I worked with at all yet.

Length estimations

There are a number of factors that determine the length one can accomplish with Viking Knit work between when it is on the dowel and as it is pulled through the final draw plate hole. Some of these factors include:

- How many ribs (ladders) the piece has
- How wide the dowel is
- How tightly the chain is 'knitted' (how close together the 'rungs' of the 'ladder' are)
- If it's single knit, double knit, or triple knit
- The type of wire used (copper, steel, silver, etc.)
- The gauge of wire
- The final diameter of the draw plate hole used

With these factors in mind, it's not possible to precisely estimate how much finished chain will be produced from chain still on the dowel, though recording my numbers has allowed me to reproduce a chain of similar length by using the same factors.

Please see **Appendix 3** for more information on length estimates.

Finishing



I've mostly used non-period methods for finishing my chains, as I don't currently know how to solder or mould my own terminals.

Once the end is cut (to the left) I take the free end of the wire and curl it back into the chain.

At this point I could select the top loops and pass a jump ring through it or another wire twisted back upon itself.

Alternately, what I've done is used purchased end-caps and terminals. For the terminals, I've used non-period adhesive

which is appropriate for metal. This is my technique in place of soldering or any other metal-working technique that I don't possess the skill for yet. The chain is glued into a terminal with a very tight-fitting hole, and then the clasp passes through the terminal.



For the end caps I've threaded a thin wire through the top loops of the trimmed and finished wire, and then run the thin wire up through the hole in the end cap. I've twisted the threading wire back upon itself around a ring to attach the clasp.

To the left is a 24 gauge silver-plated copper wire double-knit chain capped with simple end-caps. The ring is a split ring, and the clasp is a modern magnetic clasp.

For the featured project, I took a heavier gauge of wire (18 gauge silver-plated copper wire) and made a wrapped ring in the style of the original find to finish the ends of each of my chains. Like the original

find, I opted to hammer the ends of cut wire to flatten them, then I shaped the ring around a mandrel (actually a highlighter) and attempted to anneal the flattened ends to restore some flexibility to them. I then tapped the rings to work-harden them slightly into the ring shape, and, after threading the chain onto the rings, I used the mandrel and pliers to spiral the flattened ends back around the ring, creating a very secure connection between each of the chains.

Additional examples

I've also experimented with a few other things – the difference between single-knit and double-knit for instance. The double-knit chain feels sturdier and looks denser; much more like period examples. The single-knit is much more flexible and open; almost lacy.

For the example to the right, I've used non-period red-coloured coated copper wire using the single-knit technique, and then before drawing the chain through the draw plate, I filled the tubular chain with a thick leather cord, then pulled the two together through the draw plate. The wire shrinks down as it passes through the draw plate, but the cord of course does not, thus the shrunken chain tightens down upon the cord, adding sturdiness to the otherwise lacy-looking chain.



The single-knit Viking Knit chain technique also loops up much faster than double-knit, so it's easier to make a long length of chain in a shorter period of time. I suspect that with its open weave, it may not be as strong or sturdy as double-knit however. I don't know if period examples favour single, double, or triple knit.

I've also experimented with single-knit using two wires at the same time. This was very frustrating (trying to keep both wires together through every loop) but offered a really nice opportunity to try out a two-colour blend in a very modern, non-period example of this period technique.

For the chain above (shown still on the dowel) I did two strands of purple wire, then a strand of blue with a strand of purple, and then two strands of blue, to produce a chain that appeared to seamlessly transition between blue and purple. The finished example after going through the draw plate is to the right.

This modern use of the period technique using coloured wire is finished with snake-head terminals, a ring clasp, and hangs a Thor's Hammer pendant.



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Translations provided by:

- Björn Sandberg Lynch in person and email, March 2015
- Google Translate
- Hanna Lehmusto & Bart van der Oordt via the Viking Clothing Facebook group, March 2015

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Appendixes

Appendix 1 – additional chain types

In order to simply my entry, I am including chain types that are not commonly mistaken for Trichinopoly chain here.

More loop-in-loop chain examples



Another example of loop-in-loop chain dated to the Viking Age is from the British Museum as well, and is described as a silver chain on a pendant head and an attachment for a pin. The item is part of the Vale of York Viking Hoard, found in England. The items in the hoard have been dated to the late 9th-early 10th century, and the hoard's deposit has been dated to 927-928. This chain is pictured to the right. The chain here is much less dense, allowing us to see the construction method when only one 'row' of chain is constructed at a time.

