Late Prehistory Through a Needle's Eye: How textile research can contribute to the archaeology of the European Bronze- and Iron Ages

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Cover image:

Spinning and weaving tools. Various tools that were used in the process of textile-making in the Iron Age. (British Museum, museum number: 1988,0409.5, https://www.britishmuseum.org/collection/object/H_1988-0409-5_1).

Late Prehistory Through a Needle's Eye

How textile research can contribute to the archaeology of the European Bronze- and Iron Ages.

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1 Introduction

Nowadays, little regard is given to textiles and their use is often overlooked. When considering the current climate of fast fashion, the disappearance of natural fibre in many garments, and the consequent growing textile dumps, the outlook is bleak when it comes to the use and consideration that most people, and especially corporations, have for textiles. Though it seems not much thought is given to textiles, they are important to people. This includes craftspeople who make or use textiles in their professional lives, hobbyists whose art includes textile materials, and everyone who — knowingly or unknowingly — uses clothing to present their appearance and (personal) identity. As a bare minimum, clothing is a primary necessity of human life in the shape of warmth and protection.

The concept of fast fashion is a fairly new one, which makes it likely that this cultural disregard of textile is not standard. Instead, the use and production of textiles should be explored, both as a category of their own, and in relation to other aspects of human life. People have used textiles in many different ways throughout human history, even thousands of years ago; an exciting example of this is the Must Farm in England, which is a Bronze Age settlement. Due to the specific preservation of the site, finds could be discovered that would not survive so well in other circumstances, making the site a uniquely rare source of information about the English Bronze Age. Among these finds are various textile types, as well as materials that were used to produce them, such as: woven linen fragments, twined fabrics made of lime-bast, knotted nets, balls of yarn, clay spindle whorls, and looms (Harris & Gleba, 2024, p. 452-525). Finds like these are exciting and also incredibly valuable to the archaeological context of the site and the time period. These objects show what things people made and used in their day to day life, which in turn gives modern people insights into the lives and economy of late-prehistoric people. This type of information is far more difficult to gain from sites that lack finds like this.

1.1 Research problem

Textiles are a rare find in many cases in European Prehistory. They are less resilient than other materials, requiring specific conditions for preservation. Besides this, many analyses require specialists to interpret aspects like textile types, dyestuffs, the weaving process, impact of site conditions on the finds, and more (Strand et al., 2010, p. 154-159). This leads to a lack of attention being given to textiles in the context of archaeological research. However, many different insights into the daily life and society of late-prehistoric European people can be gained through textiles. Materials used to make clothing and other items vary between times and places, which is reflected in the finds at archaeological sites (Grömer & Saliari, 2018, p. 135-142; Leuzinger & Rast-Eicher, 2011, p. 540). Steps in the production of textile like spinning, weaving, and dyeing require particular tools and knowledge (Keijzer et al., 2011, p. 128-129; Grömer & Keijzer, 2018, p. 58). All of this information is valuable, and can contribute to understanding how people lived even when the textiles themselves can no longer be found.

The potential that textiles have as both a separate finds category and to expand the contextual information of other finds is high, in part due to their connection to a number of important aspects of life. One example is subsistence economy, which can be broken down into trade, animal husbandry, use of land, metallurgy, and more. Similarly, craftsmanship and identity can be understood better through textiles, their production, their use, reuse, and ultimate discard.

1.2 Research questions

The goal of this thesis is to set up a method that can be used to recognise aspects of textile production and use in archaeological sites and finds, even when the textile objects themselves are not or no longer present. To do this even when few (if any) textile objects can be found, the focus is to learn about textiles through related fields and objects, and combine the relevant information into a better understanding of prehistoric people in a broad sense.

The sites and finds that will be mentioned in this thesis are for the most part finds from the Bronze- and Iron ages, in various northern European countries. Some exceptions are made to illustrate things that have happened on a wider scale, or that pertain to textile research and preservation as a whole. The focus is on the Bronze- and Iron Ages of the Low Countries, however the possibilities in application of the method are not limited to this specific area or time period.

The main question that will be answered in this thesis is:

> How can archaeological textiles and textile production contribute to the contextual understanding of subsistence economy in the Bronze- and Iron Age in North Europe?

This question will be answered through the use of the following sub-questions:

1. Which textile types were produced in the Bronze and Iron Age of North Europe?
2. Which objects related to textile production are known from the archaeological record and what was their function?
3. Where and how would Bronze- and Iron Age people in North Europe have procured their raw materials for textile production?

1.3 Approach

To answer the posed research questions, relevant information will be collected and discussed. This will first compile the literature research, which is used to showcase the methods of textile research and what results this yields, and to show how textiles are related to many areas of life. Examples are economy, craftsmanship, and social and personal identity. These aspects are what makes it relevant to include the relationship to textiles objects, even when they are not present at the site.

Then, some sites or finds will be highlighted, in case of exceptional, unique, or well-preserved textiles. These sites are often enormous sources of information that can be used to learn about textiles and connect the dots through contextual information at sites where no textiles are found.

Lastly, a method will be made and tested through the use of Dutch case studies. This method allows research related to textiles to be done despite the scarcity of textile finds. While examples from various (European) sites are used, the final product will be intended for use within bronze- and Iron age sites in the Low Countries, and more specifically the Netherlands. This is because there is a lack of information about textiles here, generally within the time period and when compared to other European countries.

1.4 Thesis outline

The following structure will be used in this thesis. In Chapter 2, contextual information is given which explains the relevance of textile analysis and research. This includes explaining the intersectionality of the textile economy with other important aspects of life.

Chapter 3 is used to explain how textiles and their impact can be researched, even when there is a lack of resilient finds. This is done with the use of direct archaeological evidence and indirect implications.

In Chapter 4, case studies are used to showcase how the information from chapter 2 and 3 can be used to research the textile economy of sites that seem to have little to do with textiles. This also shows how much can be learned about various aspects of life that overlap with textiles, even without textile finds.

Chapter 5 is the discussion, where the results are reviewed and limitations and possible future research are commented on, including options to expand the method to other time periods and locations.

The last chapter, Chapter 6, is the conclusion. Here, a summary of the previous chapters is given and the research questions are answered.

2 Theoretical framework

In this chapter, aspects of textile research will be discussed along with their intersectionality with other aspects of archaeology. Three main concepts will be mentioned which are both influential to textile production and use, as well as being influenced by it. Here the emphasis is not on how these aspects can be researched, but why they are important to the goal of expanding archaeological knowledge. While the time period and geographic area are limited in variety with regards to the examples used in this thesis, the importance of textiles is applicable in many more contexts.

The first concept, which is discussed in 2.1 is identity. This is a large topic, but can be recognised in various scales of objects and materials, ranging from monuments to grave goods, and from art to everyday objects. In 2.2, craftsmanship is considered. This is an important step to the practical application of things that are seen as identity, and the skills and knowledge that are needed to create the objects that were used in the European metal ages. Though craftsmanship is related to identity, it is also the stepping stone to subsistence economy, which is what provides the raw materials and tools needed to apply to the creation of objects. Subsistence economy is what makes up 2.3, and concludes the chapter.

Before the larger concepts are examined, a few terms should first be defined that will be commonly used in this thesis. The first is the term 'textiles'. This generally refers to "any filament, fibre, or yarn that can be made into fabric or cloth, and the resulting material itself", as explained by encyclopaedia Britannica (Abrahart & Whewell, 2024). The archaeological definition of textiles has generally been more narrow, and only considers woven fabrics to be textiles, though this has already branched out in recent years to include any interconnected objects made of various components (Grömer 2016, p. 32). This text will refer to textiles using the broader definition.

The second term that will be discussed is 'textile economy'. I have made this term to use as a shorthand to refer to textile production, use, reuse, discard, and any other acts that happen to textile- and textile related objects through human interaction. Using the term in this manner facilitates a more concise text.

2.1 Identity

As mentioned in chapter 1, one aspect of textile use is identity. This is a broad subject, spanning many variables of life both in modern times and by archaeological standards. Identity can be defined as:

> An individual's sense of self defined by (a) a set of physical, psychological, and interpersonal characteristics that is not wholly shared with any other person and (b) a range of affiliations (e.g., ethnicity) and social roles. Identity involves a sense of continuity, or the feeling that one is the same person today that one was yesterday or last year (despite physical or other changes). Such a sense is derived from one's body sensations; one's body image; and the feeling that one's memories, goals, values, expectations, and beliefs belong to the self. Also called **personal identity**. (American Psychological Association, 2018).

There are many variables that make up identity and different types of identity that are used, like social, personal, and collective identity. There are even more ways to express identity, with both conscious and unconscious signals.

One of the questions that archaeologists deal with is how current perceptions of identity compare to ancient times. Many lines of thinking are assumed to have been used by people regardless of time period and location, like that art is important and that cold weather increases the need for warm clothing. How these ideas were practiced can differ greatly between cultures and time periods, and researching these aspects of identity can be complicated when considering the limitations of the archaeological context.

Current ideas of identity often include material signifiers of status through grave goods, but also the tangible, often practical objects of daily life. These are judged, for instance, by how hard or complicated they are to make, how foreign the material is, and how much craftsmanship can be shown through the object.

Textiles are the perfect material category to convey these aspects of identity, through their versatile representation in all above-mentioned categories.

