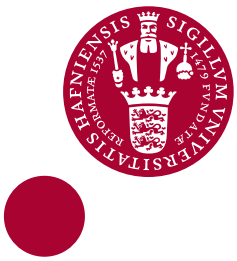

Unravelling the confusions: Defining concepts to record archaeological and historical evidence for knitting

Malcolm-Davies, Jane Anne; Gilbert, Ruth; Lervad, Susanne

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Editorial

Welcome to the diamond issue of the *Archaeological Textiles Review* 2018. It is an achievement worthy of celebration to have kept an independently-funded peer-reviewed journal up and running for 60 issues. We endeavour to strike a tone which embraces both scholarly articles and current affairs in textile-related matters. We are pleased to report that we are still going strong thanks to the staunch support of the Friends of ATR, which we very much value. Many thanks to you all!

For the ATR team, 2018 has been a turbulent year. Ulla Mannering has been on a long-term sick leave, but is now fully recovered and back on track. This is also why there has been no Annual General Meeting of the Friends of Archaeological Textiles Newsletter this year. We will provide more information about the next AGM on our homepage www.atnfriends.com at the beginning of 2019. Further, Ursula Rothe has left the editorial board and suggestions for a new, preferably native English speaking, editor are welcomed, and can be emailed to evaandersson@hum.ku.dk.

This year's issue is primarily dedicated to the study of knitwork with articles on protocol and terminology, and evidence for the craft's origins and development. The nine joint articles by Jane Malcolm-Davies, Ruth Gilbert, Susanne Lervad, Helena Lundin, Lesley O'Connell Edwards, Annemarieke Willemsen, Maj Ringgaard, Sylvie Odstrčilová and Rosalind Mearns are important contributions to the formation of a more standardised way of addressing and describing knitted items in an archaeological and historical context. We hope that readers will appreciate this initiative and continue the scholarly development of our scientific languages, which are imperative for modern textile research.

While this issue concentrates on knitwork, the editors would like to bring needle binding into better focus. We encourage our readers to submit articles about this technique for future issues. This issue presents five project descriptions about on-going and up-coming textile research projects. It is inspirational to see how textile research and the many excellent researchers working within this field are capable of creating new and innovative projects that successfully generate large sums of external funding.

We welcome new contributions to forthcoming issues and encourage you to send them to us as they are ready, so that we may spread the editing work over the year and have time for the peer review process. The deadline for contributions is **1 May** each year. Please also remember to send us news of projects, PhDs, publications and conferences, so that we can continue to be a hub for the archaeological textile community.

The Editors

Klaus Tidow celebrates his 80th birthday

Beautiful summer weather provided a wonderful backdrop for the handing over of a photo album to celebrate Klaus Tidow's 80th birthday on 15 July 2018 in Neumünster. Fit and joyful, Klaus and his wife Dörte arrived by bike. It was a great pleasure to see

Klaus at all the symposia, meetings and workshops that have been documented in this photo album that also impressively demonstrates Klaus' long working life.

It is clear that NESAT would take up a lot of space in the photo album. After Susan Möller Wiering had recited a multi-verse poem about Klaus, an ice cream was needed to cool the emotions. Thanks to Annette Siegmüller and Christina Peek from the The Lower Saxony Institute for Coastal Research in Wilhelmshaven, who all helped with the compilation of the photo album and to all colleagues who contributed photographs. Klaus is still actively involved in textile archeology. Nevertheless, it is good to know that he has deposited his most important works and records in digital format with me for safe keeping. We all hope that on his 90th birthday we will be invited back for more ice cream!

Johanna Banck-Burgess

Jane Malcolm-Davies, Ruth Gilbert & Susanne Lervad

Unravelling the confusions:
Defining concepts to record archaeological and historical evidence for knitting

Abstract
Evidence for the development of knitting as a craft and industry is not as readily available as it is for weaving. The reasons for this include the relative scarcity of the archaeological and historical material, its inaccessibility due to incomplete or inaccurate cataloguing, and the lack of agreed terminology for a scholarly discussion. This paper proposes a vocabulary based on English terminology used in textile analysis, in craftwork and in the mechanised knitting industry today. A recording protocol is required to provide reliable descriptive detail for those who cannot view the items for themselves and to offer a sound foundation upon which later observers can build with further insights. This paper aims at a protocol for recording knitted items which may be used as a guideline by experts and non-experts in textile analysis of knitwork. It cautions against deductions as to methods of construction without credible evidence and calls for more discussion of appropriate terms in English and other languages.