Another fragment of this chain is at the Swedish Historical Museum; this is a short fragment of chain dated to the Viking Age made of silver, found at Bikra. (Source: *Objects 977*, Swedish Historical Museum) The museum also has a fragment of a chain suspending a needle case made of bronze, dated to the Viking Age. (Source: *Objects 547*). From Sigsarve in Gotland, the same museum has a silver chain that I believe to be loop-in-loop style based on the end of the chain, from Lots 106. This chain as well has been dated to the Viking Age.

Below is a photo I took from the Swedish exhibit when it was in Victoria, BC. This needle case is suspended on a loop-in-loop chain that is loose enough to see the construction. The needle case is made of bone, while the chain and ring are made of bronze. This was a grave find from Oland, Sweden.



Rolo chain



I don't know a lot of chain types, so I went to Fire Mountain Gems and identified the chains I was seeing in photos of archaeological finds as 'Rolo chain' based on their illustration. This is two or three loops of a coil, joined at a right-degree angle to another two or three looped coil.

Evidence of this chain in period is robust, I've seen many examples from my period and locations of interest, as well as examples dated to far earlier than the generally accepted beginning of the Viking Age and locations outside of Scandinavia and into neighbouring lands.

From the British Museum there are several examples, including a surviving example dated to the late 11th or early 12th century from Latvia

made of copper alloy. These are double-coiled links, found in a grave site. A photograph of these chains are above.

Additional chains of this style made of copper alloy are in the British Museum's collection found from Sweden (Gotland) dated to the 7th century, and another from the 6th century.

Another chain of this type is in the Norwegian Museum of Cultural History in Oslo, made of bronze, and dated to the Viking Age. (Source: <http://www.unimus.no/photos/khm/422287/?f=html>)

Finally, another chain fragment in this style is dated to the Viking age by the Swedish Historical Museum, and is made of bronze. (Source: <http://mis.historiska.se/mis/sok/fid.asp?fid=106568>)

Curb chain



As mentioned before, I'm not a jeweller, so I looked at a visual guide of chains to identify this, and I suspect it's a curb chain.

This example is from the Swedish National Museum, and is a fragment of chain from Birka made of bronze and dated to the Viking Age. It's described as a chain for a brooch, made of "seven links of doubled and trebled wire" (Google Translate) (Source: *Object 974, Swedish National Museum*)

Link & bar chain



I haven't found many examples of this type of chain. The photo to the left is from the Swedish Museum, however the original source only links to the photo, and not to a page describing the find. The Pinterest page that links to it describes it (undocumented) as a "Viking Age Bronze chain from Gotland", being "four links of a chain, where each link is wrapped in bronze wire, and a loop attaches each link to the next link".

Another example from the Swedish Historical Museum I was able to find the

original entry for, which describes the chain (*Source: Image 28260*) as made of bronze, and dated to the Viking Age. It was found in Lappland.

A final example of this chain style I found is of a (translated by Google) "flat ring brooch with finely profiled plait and twist décor". The brooch has "seven decorative chains rattling plates". The brooch is listed as "Nordic, 8th – 10th century" however the website where this object is listed is a historical item auction website, and doesn't include any academic resources. It is listed as a Viking Brooch, and a photo of the brooch is shown to the right.

Another undocumented example of this chain is listed on Pinterest as currently being on display at the National Museum of Scotland, which includes both this kind of chain as well as Rolo chain. (*Source: <https://www.pinterest.com/pin/420594052675704419/>*)

I found an interesting tutorial for a chain similar to this (which I did not explore for this entry) at: <http://ragnvaeig.dreamwidth.org/491283.html>



Spool knitting

While speaking to Diane Standen-Downie at Borealis' Winter War in March 2015, she suggested that some of the finds attributed to Trichinopoly may actually be spool knitting, though I have yet to find any references to spool knitting attributed to the Viking Age; there is even debate amongst Viking Age enthusiasts if finds of possible lucets are, or are not lucets. Diane noted that there are four chain types which are commonly misinterpreted for one another; Trichinopoly, spool knitting, loop-in-loop, and one more she could not recall that did not appear during my research to date. I thought perhaps after some reading that the other method may have been Påtning, but my reading let me to believe that Påtning is just the Swedish term for Spool Knitting

The chain produced through Spool Knitting is hollow like Trichinopoly, with similar ladder-like rungs, the number of ridges relating to the number of pegs on the spool used for "knitting" the wire. This is another textile/jewellery technique crossover, and the spool method may be a deviation of lucet, just with more than two pegs.