Identity can be considered to be a more abstract concept compared to tangible things like economy and craftsmanship, although they are intertwined when archaeological sites are analysed. Examples of specific identities in archaeological contexts are things like the burial in Oss, referred to as a Chieftain's grave, or 'vorstengraf' (Rijksmuseum van Oudheden, n.d.). This burial is a unique example from the early Iron Age in the south of the Netherlands. In it, various items were found that were not locally found. This, in combination with the comparatively large size of the burial mound and the amount and decoration of the items, is what led to the use of descriptors like 'rich' (Fontijn & Fokkens, 2006).

The idea of wealth is in this case equated with the number of items made of expensive material that were non-locally sourced, or that have been decorated intricately. Among the objects found are a large bronze urn, a sword inlaid with gold, various horse bits and other iron objects, and a few textile fragments. These textile fragments are made of wool, and were wrapped around the other objects inside the urn (Van der Vaart-Verschoof, 2017, p. 180-194). Textiles likely played a common role in funerary practices of chieftains' graves. Fragments have been found in various similar sites, and were used to cover both objects of high value, and in some cases the buried person themselves (Schumann & Van der Vaart-Verschoof, 2017, p. 314-315). The grave in Hochdorf even featured a burial chamber richly furnished with various textiles, both dyed and patterned, from wall-adornments to shrouds (Banck-Burgess, 2012, p. 140-142).

Adornment through metal materials has already been associated with wealth and status in Bronze- and Iron Age burials throughout Europe, and it is not an unlikely possibility that clothing could have been used in combination with a similar purpose (Moore, 2018, p. 981-983). The reach and connections through trade are shown by materials that cannot be sourced locally. Clothing worn by people and the methods and materials that were needed to create the garments give insight into everyday lives as well as social dynamics and identity.

When considering how textiles fit into the idea of identity, there are various facets to look at. One method is to recognise the difference between cloth, clothing and costume. This distinction was proposed by Marie Louise Stig Sørensen, and allows for far more nuance to be introduced into the use of garments than would be allowed if all three types were seen as the same group (Sørensen, 1997, p. 95-96). The cloth on its own is a signifier about identity, through its construction, pattern, colour, sensory effect, etc. This is then expanded on or changed by turning it into a specific garment, which gives information about its original purpose and practical use, which are not at all times the same. This happens once again at the level of costume, where different garments as well as hair styles, jewellery, and other items are added.

Particular object types have been found on bodies of various groups, indicating some social identities were possibly formed that reflected the group someone was in. The groups as can still be found in the

archaeological record are geographic location, age, and possibly gender and status. The introduction of wool as a spun and woven textile is an example of these groups, since wool behaves differently than linen as clothing, and therefore would isolate people who had access to wool clothing from people who were not (yet) able to. This could be a regional marker between people who had sheep and thus access to wool, and people who did not, as well as a differential in economic status between people who had the resources to trade with wool and those who did not (Haughton et al., 2021, p. 175).

2.2 Craftsmanship

The relevance of craftsmanship was already touched upon at the start of chapter 2, however there is far more to it than has so far been mentioned. In order to make the objects that were used in day-to-day life, a large amount of skill and knowledge was required. This can in part be seen by the constant evolution of already existing objects, as well as the invention of new ones. People have used plant materials like tree bark and nettle since the Mesolithic era, which continued to grow into the creation of linen clothing and other items in later time periods (Harris, 2014, p. 3-7). The process of making linen clothing was not simple, and required both skill and craftsmanship, as can be seen in Table 2.1.

1.	First, flax was needed. This was grown on a field and required enough time and space for the fibres to grow long enough for textile use.
2.	After this, the flax was harvested, which was done entirely by hand, only with the use of tools like sickles made of flint, or in later times, bronze or iron (Gurova, 2016, p. 159-162; Ibáñez et al, 2008, p. 192-193; Arnoldussen & Steegstra, 2016, p. 64-68).
3.	Once harvested, the flax was left to dry for a number of days. The next steps were to sort seeds from the rest of the plant.
4.	Retting happened next, which is where the flax would be laid out in a field or in water, so that the last unwanted plant parts could loosen and decompose. Depending on the elements, this could take varying amounts of time.
5.	After retting, the flax needed to dry, which could most easily be accomplished by laying it out outside.
6.	Then the last step is taken to separating the useful fibres from the rest of the plant. This was done by beating the flax or moving it loose by hand, so that the unwanted materials break off.
7.	Once only the linen fibres were left, the shorter fibres and last possible traces of other plant materials would be removed. This could be done by combing the flax over a heddle. This also helps to align the fibres so they can be more easily used.

Table 2.1 The steps required to prepare flax. (Table by Sid Fitsch).

When the needed fibres were finally in a usable state, the next step of the process would start, which is spinning. This was done by hand, either by spinning the fibres between fingers, or by using the faster method of a spindle (Grabundžija et al., 2021, p. 628-631). The spinning would have taken a long time regardless of method, however, since a very large amount of thread was necessary to make most objects out of. Some skill was also necessary once again, in order to control the thickness of the thread and the consistency in shape.

To make the clothing article, the spun threads of linen would be used on a loom, where it could be woven into a large swath of fabric. The very final step was assembling the cloth, which could be done by sewing the relevant parts together.

All of the steps that were needed to create a linen object required enough time and skill that it was likely not possible to disregard the process like how textiles are often treated nowadays. It is possible that the production and mending of textiles were respected as valuable skills, and textile products were highly valued both on their own as objects that were a part of daily life, as well as objects that were useful for trade.

Another example of craftsmanship and how it expanded can be seen in wool objects. Wool was not spun as early as flax, and the exact period in time when this happened has been hard to pinpoint (Pipes, 2015, p. 16-25). Once people did start spinning wool, it was used similarly to linen, in order to create woven fabric, which could be done on various loom-types. Besides this, it was used for the ancient craft of nalbinding (Andersson Strand, E., 2018; Piening, et al., 2018).

A development in the use of wool was dyeing it. This was done from at least the Bronze Age, though earlier indications of dye have been found in various places over the world (Barber, E. J. W., 1991, p. 227-228). The method using a dye bath can be seen in Table 2.2.

1.	Plants that would give off colour were grown on fields or foraged.
2.	The relevant part of the plant would be kept for the dye. To extract the colour, the plant would be put into a big vessel of water, which was then put near fire to heat up. This was left to sit for a while.
3.	Then, the plants would be taken out and the wool would be added.
4.	Various methods could be employed to prepare the wool for the dye bath, depending on the state of the wool and the desired effect. A mordant could be used, to allow the dye to adhere to the wool better. This could be derived from various materials; such as tannin or copper (Barber, E. J. W., 1991, p. 236).
5.	After dyeing, another possible step was to treat the wool with ammonia, which could allow some colours like red to become richer or more vibrant on the cloth (Barber, E. J. W., 1991, p. 236). Some colours would be vibrant enough after one dye bath, some needed several.

Table 2.2 Steps taken when vat dyeing. (Table by Sid Fitsch).

In order to create some colours, various dye baths would be used on the same wool, so that the colours would mix. By the common era, many different colours could be achieved through variations in the dyeing method (Barber, E. J. W., 1991, p. 236; Bichler et al., 2005, p. 56). Not only did it take the cultivation of specific plants to start the process of dyeing wool, but in some cases, wool had to be dyed many times before the colour was sufficiently vibrant. This again alleges the likely status of more complicated textile objects, at least in terms of time needed to take on all the steps of the process.

The same can be said about the weaving aspect of textile production. This did not only take a considerable amount of time and skill, it could also be complicated further with the use of looms that allowed for more complex patterns, especially when combined with the different colours of thread that were available (Haughton et al., 2021, p. 175).

When considering the above-mentioned developments in textile creation, it should be noted that there is a difference between household crafts and industry. This is a large spectrum, and people existed on many

different places of this spectrum (Grömer, 2016, p. 244-255). Here the intersection between craftsmanship and economy is once again relevant. Household crafts were likely to deal mostly with mending and adjusting of pre-existing clothing, while people making textiles on a more industrial-like level would possibly create various textiles and trade them for different objects. This is not to say that less skill or knowledge should be considered to have gone into 'crafting', as the name can imply, but instead the spectrum is an indicator of time and resources spent, and the specific skill that is necessary for creating large numbers of fabrics. It is not possible to claim any position on this spectrum for any people of the European metal ages without enough data to confirm it , however it is an aspect of prehistoric life that should not be disregarded without thought.

2.3 Raw materials and subsistence economy

Many different materials are required to make textiles. This affects various aspects of day to day life, like use of land, animal husbandry, woodworking, metallurgy, and trade. To illustrate, the Huldremose woman will be used as an example. She is a bog body that was dated to the early Iron Age, found in Denmark. Her clothing, seen in figure 2.1, was remarkably well preserved, and consists of two capes, a skirt, a scarf, and some accessories, as well as possibly some kind of under-layer (Gleba & Mannering, 2010, p. 32, 35). In order to make her clothes, several processes would have had to happen.

The possible undergarment that was found has very little known information, however it was determined to be a tabby-weave, made of some kind of plant material. The likeliest options for the fibre are flax, hemp and nettle. All three are likely options for the use of clothing, though the existence of a plant fibre garment implies that enough land was used to cultivate this plant.