Keywords: Textile, knit, terminology, protocol, dossier, analysis

Introduction
Good practice in terminological work is based on an analysis of the relevant concepts, the identification of appropriate terms to assign to these concepts, and the development of definitions. There may be a need for the creation of new terms and for translation into other languages (Dury & Lervad 2016, 1). A variety of terms representing the concepts may be synonymous (Dury & Lervad 2016, 3). It is not always necessary to have prescriptive terminology or to outlaw previously used terms which convey meanings for specific concepts in other contexts. Published knitting instructions, for example, serve a different purpose to museum catalogues. Conventions used in instructions rely on a cultural understanding of the practice of knitting and, aside from the language in which the instructions are written, require translation from word to action. Knitters learn that words may need interpretation across geographical and cultural conventions. Their priority is finding the appropriate actions to create/recreate a knitted item. A new scholarly language for recording the evidence of knitting should be authoritative but need not become the standard in other contexts. The requirement in an academic context is to describe the items accurately in a way that may be understood by scholars. There is no need for words to translate into actions. Indeed, the difference between description and prescription is key. The language used cannot therefore rely on the practical expertise of an experienced knitter or the understanding that words may mean one thing in one place and another elsewhere.

The search for terminology
Best practice in the definition of textile terminology has been established in several projects (notably in Scandinavia) which take an inclusive approach to identifying concepts, terms and meanings. This provides a broad base from which to select the most helpful terms. In contrast to words (or "general language"), an agreed terminology is a "special" or subject-specific language, which aids clear communication (Humbley 1997, 14). Some of these web-based resources include international and literary

references, which shed light on the origin, etymology and use of terms, facilitating cross-cultural analysis of textiles (see, for example, textilnet.dk). Thus far, none of these resources has tackled archaeological or historical knitting terms with the rigour required for academic application.

Textilnet.dk identifies the key concepts to define as: the tools; the materials; the techniques used to construct and decorate the fabric; and the product of those techniques with all its features. There are many useful sources in English to draw upon (Thomas 1943; Emery 1994; Phipps 2011) in addition to the international standard which defines some basic knitting concepts (ISO 4921:2000).

Knitting may be performed by hand or by machine – the pulling of a new loop through a previous loop is common to both. In contrast to the succession of loops worked from one needle to the other in handknitting, a knitting machine has one needle for the top loop of each **wale** (the vertical column of loops), which increases the speed at which the fabric is formed (Black 2012, 62). The international standard for knitted fabric was developed primarily for the modern mechanised knitting industry (ISO 8388:1998). Although this proposal is primarily concerned with handknitting, it is desirable that the terminology be, as far as possible, applicable to machine-knitted items too. Knitting machines, including William Lee's 16th century frame, employed the same fundamental action as handknitting – termed weft knitting in industry because the yarn is fed horizontally to form rows of loops (Miller 1992, 12). The structure of handknitted and weft machine-knitted fabric is the same. Warp knitting, patented in 1775 (Spencer 2001, 9-12), may only be achieved by machine and has no equivalent in handknitting. It employs multiple continuous yarns which are interlinked laterally, which distinguishes it from true knitting (Miller 1992, 100). A photographic method for "differentiating between handknitting, frame knitting, v-bed knitting and Cotton's patent knitting" has been published and tested (Cooke & Tavman-Yilmaz 1999).

Much of the terminology proposed here has been developed in collaboration with scholars, knitters, textile technologists and terminologists working in several languages. It has also been discussed as part of the *Knitting in Early Modern Europe* (KEME) citizen science project. The terms shown in **bold** are those currently proposed but it is anticipated that further collaboration will permit these to be refined. The aim is for it to serve a similar purpose to Linnaean classification of the natural world; the Latin names are not used in common parlance but ensure a reliable basis for communicating exact information among specialists.