Braham Norwick references Edward Hawkins' 1847 "Account of Coins and Treasure found at Cuerdale" and describes a chain found which is "fine wire knitted

About The Cuerdale Hoard

The Cuerdale Hoard was found in 1840 in Lancashire, England, and represents the "largest Viking silver hoard ever found outside Russia" and has been dated to between 903 and 910, thanks in part to a large number of coins. (*Source: Wikipedia*)

precisely in the same manner as a modern stocking” – hollow, in the same way spool knitting (and Trichinopoly chain) is formed. The chain is described as made from “one continuous wire, and the stocking-like ‘knit’ looks like modern (at the time) stockings in the knit structure from both sides of the work. If it is indeed one continuous wire, that suggests that spool knitting could be the construction method – however it is difficult to see the joins when pieces of wire are used instead.

Additional experimentation – spool knitting with wire

In an effort to compare these two techniques better, I purchased a spool knitting tool, taught myself how to use it through the included instructions, and constructed a short length of chain using 26 gauge red coloured copper wire. (I chose 26 gauge copper wire because it’s a bit ‘softer’ than thicker wire, and I thought that would assist me with this new technique. It is also far less expensive than even softer silver wire.) The method of construction is far more challenging than Trichinopoly, and I found the result as it came out of the spool far less consistent than the Trichinopoly that I had worked on in similar materials. Like the Trichinopoly, I did the spool knitting in double-knit, with 5 ribs to best be able to compare the results.



After completing a short length of chain, I could see the familiar ‘herringbone’ ridges similar to Trichinopoly, separated by the similar straight connecting pieces. From there I pulled it through the same draw plate I’ve used for my Trichinopoly, and found that the end result is very, very similar in look to Trichinopoly (apart from some inconsistency due more to my skill level with the technique than the technique itself).

To the left is a photo of the spool-knit chain before going through the draw plate.

With this experiment, I can definitely see the challenge in determining the difference between an already constructed piece of chain in Trichinopoly and spool knitting. The major differences that I could see is consistency:

- My Viking Knit chain is far more consistent than my spool knit chain – though as this was my first time trying spool knitting, I can see this may improve
- While Viking Knit adds in new wires for length, spool knitting only needs one piece of continuous wire; thus there no joins. In loosely drawn chain, this joining or lack thereof may be a tell-tale sign between the two methods, however with tightly drawn chain, these joins are difficult to see.

Appendix 2 – wire cost

Although silver wire is available, the cost is higher than other materials. Below is a comparison table for reference, which illustrates my reason for the material I used despite its period inaccuracy: price. The selection in bold typeface is the material used for my featured project.

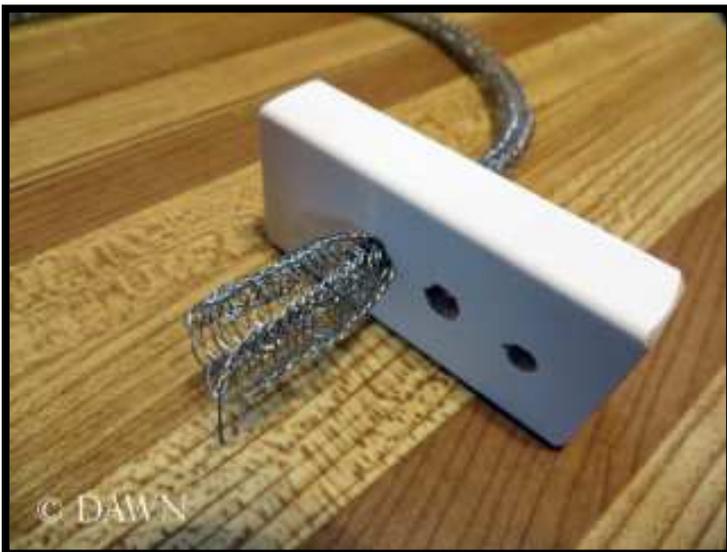
Type of wire	Cost	Cost per yard	Source
Sterling Silver wire, 24 gauge, 25 feet – dead-soft, round	\$24.53 US (plus shipping, tax, duty)	\$2.94 (US, plus shipping, etc)	Fire Mountain Gems
Sterling silver-filled wire, 24 gauge, 100 feet – dead soft, round	\$62.40 US (plus shipping, tax, duty)	\$1.87 (US, plus shipping, etc)	Fire Mountain Gems
Silver coloured copper wire, 24 gauge, 20 yards – round	\$4.90 40 US (plus shipping, tax, duty)	\$0.25 (US, plus shipping, etc)	Fire Mountain Gems
Silver-plated copper wire, 24 gauge, 15 yards	\$8.25 Canadian (plus tax)	\$0.55 Canadian	Beads & Plenty More, Calgary
Silver ½ round 21 gauge, 4 yards	\$8.99 Canadian (plus tax)	\$2.25 Canadian	Beads & Plenty More, Calgary