The scarf and skirt were made of wool, which had to be collected and spun, for which sheep were needed. Metal shears would not have been strictly necessary to collect the wool, however they would have aided the process. Both capes were made of leather, with the wool of the sheep still attached, possibly for warmth. It is likely that these skins came from the same sheep as the wool for the scarf and skirt (Gleba & Mannering, 2010).

The wool was dyed, the light and dark colours most likely having had a combination of red, blue, and yellow colours. To achieve this, various wild plants would have been collected in large enough quantities, or some might have been grown on the farming fields (Amerongen, 2016, p. 275-276). This way, the yarn would be coloured before being woven on a loom. For the dyeing process, a large vessel would have been used. This was likely a ceramic pot (Sofaer et al., 2013) or a metal one made of copper, bronze, iron, or a combination.

At the weaving stage, woodworking comes into play. While a comb would have been used to prepare the wool, and a spindle to spin it, the loom is the most complicated wooden tool that was used. Both the skirt and scarf were woven in a twill pattern, with the dyed yarn giving the garments the checkered pattern. Other possible wooden tools that could have been used in the process of creating the skirt and scarf are a heddle and needles. These could have also been made of bone or horn.

Figure 2.1 Outfit of the Huldremose woman (left) next to an example mock-up of what the colours possibly looked like originally (right). (National Museum of Denmark, N.D. https://en.natmus.dk/historical-knowledge/denmark/prehistoric-period-until-1050-ad/the-early-iron-age/the-woman-from-huldremose/the-huldremose-womans-clothes/).

It should be noted that at any stage of production of the garments the Huldremose woman wore, trade could have been involved, to obtain any necessary material that may not be found or made near the home. Through analysis of strontium isotopes, the wool scarf was concluded to be locally sourced, while the plant fibre underlayer and the woman herself were likely not local (Gleba & Mannering, 2010, p. 36). Any of the tools and materials that were needed to create the garments could have been traded instead of cultivated or made by only one person. In that case, the question would be what the Huldremose woman had to trade for these garments, which broadens the possibilities in economy even more.

Craftspeople who made high quality tools were advantageous in trade, and even materials that are not always necessary might be traded for. This can be seen in the case of the Egtved girl, who was buried in Denmark but wore a bronze belt disc made up of materials from more southern areas of Europe, possibly the Alps, the Iberian peninsula, or the British isles. Though she is by many seen as an iconic Danish figure, recent research has shown that she herself was not originally from Denmark, but was a well-travelled person before her burial (Felding, 2016, p. 11-12, 16).

It has now been shown in what ways daily life was impacted by the textile economy. This will be expanded on in the next chapter, in which this information can be transferred into an archaeological approach. The focus here will be on the production process of textiles and the subsistence economy. While the focus will be less on identity, this concept will be mentioned once more in the discussion.

3 The process of textile production

As mentioned, textiles as a finds-category lack resiliency. However, many materials that are needed in order to process textiles are resilient, which is how evidence for textile production and use can be found in places where the textile objects themselves have not survived the passage of time. These related objects will be discussed in this chapter, and are divided into tools in 3.1, materials in 3.2, pseudomorphs in 3.3, and lastly a summarising overview of all objects mentioned in 3.4.

3.1 Tools

Various tools have been used throughout human history to create textile- and textile-like products. It is generally believed that upper-Palaeolithic and Mesolithic people wore primarily leather clothing, through lack of evidence of alternatives. This does not mean, however, that weaving did not exist during these times or that no tools were used. Mentioning a period this early may seem counter-intuitive when the focus of the research are the metal ages, however no tool or method was made in a vacuum, and the steps that came before can in many cases be relevant to later uses of tools.

There is evidence of woven objects like basketry as early as the upper-Palaeolithic era, in Spain (Tortosa et al., 2020). Similarly, depictions of woven and braided structures have been found on art objects like Venus figurines (Soffer et al., 2000, p. 517-522). While this does not provide proof for any particular type of weave, clothing or ornament on its own, it serves as an indicator of possibility.

Though woven items are hard to research from a period so long ago that organic material generally does not last, objects made of bone, horn, and stone have far better chances. Examples of these have been documented by Gilligan et al., (2024) and concern needles made of bone, in some cases paired with an awl to facilitate making the holes in leather before needle and thread are used to sew the pieces together. Also found are stone tools like scrapers and burin to work and perforate leather.

From the Neolithic time period on, some large developments can be seen in textile production. The use of flax to weave into linen cloth, as well as the various tools that are required for this process.

To process the flax itself, several methods are used to separate parts of the plant, some of which were possibly done with heckles, or combs (Malyutina & Charniauski, 2024). After this is done, loose thread is spun by hand or by spindle, for expediency. In many cases, these look like slender wooden sticks with a notch at one and a weight on the other (Grabundžija et al., 2021). The weight can be made of a stone in which a hole has been drilled, or baked clay shaped around the wood (Grabundžija et al., 2021). While the wooden parts are in many cases less resilient than the bone, stone, and clay parts, the existence of the other materials allow these tools to be found and analysed for their use.

Similarly, weaving the linen thread into a garment or other piece of fabric requires a loom. These are rarely found in complete condition, since most of them are made of wood. However, the weights that anchor the direction of the warp were in various cases made of clay or stone. The material, as well as their often distinctive shape is what allows them to be recognised as part of a larger tool for weaving, and specifically a warp-weighted loom (Strand, 2018).

While the exact first use of spun wool has been hard to pinpoint, it is often thought to be near the end of the Neolithic era (Gleba, 2014). This does not change much in the way of tools that were required, since looms, spindles and needles were already in use at this point. From at least the Bronze Age, there is a slight difference through the use of smaller, handheld constructions that allow a small woven band to be made (Lau, 2022, p. 289). These bands are generally only a few cm wide, though they can be meters long.

The Bronze Age brings new wool techniques, as well as the use of metals. Both copper and bronze were implemented in already-existing methods of textile making, as stronger replacements of earlier tools. This was documented in the case of needles and awls (Procelli, 2019, p. 63-65).

Most likely through the use of needle binding, some variations in needles are documented. Needle binding requires the knotting of thread – often thicker than the thread used for sewing – with a single needle. The needle is therefore generally bigger and thicker, with a large eye to pull thick thread through and a rounded tip (Maner et al., 2025).

The practice of dyeing wool, for which the earliest evidence is in the late Bronze Age, required tools that already existed, but which could now also be linked to textiles. For vat dyeing, a vessel was used in which the colourants were first extracted from plants into hot water, after which the plants would be removed, the temperature lowered some, and the wool added. This way the wool could absorb the dye (Barber, E. J. W., 1991, p. 239-243). The vessel could be made of a few different materials, though ceramic pots were the likeliest choice. Copper or bronze vessels were possible as well, however due to the scarcity of bronze in some areas of Europe, this would not have been a likely choice for some people.

The Iron Age is the last prehistoric period in Europe, variation in exact dates non-withstanding. Iron itself belongs to the list of textile tools because of its use through shears, making it easier to cut thread and cloth, and providing an easy way to collect wool off of sheep (Gleba et al., 2022 p 39-40). Besides shears, iron could be implemented in other tools like needles, awls, and vessels for dyebaths.

A fully new type of tool came into use in the Iron Age as well, to aid smaller versions of weaving called card weaving, where cards were used that were often made of horn, bone or wood (Knudsen, 2009, p. 151). These cards were used in a similar fashion to band weaving, and allowed the creation of even more complex patterns (Bichler et al., 2005, p. 81).

There are some objects that are oftentimes associated with fabric, and more specifically clothing, while not being used as tools to construct them. Examples of this are pins made of bronze (Martin, & Weech, 2017, p21-23), or iron to fasten clothing (Martin, & Weech, 2017, p48-52), as well as belts with bronze disks (Felding, 2016; National Museum of Denmark, N.D), and even buttons (National Museum of Denmark, N.D.)

Also found are objects that were used for ornamentation both related to garments as well as personal decoration. In this category pins can be found as well, as they were in many cases both practical and decorative. Other examples are decorated hair nets, and beads made of bone, horn, and various metals on clothing and other items.

3.2 Raw materials

Both tools and textiles are made up of various materials, which play as important a role in textile-making. Many of the tools mentioned in chapter 3.1 were made of bone, horn, wood, and in later parts of prehistory: copper, bronze, and iron.

A clear example to quantify materials that were needed to construct textiles can be seen in the clothing people of prehistoric times wore. As an example, the Huldremose woman will once again make an appearance. As previously mentioned in chapter 2.3, she wore various garments made of wool and leather. Likely included but unverified was a layer of undergarments made of plant material — linen, hemp, or nettle. In Table 3.1, all the different garments and objects that were on her person are shown, with relevant information that has been gained through various types of analysis, mentioned in *A thread to the past: The huldremose woman revisited* (Gleba & Mannering, 2010).

Clothing items

<table>
<tr><td colspan="2">Outer cloak</td><td>Current status</td><td>Construction</td></tr>
<tr><td colspan="2">  </td><td rowspan="3">82 cm high by 170 cm wide.

Most of the cape is dark brown sheepskin, one rectangular patch is light goat skin.</td><td rowspan="3">Five rectangular pieces to form the majority, with two triangular pieces, all sewn into one garment. All pieces have the sheep fleece still attached.

The inside of the cloak has no fleece except for a lining at the upper front side. This is made of dark sheepskin as well.