Note: Prices from March 2015 – subject to change.

Appendix 3 – length estimations

Although I don't think that there is an exact formula, I thought I'd share some of my project notes to give an estimate to anyone wishing to make a similar chain in a similar length.

My current draw plate has holes approximately 6mm, 7mm, and 9mm in diameter, though through use



these holes have enlarged and changed shape slightly. This is due to the wire drawn through the softer wood. This means that eventually I will need to make a new draw plate. I've also used other random objects as draw plates, particularly when working with the very large 8-rib chain built on a 1" dowel. Selecting the final draw-plate hole relates to the hole in the terminal; you can make a chain smaller (usually) to fit a smaller terminal end, but you can't enlarge a chain once you've drawn it through if your terminal hole is larger than the chain it is to receive.

Project name	Wire material	Wire Gauge	Length off dowel	Draw plate diameter	Finished length
½" dowel, double knit					
Horse	Stainless steel	26	undocumented	6 mm	undocumented
Lion silver	Silver-plated copper	24	58 cm	9 mm	88.5 cm
Triple colour	Copper	24 & 26	56 cm	9 mm	80.5 cm
Lion steel	Stainless steel	26	61 cm	9 mm	89 cm
Narrow silver	Silver-plated copper	26	54 cm	6 mm	84 cm
Narrow silver (2)	Silver-plated copper	26	54 cm	9 mm	92 cm
Brass	Brass	24	12.5 cm	6 mm	19.5 cm
½ round silver	Non tarnish soft tempered silver	21	11.5 cm	6 mm	22.5 cm
½ dowel, single knit					
Snake	Copper	24	48 cm	6 mm	88 cm
Double wire	Copper	26	51 cm	9 mm	77.5 cm
1" dowel, double knit					
8-rib	Copper	24	22 cm	9 mm	40 cm

Appendix 4 – Trichinopoly or wire spool knitting?

Derryrnaflan paten



The authors of ‘Ancient & Historic Metals: Conservation and Scientific Research’ identify the Derryrnaflan paten as well as the Ardagh chalice (above) as having “curious herringbone-braided wire decorations” that are “closely related, if not identical construction” to Viking Knit.

The Derryrnaflan paten (shown to the left) is described on the National Museum of Ireland website as a hoard find dated to the 8th century. The museum’s article explains that the hoard included a silver chalice,

and a bronze strainer. The paten is very complex; “assembled from more than 300 pieces” including a beaten silver dish stitched with wire to a bronze rim. There are gilt-bronze frames with gold filigree panels, and a central stud on each of the twelve frames. Bronze rivets attach the frames to one another, under glass and enamel studs. The article speculates that the use of “use of filigree, knitted wire, mesh and enamels on both objects suggests that they may have been made in the same workshop” as the Ardagh chalice (above). The article notes that these objects were common in “the later Roman world, but very few examples survive from early medieval Ireland”.

Sunnifa Gunnarsdottir describes the knit wire on the paten a bit more: “There appears to be knit wire placed around the rim of the paten, as well 2 knit wires around the inner rim (between the gold work and the silver platter part). There are also 2 knit wires flanking the bottom layer of the silver work stand”. Her article (linked below in the bibliography) has additional detail photos of the paten from the book ‘The Work of Angels: Masterpieces of Celtic Metalwork 6th-9th Centuries AD’.

I had the opportunity to present my documentation and work at Borealis’ Winter War in March 2015, and Diane Standen-Downie suggested that the “herringbone-braided wire” may actually have been constructed using a spool-knitting technique instead of Trichinopoly, another technique perhaps ‘borrowed’ from Viking Age textiles. With this suggestion, I’ve moved the Derryrnaflan paten into my appendix for future research and investigation.