Asymmetric design, slanted neckline.</td></tr>
<tr><td>Material</td><td>Provenance</td></tr>
<tr><td>Sheep fleece,
goat skin,
unnamed sewing medium.</td><td>Unverified, though the wool is so similar to the skirt, they most likely come from the same area of sheep.</td></tr>
<tr><td colspan="2">Inner cloak</td><td>Current status</td><td>Construction</td></tr>
<tr><td colspan="2">  </td><td rowspan="3">80 cm high by 150 cm wide.

The garment was cut open at the top to take it off of the body, however due to damages and poor preservation, this area can no longer be seen.

The bladder-pocket is no longer attached to the cape.</td><td rowspan="3">7 to 8 mostly rectangular sheep skin pieces, 22 smaller patches of deer and goat skin.

Asymmetric design, slanted neckline.

A pocket made of bladder was sewn into the cape to hold various items.</td></tr>
<tr><td>Material</td><td>Provenance</td></tr>
<tr><td>Sheep fleece,
goat skin,
unnamed sewing medium.</td><td>Unverified, though the wool is so similar to the skirt, they most likely come from the same area of sheep.</td></tr>
<tr><td colspan="2">Pocket items</td><td>Current status</td><td>Construction</td></tr>
<tr><td colspan="2">  </td><td rowspan="3">The pocket was at some point removed from the inner cloak. Small pieces of leather string can still be seen in it.

The other items (shown in the picture) were removed.</td><td rowspan="3">The pocket itself was made of a bladder.

The comb is made of horn and has a decorated handle.

The string is made of leather.

The woven band is made of brown wool, undyed. It is 74 cm long and 1.5 cm wide, with tabby weave in s-twisted yarn. Two cords are attached perpendicular to the long side of the band, of 77 and 78 cm.</td></tr>
<tr><td>Material</td><td>Provenance</td></tr>
<tr><td>Bladder,
horn,
leather,
wool.</td><td>Unverified.</td></tr>
</table>

<table>
<tr><th colspan="4">Clothing items</th></tr>
<tr><th colspan="2">Scarf</th><th>Current status</th><th>Construction</th></tr>
<tr><td colspan="2">  </td><td rowspan="3">Due to preservation in the bog environment, the colours are no longer as they were at the time of burial. The dyestuffs indicate an original combination of yellow, blue, and red. Now, only differences in intensity can be seen on a mostly brown-orange garment.

The scarf was cut in half to remove it from the body.</td><td rowspan="3">The scarf was woven in a plain 2/2 twill.
It has tubular selvages and closed fringes at the short ends.

S-twisted yarn of 6-7 threads per cm in both directions.

The woven dyed wool in different colours creates a checkered pattern.</td></tr>
<tr><td>Material</td><td>Provenance</td></tr>
<tr><td>Dyed wool.</td><td>Local, close to Ramten, Jutland, Denmark.</td></tr>
<tr><th colspan="2">Skirt</th><th>Current status</th><th>Construction</th></tr>
<tr><td colspan="2">  </td><td rowspan="3">Similar to the scarf, the bog environment has changed the colours to be more uniform and brown than they likely originally were.

Besides this, the skirt seems to be mostly in good condition.</td><td rowspan="3">220-252 cm long (circumference), 81-84 cm wide (height).

Woven in 2/2 plain twill, with s-twisted yarn. There are 7-10 threads per cm.

One selvage holds the waistband, the other is a tubular tabby.

The skirt was dyed with three dyestuffs that when used together create brown. Thus, it is likely that it was over-dyed with a different colour when the vibrancy lessened.</td></tr>
<tr><td>Material</td><td>Provenance</td></tr>
<tr><td>Dyed wool.</td><td>Unverified, though the wool is so similar to the fleece of the cloaks they most likely come from the same area of sheep.</td></tr>
</table>

Table 3.1 The separate items of the Huldremose woman. (Gleba & Mannering, 2010, p. 32-36, adapted from Figure 2).

While the analysis of still-existing archaeological textile finds is useful, the information is not only relevant to find out what textiles were created in prehistory, but also for researching textiles that no longer exist. In this chapter, some of the methods and materials necessary for creating textile objects in European prehistoric context are quantified, to show their impact on daily life. By having a complete understanding of the production process of textiles, more context is given to the daily lives of the people who made the objects. From the land that was used to grow flax to the materials needed to turn it into spun thread, and from the environments in which to keep sheep to the amount of wool needed to weave one skirt. Even the dye on clothing can add information about production, trade, and the evolution of textile-making (Grömer, 2016, p. 140-144).

The following paragraph will be used to bring the use of the so-far mentioned tools and materials into perspective. By considering the various materials needed and how someone in the late prehistory would be able to acquire them, more steps of the textile economy can be outlined. Some of these data come from experimental archaeology, in which the recreation of an object in the most similar circumstance manageable to the original is used to create a plausible timeline and method of how an object came to be. Any information

that has not yet been quantified is instead written as a hypothetical, using the sources that are available to create a likely way that the textile has come to be.

An item like a linen skirt might in some lucky cases be found in the archaeological record of a Bronze- or Iron Age settlement. If found at all, it would likely be only a fragment in fragile condition. In order to learn more about it, research can be done into the necessary tools to create this object, the use of the surrounding land to get the materials, how long it would have taken to create the garment, and which steps could have been outsourced through trade. For the purpose of this exercise, it is assumed that a linen skirt from this time period could have had similar dimensions to a wool one. The Huldremose skirt's dimensions are borrowed, in combination with the weave and thread thickness of a Bronze Age linen textile from Suffolk (Harrison et al., 2023, p. 57), and both of which the smallest numbers of the margin were used to calculate the minimum amount of thread that was necessary to create the hypothetical garment.

To calculate the amount of linen thread needed, first the weft (10 strings per cm) is multiplied by the width of the skirt (220 cm). The same is done with the warp (10 strings per cm) and the length of the skirt (81 cm). Then to calculate the length of the total amount of string needed to create this hypothetical skirt, the weft strings are multiplied by the length, and then added to the warp strings multiplied by the width.

The calculation is as follows:

220 cm x 10 strings per cm = 2200 strings along the width.
81 cm x 10 strings per cm = 810 strings along the length.

(2200 strings x 81 cm) + (810 strings x 220 cm) = ***356,400 cm*** *of string in total.*

The amount of flax plants needed to spin 3564 meters of string is difficult to quantify, in part due to the lack of sources that deal with this specifically, and because the amount of usable flax varies largely and is dependent on many factors like climate, soil, and what exact method for processing is used. This means that it is also difficult to quantify how much space was needed for the flax plants to grow.

The time required to process flax, however, is slightly less hypothetical. First, flax that is used for linen is generally given 100 days to grow. After harvesting, the plants can be laid out to dry, which takes a few days. Then the plants can be stored or immediately processed. The processing takes varying amounts of time, depending on the amount of flax that is being worked on, how many people are doing it, and their skill level. The same goes for spinning and weaving. All numbers that have been estimated for the hypothetical garment are noted in Table 3.2.

Linen skirt requirements				
Dimensions	**Materials needed**	**Tools needed**	**Time margins**	**Trade options**
220 cm wide (circumference), 81 cm long (height). Weave: 10 threads per cm in both weft and warp.	3564 meters of linen thread.	Needle, loom, spindle (and whorl), heckle, scutch, and sickle.	Flax on the field: ca.100 days. Flax processing: at least a few days, up to several weeks.	Theoretically, every step of the linen process could have been outsourced, though likely at least the unfinished but woven fabric is a strong possibility for trade.

Table 3.2 Minimum linen skirt requirements. (Table by Sid Fitsch).

Similarly to the linen garment, a wool skirt can also be quantified to get an indication of the time and materials that were necessary to create it. For this example, the skirt of the Huldremose woman will be used again, this time for the dimensions as well as the weave. As before, the minimum amount of required material will be considered. To calculate the necessary wool yarn, the same calculation is used as with the linen skirt.

The weft is multiplied by the width of the skirt (7 strings per cm x 220 cm). Then the warp is multiplied by the length of the skirt (7 strings per cm x 81 cm). Then, like before, the weft strings are multiplied by the length, which is then added to the warp strings multiplied by the width, to create the following calculation:

220 cm x 7 strings per cm = 1540 strings along the width.
81 cm x 7 strings per cm = 567 strings along the length.

(1540 strings x 81 cm) + (567 strings x 220 cm) = ***249,480 cm*** *of string in total.*

Similarly as with linen, it is difficult to translate the meters of yarn needed to weave a skirt into how much raw wool is required, due to the huge variability in wool density, yarn thickness, fibre length, etc. Instead, archaeological sites have been considered to fill in some of the remaining questions. The numbers of sheep, amount of raw wool, and amount of space necessary to keep them is thus not based on the hypothetical skirt, but on examples from the archaeological record.

Modern sheep generally grow between 2 to 5 kg of wool per year. This varies between breed, however, archaeozoological research has shown that prehistoric sheep were vastly different from modern ones, and likely experienced changes through domestication. Sheep herds could yield anywhere between a few hundred grams to just over a kilo of wool per year per sheep, depending on industry scale and location (Sabatini et al., 2019). Not all raw wool can be used for weaving, since some weight is due to grease, dirt, and unusable fibres. The percentage of usable wool differs per breed. Between the absolute minimum of 200 grams per sheep and maximum of just over 1 kilogram per sheep, an estimated average would be 600 grams per sheep.

Sabatini et al. (2019, p. 4914) also mention that household-scale keeping of sheep likely happened in mixed herds of below 100 sheep, while industrialised institutions could range from just over a hundred to up to 100.000 animals, which were managed in smaller herds. A herd of a hundred sheep or less would therefore produce roughly 60 kilos of useable raw wool. It should be noted that Sabatini et al. (2019) mention differences in sheep from various locations, and this estimate is based on sheep from the south of Europe, meaning that sheep from the Low Countries or other north-European places may have been woollier to account for the colder climate. This would then heighten the average production of usable wool per year.

Wool skirt requirements				
Dimensions	**Materials needed**	**Tools needed**	**Time margins**	**Trade options**
220 cm wide (circumference), 81 cm long (height). Weave: 7 threads per cm in both weft and warp.	Yarn: 2494.8 meters Raw wool: at least 100 gram per sheep. Sheep: 100 or less.	Spindle (and whorl), loom, needle.	Wool growth on sheep: 1 year.	Raw wool, spun wool, woven fabric, finished skirt.

Table 3.3 Minimum wool skirt requirements. (Table by Sid Fitsch).

Table 3.3 only accounts for a single woollen garment, however it is more likely that there would have been more wool production per settlement. If a settlement in the Iron Age had farms with at least more than one

inhabitant, that already creates a higher amount of wool needed for each person to have at least one garment. This does not account for any other garments people might have owned, or doubles of these garments, or woollen objects that were not strictly clothing like blankets, bags, etc.

Besides the absolutely required materials that were used to create a woollen garment or object, more materials were used often. This includes tools like distaffs and dyestuffs as well as non-textile items like leather garments, shoes and other objects made of rush, thread made of sinew or intestine, buttons, pins, beads and more made of bone, horn, wood, metal, amber, etc.

3.3 Pseudomorphs

Textiles are generally considered to not be a resilient finds category, with the notable exceptions of those found in well-preserving places. In lucky cases, this can mean that the textile fibres are still preserved as they were. Examples are plant-fibre objects in waterlogged contexts and fens, wool and other animal products in raised bogs, and more indiscriminately textiles in salt and frozen contexts (Grömer, 2016, p. 22-30). More often, textile finds are changed by the context, which degrades them but also allows for preservation. These are called pseudomorphs, and examples are mineralisation due to metal corrosion, and carbonisation of charred materials (Grömer, 2016, p. 23-24,30-31; Cybulska, 2007, p. 188).

Various things can be learned from any of these finds, ranging from the type of fibre used, how they were manipulated to become a textile object, the mechanical and chemical properties of the material, and how all of these attributes influence the current state of the object. To gain this information, various types of analysis can be done.

Visual analysis can be used to get specific information like measurements of the object, the thread count in case of a woven or otherwise interlaced textile fragment, colour determination, preservation state, and more. This information is relevant to later conservation of the object, and can give a preliminary idea of the object's function and history. Some of these details may still be visible, depending on the state of preservation of the object and the type of chemical process it underwent.

Microscopic analysis sheds a light on details that are not visible with the naked eye. This includes the type of fibre that was used, analysis of any dyes that were used, and the spin-direction of the individual threads (Clark, 2011, p. 28-54). Similarly to preserved textile fragments, how much of this information is still verifiable in pseudomorphs is dependent on the state of the object and the type of context it was found in.

In many cases especially in time periods older than the late-prehistoric metal ages, the textiles themselves are no longer present in any shape, and some of the above-mentioned information can still be found through impressions in other materials like clay, mud, and ceramics (Grömer, 2016, p. 31). Impressions can show the weaving and/or spinning pattern of the textile, and in detailed cases they can even be used to determine the thread count and type of fibre that was used. See figure 3.1, which is an example of a corded-ware fragment from Franzhausen, Austria, with textile impressions.

Figure 3.1 (Left) Franzhausen III, gr 1. Corded-ware fragment with textile impressions. (Grömer & Kern, 2010, p. 3140, Figure 4).

Figure 3.2 (Right) 'Heidengebirge' (layers containing objects from ancient mining activities) with textiles from the salt mine in Hallstatt, Austria, Early Iron Age. (Grömer, 2016, p.25, Fig. 10).

Besides the construction of finds that were formerly textiles, pseudomorphs can be used to construct a timeline of use, degradation, and preservation of objects. The Hallstatt textiles — an example of which can be seen in figure 3.2 — were preserved so well due to the moisture and salt of their context (Bichler et al., 2005, p. 15), however 'why' is as important to ask as 'how'. Their presence in salt mines was determined to be through use of people who worked in those mines, either as worn clothes or bags and other items that served as tools for the mineworkers (Bichler et al., 2005, p. 171).

A vastly different example would be of a piece of fabric that was wrapped around an iron dagger (Van der Vaart-Verschoof, 2017, p. 194), which allowed the woollen fabric to mineralise from prolonged contact with the iron, as seen in figure 3.3. The preservation of the textile in this way is what allows questions to arise about the use of textiles in tools like axes, and whether that was limited to bronze axes or if this happened with more materials.

Figure 3.3 Mineralised textile. A wool fragment on a piece of an iron dagger. (Rijksmuseum van Oudheden, inventarisnummer: k 1933/7.8, https://www.rmo.nl/collectie/collectiezoeker/collectiestuk/?object=156555).

3.4 List of variables

The objects that have been discussed in chapter 3 so far are all connected to textile production and use in some way, though they have varying degrees of impact and versatility. In order to effectively utilise these finds in textile research, an important distinction should be made between finds that serve as evidence for textile use or production, and finds that imply these processes, but do not fully support them as fact on their own.

Grouped under the list for ‘archaeological evidence’ are finds like loom weights, spindle whorls, needles, and pseudomorphs. All of these objects are used primarily for textile-making, and in the case of pseudomorphs re-using.

In the list called ‘archaeological implications’ are the finds that imply some form of textile use or production, but which are multi-functional or for which textiles would count as a secondary product. In the case of secondary products, it can only be stated that textile use and production are a possibility, however any other claim should be based on more direct evidence. Examples of this list are bone smoothers, shears, hair- and cloak pins, and evidence of specific land-use like heaths and moors, or cultivation of flax and plants used as dyestuffs. Both lists and their subdivisions are laid out in Table 3.4.

This distinction between archaeological evidence and archaeological implications serves not only to ensure that no claims are made that cannot be proven with tangible evidence, it also serves to allow for theories to be explored that would otherwise not be considered feasible. Instead of discounting possibilities due to lack of evidence, they can be kept for further research until more direct archaeological evidence is found to either support or discredit the theory.

Archaeological evidence	Direct textile finds, pseudomorphs	
	Textile-related tools	Loom weights, spindle whorls, needles, awls, etc.
Archaeological implications	Indirect tools	Vat with dye residue, sickle, shears, etc.
	Related materials	Pollen, flax, hemp nettle, dyeing plants, wool, pins, buttons, beads, etc.
	Land use	Fields for flax, foraging options for nettle, dyeing plants, grazing options for sheep, indoor stalls possibly for sheep, etc.
	Unidentified objects that could refer to textiles	Broken/unidentified objects that could be related to textiles but cannot be identified with certainty.

Table 3.4 The different objects that can be seen as archaeological evidence and archaeological implications. (Table by Sid Fitsch).

The many items and materials that have been mentioned in chapter 3.1 through 3.3 are listed in various tables below. In these tables, they are more efficiently referenceable and can thus be used in the evaluation of sites, as is done in chapter 4 of this thesis.

Table 3.5 is composed of all objects and materials that have been discussed, grouped by chronology (based on the time periods of the Low Countries specifically) and objects that can be made with them. Both items that serve as archaeological evidence and are thus required to the creation of a tool or object are mentioned, as well as items that are seen as archaeological implications, due to their ability to be used in textile processes as well as for other purposes. The distinction between the two is made with the placement of an asterisk (*) behind the optional items. Materials grouped with a comma are all needed to create an object, materials grouped with a forward-slash are various options of which an item can be made up of in archaeological contexts.

Chronology & object	Tools	Materials
Upper-palaeolithic, Mesolithic (±50.000–12.000 BC, ±15.000–6.000 BC)		
Leather clothing	Needle Awl Smoother Burin + fragment with puncture holes	Bone/horn Bone/horn Bone Flint, bone
		Treated leather Intestine/tendon thread Bark
Woven objects		Willow Stinging nettle Bark Reeds Rush
Neolithic (±6000 BC–2000 BC)		
Linen clothing	Heddle Spindle (and whorl) Loom Needle	Wood, bone/horn Wood, fired clay Wood, fired clay wood/bone/horn
		Flax
Bronze age (±2000–800 BC)		
Wool clothing	Heddle Spindle (and whorl) Loom Needle Dye Dye vessel* Rigid heddle	Wood, bone/horn/copper Wood, stone/clay Wood, fired clay Wood/bone/horn/copper/bronze Various plants, various mordants Fired clay/wood/iron/copper Wood
		Wool
Non-textile clothing related items	Pin for hair/cloak* Beads (on clothing)*	Bone/horn/copper/bronze/shells/ amber/clay/jet/etc
Iron age (±800–50 BC)		
Wool clothing	Heddle Spindle (and whorl) Loom Needle Dye* Dye vessel* Rigid heddle Shears* Tablet weaving tablets	Wood, bone/horn/copper Wood, stone/clay Wood, fired clay Wood/bone/horn/copper/bronze Various plants, various mordants Fired clay/wood/iron/copper Wood Iron Horn/bone/wood
		Wool
Non-textile clothing related items	Pin for hair/cloak* Beads (on clothing)*	Bone/horn/copper/bronze/iron/ shells/amber/clay/jet/etc

Table 3.5 All objects and materials, grouped by chronology. Items marked with an asterisk (*) are associated with textiles but are not required to create a textile object. (Table by Sid Fitsch).