Appendix 4 – In the style of the Hämeenlinna necklace



Period examples

More about the Hämeenlinna (aka Linnaniemi) necklace

In *Halskedjan i Linnaniemiskatten* (The neck chain in Linnaniemi) there is additional information about the “Linnaniemi treasure” including the Hämeenlinna necklace. The article reports that the treasure includes a total of 56 coins, the neck chain with more coins and pendants, a buckle, two silver beads, and two silver pendants. Although my translation may be in error, I believe that these pendants are believed to be originally from the neck chain as well. These are either axe or “bjäller-shaped” which I believe refers to the lunula. The treasure was found at a depth of 40-42 cm, and the excavation is also referred to as the Varikkoniemi project.

Eeva’s article is largely about the coins of this necklace, though she does make a brief note about the chain itself. She describes it as “loop stitches” similar to textiles from Birka, Russian bracelets, and Karelian hair jewellery.

Eeva writes that the two detached silver pendants are likely locally made, while the buckle found in the treasure is “probably Gotlandic origin”. She also writes about elements of the necklace:

- 51 cm long
- 9 coins, 4 other pendants
 - Triangular-shaped pendant is probably from “a Persian dish”
 - Heart-shaped pendant was a belt-fitting
 - Lunula
 - An additional belt fitting

The article indicates that the coins on the necklace are:

- 5 Islamic coins
- 1 German coin
- 3 English coins

Coins in the treasure have an “unusually long” history - the oldest from 616, and the youngest, a German coin from circa 1088. This led the writer, Eeva Jonsson to state that the treasure was likely buried around 1100, however she adds that the earliest coins from the treasure would have been brought to Finland in the early 800s. She refers to the 1912 work of another researcher who suggested that the original necklace included only the Islamic coins, and that the western coins and pendants were later additions. The western coins which were added after the original construction were interestingly strung so that the crosses on these coins faced outwards. Eeva speculates that perhaps this was in response to ongoing pressure to appear to give up a heathen history in favor of the new Christian religion.

Christianity in Finland

Christianity in Finland “traces its lineage from the medieval Diocese of Turku” in southwestern Finland, through a slow introduction. A Wikipedia article on the topic states that the first sign of Christianity is “found in prehistoric burial sites dated to the 11th century”, and that by the middle of the 12th century, Christianity was already the dominant religion in Turku.

Based on grave findings, she establishes that the style of coins used as pendants, including this necklace style was worn by women, but also that these necklaces likely represented a family’s wealth and were passed down over generations, with recipients adding new coins and pendants. As complete necklaces don’t show significantly more wear in the oldest coins, she speculates that the necklaces weren’t likely for ‘everyday’ wear.

The coins from the treasure that the necklace was found with (56 coins in total) appeared to have been prepared for use in jewellery; almost all of them have either a loop or “residues of a loop”. Two English coins from the hoard have a small hole instead, and Eeva speculates this was for a hanging loop. All of the loose coins, apart from one very worn English coin, she reports were clean and not especially worn.

Coin dates

Necklace Location	Coin origin	Number of coins	Oldest	Youngest
Linnaniemi	“Sasanidiskt” (Islamic)	1	616	-
	Islamic	4	892/3	925/6
	English	3	c. 1023 -1029	c. 1042 -1044
	Danish (<i>German</i>)	1	1047-1074	-
	Total	9	616	1047-1074

(Source: Eeva Jonsson)

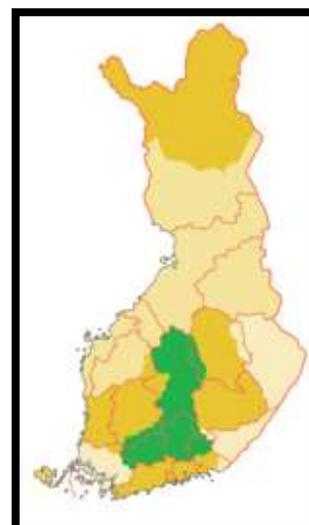
Eeva’s article also gives further details about Viking Age coins found in Finland:

- 45 known Viking finds containing coins
 - 10 of which are in Åland
 - The majority of these are Islamic coins from 800-900
 - The remainder in the mainland
 - The majority of these are from western Europe, and are dated to the 1000s
- Approximately 7,000 coins in total
- Majority of coins are German, English, and Islamic



Eeva Jonsson states that there are necklaces (in whole or part) from six different treasure hoards in the style of the Hämeenlinna necklace. Two of these are from Southwest Finland (in red to the right), and four from Tavastland (Häme in Finnish) shown in green in map to the left (Source: Wikipedia) She lists the finds as the following:

- Alanko in Hämeenkoski treasure
- Fully preserved neck chain from Lehdesmäki in Hauho
- Linnaniemi in Hämeenlinna
- Alanko in Hämeenkoski
- fragments of Nikkilä in Nousiainen
- fragments of Luurila in Hattula



She also writes about similar necklaces or fragments found outside of Finland, including one complete necklace and two fragments in Estonia.