Tables 3.4 and 3.5 are both made with the purpose of researching textile processes when the textile objects themselves are not present in the archaeological context. Table 3.4 shows the difference between the type of objects, and can be used to gauge how directly relevant the finds are to textiles. By following the order as noted down, the finds with the most substantial information about textiles can be identified first, after which each step ensures that every possible option has been considered.

Table 3.4 does not cover any details about the objects except for the time period and tools and materials used, which allows it to be an easily accessible way to consider possible archaeological finds. The layout of the table also shows the combination of tools and materials used to create various objects, which can help to serve as an indicator of what possible processes or uses an archaeological find was part of.

While they are as important to the research of archaeological textiles as the tools and materials, pseudomorphs have not been added to table 3.5. This is due to the varying contexts they can be found in, making it difficult to classify them into the groups as currently represented. Instead, they should be looked at with their context in mind, to account for the chemical processes that turned them into pseudomorphs, and what environmental factors were necessary for this to happen.

Now that the various aspects of the textile economy have been explored, it is time to apply this information to existing archaeological sites. The order that will be worked in is based on the distinction that was made between archaeological evidence and implications, with textile finds being the first step, though also the least likely to find in many cases. This is based on Table 3.4.

In the next chapter, two case studies will be used to consider sites that have been widely published about, but for which textile finds have been few. Both case studies are examples of the Bronze- and Iron Ages, and will be considered through a ‘textile lens,’ using textile economy to deepen the understanding of the sites.

4 Results: case studies

In order to showcase the relevance of the tools, materials, and processes that have been discussed in chapters 2 and 3, this chapter will explore two case studies. To do this, two sites have been chosen that belong to the Bronze- and Iron Ages of the Netherlands. These sites have been researched before and information is available about them including details about the settlements, landscape, finds that have been discovered and likely subsistence economies. In these sites, there have been no textile finds, and not much consideration has therefore been given to any textile economy.

By considering finds through the lens of textile economy, information may be found about the people who lived at and around these sites that has not been considered before. This will be done specifically with the tables of chapter 3.

4.1 West Frisia

The first area that will be looked at in this chapter is that of West Frisia, a part of the Netherlands that was inhabited during the Bronze Age and has been researched over a long period (Roessingh, 2018, p. 17). This area consists of several specific sites, though for the purposes of the most complete information, data from the entire region will be considered as opposed to picking a single site.

West Frisia is an area in the north of the Netherlands, within the province of North Holland, as can be seen in figure 4.1. While the excavation history of this area is long, there are few notable finds of the Bronze Age specifically tied to the region. Much of the research is based on soil surveys, through which burial mounds and settlements have been discovered. Notable finds according to Roessingh (2018) are moon-shaped flint sickles, of which a West-Frisian example can be seen in figure 4.2.

Figure 4.1 The contemporary region of West Friesland highlighted on a map of the Netherlands. (Left). (Mechielsen, https://en.wikipedia.org/wiki/West_Friesland_(region)).

Figure 4.2 A moon-shaped flint sickle. (Right). (Rijksmuseum van Oudheden, inventarisnummer: g 1923/12.1, https://www.rmo.nl/collectie/topstukken/sikkel-3/).

Now that the area has been introduced, the textile-related finds will be discussed. Following Table 3.3, the first finds that are considered are actual textile finds and pseudomorphs. Unfortunately, within the archaeological record of the Netherlands, there is only a low amount of textile finds that have been uncovered. The Bronze Age is no exception, and while some small finds have been noted, they are more often found in the south and east of the Netherlands.

Examples are pseudomorphs, which have been found within pottery. This pottery was made in the Early Bronze Age, called the ‘Wikkeldraadbekercultuur’ or barbed wire ceramics. This culture is generally seen as a later phase of the bell-beaker culture, which was prevalent throughout a large part of western Europe

(Linden, 2024). The connection with textiles in the case of this pottery is that in some cases, the decorative shapes on the pottery were made by wrapping the clay with wires before firing (Kleijne, 2015, p. 61).

The next category to consider is that of textile-related tools. Various different objects have been found within this category, among which are spindle whorls and needles (Amerongen, 2016, p. 274), and awls (Kleijne et al., 2021, p. 37). While awls are technically most likely to have been used on leather over textile materials, their use is not mutually exclusive, especially in the case of clothing where both are present in a single outfit. The most resilient of the tools are made of metal, either bronze or copper; however, clay, bone, and wooden objects have been found in Bronze Age sites as well (Zijverden, 2017, p. 46-48).

Moving away from archaeological evidence of textile economy, the following finds are of tools that are indirectly linked to textiles. Among this list are sickles, which could be used to harvest cultivated crops as well as foraging (Roessingh, 2018, p. 25). While sickles cannot explicitly be stated to have been used in the production of textiles on their own, use-wear and organic residue can still indicate this type of use.

In a similar vein, the category for related materials contains a number of different finds that may indicate a part of textile economy, especially in combination with similar and more direct finds. Flax has been found throughout various parts of north-west Europe, including West Frisia. While flax is in comparatively far lower amounts than cereals, this may be explained by the removal of seeds in the process of making linen, as well as the low survivability of oil-containing plants in charred assemblages (Amerongen, 2016, p. 206). Other materials found that may imply use of textiles are bronze pins, for either hair or clothing (Kleijne et al., 2021, p. 37), bronze bracelets, golden rings, and amber beads (Kleijne, 2015, p. 65, 67).

On a larger scale, the use of land should be discussed, since this is in many cases one of the most well-researched aspects of sites. Cultivated flax has already been mentioned, however besides the crops that farms kept, people of the Bronze Age still had opportunity to forage, and of the plants that were foraged, a number is not edible and must therefore have been used for other purposes. One of these purposes is to dye wool, which likely happened in West Frisia as well as in other parts of north-western Europe (Amerongen, 2016, p. 244-248). Also mentioned by Amerongen (2016) is the exploitation of sheep, as seen through bone assemblages, which were likely not used solely for meat, but also for secondary products including wool. Also taken into account are the space and vegetation requirements of all farm animals, and despite no specific pastures having been identified, it is thought that there was space for grazing, and that this may have been done purposefully to shape the landscape as well as feeding the animals (Amerongen, 2016, p. 145-151). Sheep in West Frisia were likely not kept on an industrial level, though enough wool could be gained from the sheep for household amounts. This means that for larger textile needs, trade was likely (Amerongen, 2016, p. 158). Estimating the amount of space necessary to keep a herd is difficult, however through trends in deforestation in combination with sheep populations and the creation of heath environments, it may be theorised what space a herd was generally given.

The final category is of unidentified objects, which counts as the least promising indicator of textiles, due to their mysterious nature. As an example, particular conical objects have been found in various sites that have so far not yet been assigned a likely use. However, one of the most popular theories, due to their shape and other characteristics, is that they are weights for spindles (Naardin & Roessingh, 2020, p. 103-112). This theory can as of yet not be determined to be true or false, however it is worthy of mentioning as a possible textile-related tool. The unidentified object and all relevant finds that have so far been mentioned are listed in Table 4.1 at the end of 4.2.

Now that the indicators for the existence of some form of textile economy are discussed, another relevant aspect should be considered; people's basic need for clothing. By creating a hypothetical scenario of the

population of a site and their general activities, more insight can be given into what textiles they likely needed, which can be a starting point to consider both their own capabilities in textile production and in trade.

To do this, the first consideration should be the amount of people in a given area that require clothing. According to Roessingh (2018, p. 332), the farms were lived in and abandoned in phases, where at most an extended family would live there, and various members would leave for a variety of reasons. To again estimate an average, the hypothetical family consists of 6 people. The mixed economy of sheep herding, growing of crops, and foraging would have allowed people to process both wool and flax, of which each member of the hypothetical family will get three garments each. This allows for both rotation and layering. During the Middle Bronze Age this would have likely come from their own fields and animals, while in the Late Bronze Age various families or groups lived closer together, which would have caused them to share land and possibly the resources on the land. It may have been possible to gain all 36 garments from the farm's own resources, though the comparatively few amount of flax crops and the below-industrial size of sheep herds imply that not enough resources were available to create all garments in a single year.

Also necessary are a spindle to create thread, and loom weights to weave the thread into a garment. Various of these tools have been found, meaning that both spinning and weaving could have been done in the farm, though if not enough flax or wool was available to create textiles, spinning and weaving may have been outsourced through trade, since a textile or even spun yarn are easier to transport than raw materials. Various bronze and amber objects have been found at Bronze Age sites in West Frisia, which confirm that some type of trade happened. Conversely, if flax and wool were harvested in a year where the creation of new textiles was not necessary, the raw or spun materials may have been kept for a later time or traded away for things like the aforementioned bronze and amber.

4.2 Someren

The second case study is a slightly later period, and concerns the Iron Age settlement and burials of Someren. This area is in the south of the Netherlands, in the province of Noord-Brabant (Figure 4.3 and Figure 4.4). Several burials have been researched, with various degrees of documentation. In Someren-Kraayenstark, for example, some pottery, human remains, a ring, and a sword have been found. However, only the location of the pottery is currently known, while the human bones have been seemingly lost, and the only documentation mentioning the sword is a drawing by W. Kam, who purchased it from the original workers that discovered the site (Van der Vaart-Verschoof, 2017, p. 216). Another iron sword was found in Someren-Philipscamping, this one has been deemed too degraded for further research site (Van der Vaart-Verschoof, 2017, p. 218).

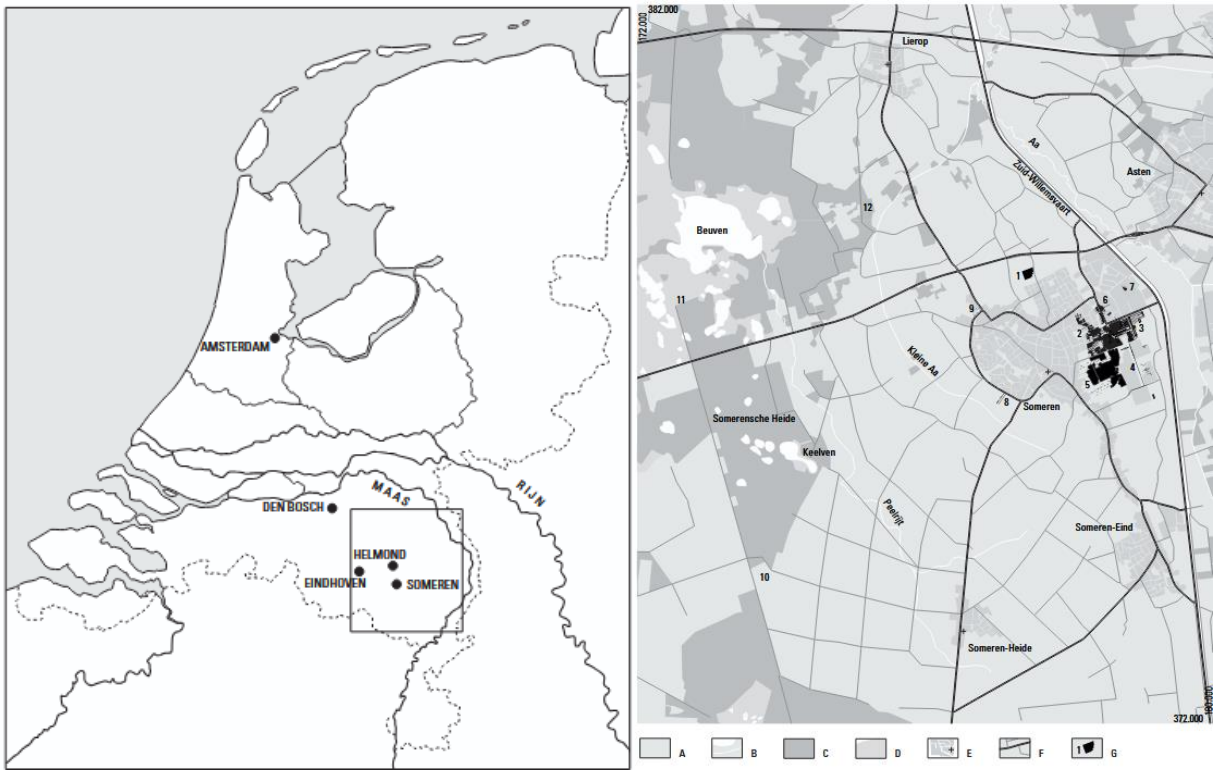

Figure 4.3 (Left) the geographic location of Someren within the Netherlands. The marked area is shown in Figure 4.4. (De Boer & Hiddink, 2009).

Figure 4.4 The region of Someren (right). The sites in and around Someren have been indicated with a number. 1 Someren-Ter Hofstadlaan; 2 Waterdael I/II; 3 Hoge Akkers; 4 Kievitsakkers; 5 Waterdael III; 6 Witvrouwenbergweg; 7 SRV-terrein; 8 Ripsvelden; 9 Lieropsedijk; 10 Kraaijenstark; 11 Hoenderboompaal; 12 Philips-camping. (De Boer & Hiddink, 2009).

Both graves and arable fields were discovered, indicating a settlement. Of the finds that have been researched, none fit into the list of archaeological evidence. The first items that can be categorised are in the list of archaeological implications, and consist of pottery shards found at various graves (De Boer & Hiddink, 2009, p. 73-74; Hiddink & De Boer, 2011, p. 179). While most are too small and fragmented to consider a connection to textiles, similar pot types have been found in graves, containing food-type residue. This is due to graves in many cases being filled with burnt materials of various origins. The food residues are what may indicate a relationship to textiles, if they were usable in the dyeing process of wool.

In the category of related materials, more finds have been discovered. These are largely objects of personal ornamentation, including glass bracelets of the La Tène type (De Boer & Hiddink, 2009, p. 92-93), and a 'hair needle' (Hiddink & De Boer, 2011, p.165), likely a hairpin that was used to style hair or fasten clothing. Lastly, some flax seeds were found in the pollen assembly, used for either oil, fibre, or both (De Boer & Hiddink, 2009, p. 100, 109-110). These were found in a Roman pit, though the used dating methods and continuity of the settlement the exact line between the late Iron Age and the early Roman age is somewhat unclear.

The land use points to some form of textile economy as well, through the earlier discussed flax finds, as well as several plants that were foraged, possibly including ones that were usable for textile dyeing. Sheep were being kept as well, as seen from unfossilised droppings. In these droppings, heath plants were found, indicating that shaping of the land through grazing happened here. This seems typical when compared to other Iron Age sites (De Boer & Hiddink, 2009, p. 109-110). The close location of the gravesites to the arable fields also implies that the mounds were cared for through the grazing of sheep and possibly other farm animals.

For the last category, one unidentified object was found. This object is small and circular, made of bone. Various theories for the use and identity of the object were mentioned, though the authors of the report favour the theory that it is a part of a distaff (Hiddink & De Boer, 2011, p. 165-166), which was used to hold the fibres during the spinning process. The textile-related finds of Someren are mentioned below in Table 4.1.

As in chapter 4.1, a hypothetical group of inhabitants will be used to give some more perspective to the possible textile economy of the site. Based on the farms and gravesites of Waterdael III in Someren, an estimation was made of a population of 9 people per farm in the middle- and late Iron Age (Hiddink et al., 2012, p. 68). To outfit each person with three linen garments and three wool garments again, this would require 54 garments in total. While this may seem much, these garments should be expected to have been made over the course of years, assuming that the entire family did not require a new set each year and clothing items could last a while.

Similarly to the West-Frisian sites, both flax and wool were possible to cultivate as raw materials, though flax was found in small amounts and sheep seemed to be in similar quantities as contemporary sites (Hiddink & De Boer, 2011, p. 240), though this is based on graves and may not directly equate to the size of the herd. A large amount of raw materials was necessary to create this many garments, however no tools have been found that would be necessary to process the raw materials.

While this cannot prove that they did not exist here, if it is to be believed that the flax and wool were not processed at the site, this would imply that trade was extremely important to the people of Someren. Possibly, raw materials were spun into thread and traded, outsourcing the weaving and sewing parts of textile-making, while dyeing of the wool was possible at the site through the foraged plants.

Area	**Archaeological evidence**		**Archaeological implications**	
West Frisia (Bronze Age)	Textiles and pseudomorphs	N.A.	Indirect tools	Sickles
	Textile tools	Spindle whorls, needles, awls	Related materials	Bronze bracelets, gold rings, amber beads
			Land use	Foraged plants (edible and inedible), sheep, heath land, arable fields
			Unidentified objects	Possible spindle whorls (conical clay objects)
Someren (Iron Age)	Textiles and pseudomorphs	N.A.	Indirect tools	Pottery sherds
	Textile tools	N.A.	Related materials	Glass bracelets, hair ‘needle’, flax seeds
			Land use	Foraged plants, arable fields, heath plants, sheep
			Unidentified objects	Possible bone distaff part

Table 4.1 Overview of archaeological finds relevant to textile research. (Table by Sid Fitsch).

4.3 Conclusion

When the two case studies that have been discussed this chapter are considered, there are many finds that point to various parts of textile economy. The most unambiguous finds are generally preferred to determine what uses of textile were possible and likely, though the existence of various indirect indicators can be used to consider the most likely scenarios in the absence of actual textile finds.

In the case of West Frisia, this means that not only were various objects found whose purpose is either the making or using of textiles, it also means that through considering the other variables it is very likely that different parts of the textile economy were happening during the Bronze Age. Since both sheep and flax were being kept in low numbers it is not probable that West Frisia was part of a large textile industry, though the people at the time were adequately prepared for at least the making household textile items. The probably mixed subsistence economy implies the same, with the possibility of less woven textiles having been used compared to contemporary settlements, and instead more use of leather from hunted animals.

Someren, on the other hand, shows a different textile economy. Both flax and evidence of sheep were discovered, though flax in low amounts and sheep in larger numbers. In combination with the various graves and the keeping of heath landscapes during both the Bronze- and Iron Age, it is possible that wool was a far larger focus than linen clothing. This could have been traded as a raw resource, or spun wool. It is possible that wool was processed further, however no indicators of this have been found so far.