The use of the coins in Viking Age Finnish jewelry seems to “coincide with times that it was not easy to get hold of coins” according to Eeva. She adds that during these periods the price of coins likely would have gone up.

Alanko neck chain

In *Halskedjan i Linnaniemiskatten* (The neck chain in Linnaniemi), writer Eeva Jonsson has a brief description of the Alanko neck chain (*Alankohalskedjan*), describing it as having the youngest Islamic or Byzantine coins of the necklaces from Finland in this style. She reports that the coin is “embossed 996-998”, so she states that the original parts of this necklace would have been created after 1000.



Eeva writes that this necklace contains 13 coins, 10 of which are original to the necklace design (8 Islamic & 2

copies of Byzantine coins). The youngest coin of the necklace is an English coin embossed 1009-1016, so she assumes that the newer coins were added afterwards, “likely a generation later”.

Coin dates

Necklace Location	Coin origin	Number of coins	Oldest	Youngest
Alanko	Islamic	8	909/10	996-998
	Byzantine	2	969-76	c. 977-989
	English	3	c. 997-1003	c. 1009-1016
	Total	13	909/10	c. 1009-1016

(Source: Eeva Jonsson)

Eeva didn't focus her work on the chain types of the necklace, but rather on the coins themselves, so her work does not include information about the chain and its construction.

Lähdesmäki/ Lehdesmäki necklace

This necklace is very similar to the Hämeenlinna necklace, with a number of side-by-side chains linked by rings, with a number of coins and pendants. Like the Hämeenlinna necklace, pendants aren't hung from the necklace with Trichinopoly chain, but rather with link-and-bar chain. This example also has an additional chain which may be a safety chain, but is more likely a chain to attach the necklace to a third brooch worn in the centre of the body, or less likely to suspend another object like a needle case which has since been removed.

Björn Sandberg Lynch provided me with an English translation of a document about this necklace, originally from the Monthly Newsletter of the Finnish Archaeological Society. In this document, the Lehdosmäki is described as “16 rings connected with smaller chains, in which a number of coins and a small round brooch are attached, plus a neck piece consisting of a longer chain with no attached decorations, which during use was laid across the neck”. The longer chain is made in one method, while the middle chain section in the necklace is made of three pieces of similar chain. The short chains making up the remainder of the necklace are of a different design, and they are all connected from rings made from a “smooth, thick silver rod, whose ends are twisted around each other”.



The short chains of this necklace, are described as “braided in exactly the same way” as the headdresses “braided from silver and bronze wire” found in Karelian women’s tombs. The authors suggest that this gives strength to the consideration that the chains themselves were of Finnish origins. On the other hand, the article tells that the rings which connect the chains are more common from Sweden and other parts of Scandinavia than from Finland.

The Finnish newsletter article indicates that the necklace includes both eastern (kufic) coins and western coins. The youngest eastern coin on the necklace is from 972/3, while the oldest is dated to 902/3. The article says that the original design included 16 eastern coins; the “empty loops bear witness” to the lost coins, 11 of which remain. Three of the eastern coins appear to not be genuine, but rather copies from a minter “unfamiliar with the Arabic language”. The youngest western coin is from between 1022-1050; suggesting the necklace was buried in the mid or late 11th century. These coins included three from England, one from Germany, and one from Sweden. The Swedish coin has been cut into a square instead of remaining as a circle.

Coin dates

Necklace Location	Coin origin	Number of coins	Oldest	Youngest
Lehdosmäki				
	Islamic	11	901/2	972/3
	German	1	c.1075 - 1080	-
	English	3	c.991-997	c.1029-1035
	Swedish	1	c. 1023 -1029	-
	Total	16	901/2	c.1075-1080

(Source: Eeva Jonsson)

The necklace was likely made originally from the eastern coins, as they are attached to the necklace “in a symmetric and purposeful way”, while the other western coins are likely later additions. If indeed the eastern coins were the original coins, this indicates that the chain “could have been made no earlier than around the year 1000”.