This way of researching sites that do not have textile remains adds information about both textiles and the general day-to-day economy that cannot be seen at first glance. This provides context clues into aspects of life from sites, and while no explicit statements can be made about textiles that were not made before, new theories might be made or existing theories might gain or lose plausibility through the indicators that textile research can give.

5 Discussion

In this chapter, both the list of variables and the results of the case studies will be summarised and discussed. In the review in 5.1, the methods are evaluated and the results interpreted. Some limitations will be mentioned as well. 5.2 is used to consider future research potential, in which the tables of Chapter 3 can be applied, as well as ways in which this method could be expanded on and improved.

5.1 Review of the results

The case studies of Chapter 4 have shown that even sites in which no textile finds have been uncovered can be researched with textiles in mind. Through the use of the tables of Chapter 3, the various tools, materials, objects, and other necessary steps within the textile economy were identified, already showing that textile research can be done without the finds category itself present. Through the identified components, some theories could be constructed concerning the creation and use of textiles in both case studies. These showed that even within sites that are relatively close in both time period and location, the possibilities in textile economy can vary much.

The information of Chapter 3 was compiled specifically to research the Bronze- and Iron Ages of the Low Countries, however it is already broad enough to apply to more contexts. The tables could be modified without difficulty to apply to various locations and time periods. The condensed nature of the tables makes them easy to reference and change to suit the needs of different archaeological research goals. The tables could even function to contextualise finds and sites that are documented to be rich in textiles, since they apply to various aspects of life related to textiles.

While the tables could be successfully applied to research two case studies and construct theories about their textile economies, some limitations should be noted.

First, while many tools for the creation of textiles were already discussed, there are various items that could still be added. Flint as a category was only briefly mentioned in the shape of scrapers and burin, however these are only a few examples of how lithics were relevant to daily life throughout prehistory and within the textile economy.

Second, tools that are largely known in the archaeological record were noted in the tables, however there are tools that have unclear origins or which are largely undocumented, which makes it difficult to note them in a list. Examples are distaffs and various shapes of needles. The tables of Chapter 3 are useful for quick referencing, however their unnuanced nature makes it difficult to note down these tools, other than giving them their own category in Table 3.4. This makes it more difficult also to apply the tables to contexts that require more nuance, like in the case of unidentified objects that may be a textile-related tool, but which have not been confirmed.

Lastly, some difficulty was noted in gathering some of the data. This was what made quantifying some of the materials difficult, and what allowed only hypothetical scenarios to be made.

5.2 Further research potential

Though already mentioned in 5.1, it is my opinion that the limited quantitative data that could be used in this thesis also shows an opportunity for future research. Through experimental archaeology, more clarity could be gained about how much flax is necessary to gain enough fibre for a garment, what methods of processing have various effects on the fibres, etc. Similarly with wool, the amount of thread that can be gained from a single

sheep, how many were likely in a herd and the scale of wool use and production compared to the size of a settlement could be researched in more detail.

More broadly, the guide that has now been made through Table 3.4 and Table 3.5 could be expanded on. With more information about time periods and locations, as well as their limitations, the tables could be used for more specific context and wider ones, or even be used to compare locations and time periods through their textile economies.

To do this, a database could be created of finds, known land use and more relevant information, which could be used to base the tables on. This also ensures that the data is easily referenceable, can be updated when necessary and no extra information, nuance or unclear aspects are lost.

6 Conclusion

Throughout this thesis, the main theme has been the way textiles can be understood better through archaeological research, as well as how they can expand the archaeological understanding of the Bronze- and Iron Ages of north Europe more broadly. In this final chapter, the thesis will be summarised, and the research questions discussed once more. Lastly, my hopes for future research within the field of archaeological textiles will be mentioned.

6.1 Summary

This thesis was introduced by considering the current way textiles are viewed and treated. Specifically the concept of fast fashion, how it contributes to the pollution of the planet, and the general disregard there is in present times about textiles. Especially this last point is interesting, since people are dependent on textiles in many ways, and use them both consciously and unconsciously. Through understanding textile economies, people can be understood better, which works similarly in archaeological contexts. The research problem was introduced, as well as the research questions, in which it was noted that while textiles themselves are a useful finds category, they are not resilient and therefore difficult to research.

In Chapter 2, the importance of textiles to archaeological research was considered. This was done with the use of three important aspects of daily life in archaeology: identity, craftsmanship, and subsistence. All three impact the use and creation of textiles, and while subsistence economy has the main emphasis in this thesis, the other two aspects still shape textile economy, though often in more abstract ways.

Chapter 3 was used to explore how research into textiles can help further the archaeological understanding of the Bronze- and Iron Ages in northern Europe, especially when considering the general lack of textile finds in this period and location. This was divided into the tools that are used to make different textile objects, as well as what materials are necessary to do so. A brief mention was also given to the use of land with regard to arable fields, sheep herding, and population density. This was followed by some information about pseudomorphs, which are not only a more direct form of evidence for the existence of textiles, they also serve to help contextualise their use. Lastly, two tables were used to translate this information into an easily referenceable list of items.

The results of using the tables were shown in Chapter 4. In this chapter, two case studies were used to show how researching textiles through tools and materials can answer questions about both textile production and more broadly the use of subsistence economy. Some theories could also be made to give an idea about the possible textile economies of the sites, and how they differ in location and time period.

The results were discussed in chapter 5, in which also the limitations of the research were mentioned and the potentials for future research.

6.2 Answer to the research questions

The main research question was the following:

How can archaeological textiles and textile production contribute to the contextual understanding of subsistence economy in the Bronze- and Iron Age in North Europe?

Due to the broad nature of this question, this has been divided into the following smaller questions. Both the questions and the answers to them are stated below.

Which textile types were produced in the Bronze and Iron Age of North Europe?

Various textile types were produced, of which several have been mentioned in this thesis, mostly in Chapter 2. The focus so far has been mostly on clothing, which came in the form of skirts, cloaks, shirts, dresses, and woven bands. Also mentioned are blankets, bags and swaths of fabric that could be traded, used as-is, or made into different objects. Lastly, in grave contexts various textiles have been found, likely to wrap grave goods and possibly the buried person in. Scraps have been used or reused to aid other objects, like pieces of fabric stuffed into axe-heads. More objects are possible, though they have not been discussed in this thesis.

Which objects related to textile production are known from the archaeological record and what was their function?

This category is broad and has been extensively discussed in Chapter 3. Objects like needles, awls, and shears are documented and have similar uses to modern times. Objects like spindle whorls and loom weights are the resilient parts of tools that are left in the archaeological record, which were used to aid spinning of thread and weaving respectively. Other objects like ceramic pottery, flint tools, and dyestuffs are not strictly textile tools, however they have been associated with textiles and have been documented as tools to create textiles.

Where and how would Bronze- and Iron Age people in North Europe have procured their raw materials for textile production?

Many of the raw materials could be sourced locally, through cultivation of flax and sheep herding. Various plants for dyeing could be foraged, as well as materials that could be used to make textile tools. Other materials could be procured through trade, such as metal objects like copper and bronze, amber for ornamentation, and wool and flax could be traded in larger quantities if the site worked only in household amounts rather than industry levels.

Through answering the sub-questions, the main research questions can be answered. By looking at the use of raw materials and tools, an indication can be given of the use of textiles at a site, which in turn can contribute to the understanding of the broader economy. Due to the intersectionality of textile production and use with other aspects of daily life, the archaeological understanding of the Bronze- and Iron Ages of north west Europe can be expanded.

In future research, I hope that textiles will be considered an important aspect of archaeology, and research into them found relevant even when few or no textile finds at all can be found. Much information can be gained when considering sites through a lens of textiles. How intertwined they are with other aspects of life is shown in the influence textiles have over — and are influenced by — identity, craftsmanship, and subsistence economy.

Abstract

Textiles are important archaeological finds on their own, and through their connection with other finds and more abstract concepts of daily life. However, they can be hard to research due to the lack of resilience of textile materials in the archaeological record. This means that textiles can be overlooked in favour of finds that are preserved better, creating a lack of awareness and acknowledgement of how relevant the textile economy is to understanding the lives of prehistoric people.

This thesis aims to showcase the importance of textiles in the archaeological record and shows how to research sites from the Bronze- and Iron Ages of the Low Countries with textiles as the main focus. The main research question is: *How can archaeological textiles and textile production contribute to the contextual understanding of subsistence economy in the Bronze- and Iron Age in North Europe?*

The answer is sought by outlining why textiles are relevant to the understanding of people from the past, through three important aspects of life; identity, craftmanship, and subsistence economy. Subsistence economy has a direct connection to the tools and (raw) materials that were used to create textile objects.

These materials and tools are the main focus of the research, and serve as a proxy when there are no or few preserved textile finds. A referenceable outline is made to identify the tools and materials that were necessary or otherwise relevant to textile production and use, with tables that cover chronology and materials. The finds are divided into two lists: archaeological evidence and archaeological implications. These tables and lists are then used in two case studies, which are the Dutch sites of the West Friesian Bronze Age and Iron Age in Someren respectively. By considering these sites with textile economy as the main focus, new insights can be gained into both the use of textiles themselves, and the implications this has on the wider economy of the sites.

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