In her examination of the coins from this style of necklace found in Finland, Eeva Jonsson reports that the necklace:

- Contains 19 coins in total
 - 11 of which are Islamic coins - original to the necklace
- The age variation between the most recent and original coins suggests the neck chain was used for about 3-4 generations.

The stated date of creation of this necklace has an interesting political connotation according to the newsletter article. While the necklace could have been used as a way of handling currency with merchants from around the world where the Viking Age Norse visited, or as a way of transporting silver which would be of value regardless of the coin type, or certainly just for the display of wealth in general, the article states that by 972/3 (the date of the youngest original eastern coin) connections between Arabs and Norse “had declined considerably, and around the year 1000 (it had) ceased altogether”. Eeva Jonsson confirms this, stating that “coin imports fell sharply during (the latter half of) 900”.

Estonian necklace & manufacturing speculation



In addition to the Finnish examples, there has been one complete necklace in this style and two fragments according to Eeva Jonsson. She does not write about these finds in detail, but mentions that the full necklace, found in the village of Paunküla, has only “Oriental” (Islamic) coins on it, and no additional western coins or pendants.

In Eeva’s article, she writes that included in the Estonian full-necklace discovery, were found “97 full coins with loops”. The loops on the neck chain were made of silver, “while the single coins” had loops made of bronze. She notes that “simple, trimmed bronze loops seem to be typical of Estonia and therefore they are probably of local manufacture”. This led her to believe that the coins attached to the necklace were probably not prepared in the same area as the loose coins.

With this evidence in mind, she states that it’s difficult to say for certainty where these necklaces were made, however she reports the statement of C. Bäcksbäck’s 1975 work which says that “all the primary neck chains may have a common origin, since all parts assumed to be original are alike”. She goes on in her article to

speculate that given the similarity of the 6 Finnish necklaces and 3 Estonian ones, that all of the necklaces were probably produced in a short period of time, possibly by “a single silversmith, around the year 1000, likely in Häme or Southwest Finland”.



Above: one of the Estonian necklace fragments.

Coin dates

Necklace Location	Coin origin	Number of coins	Oldest	Youngest
Estonia	Islamic	10	901/2	934/5

(Source: Eeva Jonsson)

Modern examples

Helene Jacobs



Helene Jacobs, the author of 'Ancient Wire: An illustrated guide to making intricate jewelry in the manner of the Vikings and other ancient cultures' also made her own version of the Hämeenlinna necklace and shares it in her book and on her website. (Source: <http://www.ancientwire.com/book.htm>)



Kalevala

The well-known Finnish jewellery brand Kalevala made a recreation of the Hämeenlinna necklace for the 150th anniversary of the Finnish national epic, the Kalevala. (Source: <http://www.kalevalajewelry.com/global/story/history>) Kalevala jewellery started in the 1930s with the goal of making and selling copies of Viking Age jewellery, and the company is owned by a cultural organisation called the Kalevala Women's Association. They produce modern jewellery, but also continue to make

jewellery based on or inspired by Viking and medieval jewellery such as Thor's hammers, Odin's crosses, Viking-style horses, birds and bears, moon symbols, axes, and more.

Appendix 5 – Additional experimentation – creating chain directly on fabric



After Diane's information about the men's cuff (listed above in the period examples) I also attempted to try my first try at creating the chain directly onto fabric.

I started with a smaller diameter dowel than I normally use, as the chain would not be able to go through a draw-plate once made up, and a small leftover piece of wool. I used 26 gauge silver-plated copper wire, and did only three ribs rather than my normal five as per Diane's information that the original was done with only three ribs. I looped the wire to get started, then threaded on one side through the wool. I did this in single-knit, and only for the length of the fabric to get a feeling for the method, the

additional time it might take, and what the result might look like.

The result is interesting, though I think to make it more accurate it would be much narrower, and much denser – likely double-knit instead of single-knit. The fabric of the original was also silk, not wool, but the weight of the wool made it helpful for a first attempt & sample. Despite the differences, it was a good sample to teach me that this method definitely could be done using the Trichinopoly technique I've been using, which reinforces my belief that the cuff may certainly have been embellished in a similar way. I did make one mistake while looping the wire, and thus there is one 'skipped stitch' in my chain.