Proposed terminology and its use

The hand tools for knitting are usually referred to as **needles,** sticks, wires or pins (see tables 1 and 2 for all terms shown in bold). An inclusive definition of knitting needles covers a range of variants. It is helpful to note that without the needles being recovered with or within a knitted item, it is usually impossible to state with certainty how many needles were used (for a rare exception, see Gilbert 2012, 95) or what form they took, although there must be more than one for back and forth knitting and more than two for round knitting (see below). This discussion of tools illustrates one of the requirements of terminological work: the need to categorise. If the tools may be defined as needles, the recognition that there are various types of needles allows for further definitions to be added and permits variants to be incorporated, if necessary.

The **material** used, known as **yarn,** is "any assemblage of fibres or filaments which has been put together in

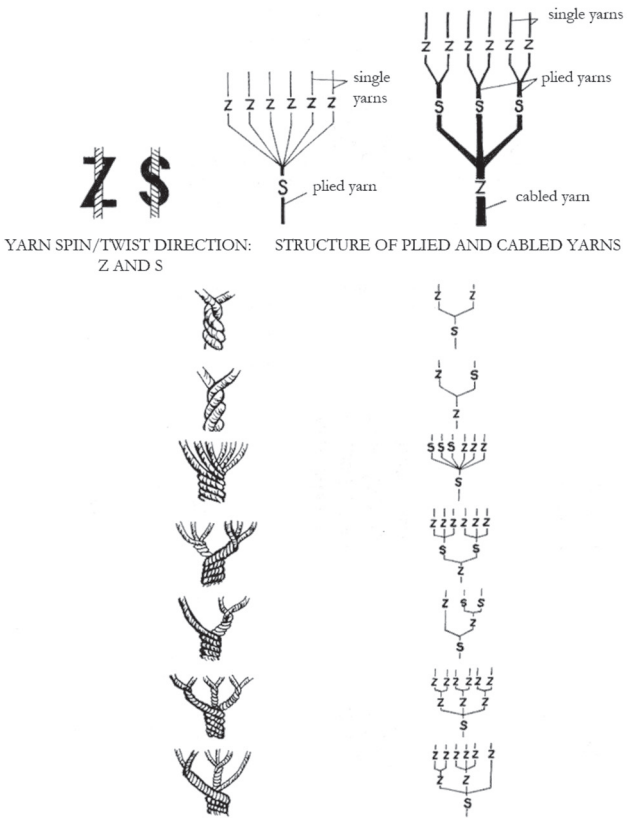

Fig. 1: The structure of yarns (Image: after Michałowska 2006; with thanks to Malgorzata Siennicka & Sidsel Frisch)

Table 1: Summary of proposed key terms for basic description of knitwork. This terminology will expand to cover more complex structures in the future.

Concept		Discussion points, variables, references	PROPOSED TERM - English
Tool	Needles (two or more than two)	Sticks, pricks, wires, pins	NEEDLES (plural)
		Double-pointed	
		Single-pointed	
Material	Yarn	Applies to all fibres (Emery 1994, 10)	YARN
	Fibre	Animal, plant, mineral or synthetic (Emery 1994, 4-5)	FIBRE
	Fibre or yarn as structural element	Element (Emery 1994, 8)	ELEMENT
Element structure	Single (spun or not spun)	(Emery 1994, 8)	SINGLE
	Spin/twist direction	(Emery 1994, 11)	SPIN (S, Z) for single yarn; TWIST for plied
	Spin/twist angle (degrees from vertical)	(Emery 1994, 11)	SPIN ANGLE for single yarn; TWIST ANGLE for plied
	More than one (spun or not spun) combined or plied	(Emery 1994, 8)	COMPOUND
	Compound (spun or not spun) but not twisted together	(Emery 1994, 8)	COMBINED (I)
	Compound and twisted together	(Emery 1994, 10)	PLIED (S, Z)
	Ply	(Emery 1994, 10)	PLY
	Number of single yarns	(Emery 1994, 11)	2-PLY, 3-PLY etc
	Additional twist	Re-plied (Emery 1994, 11)/cabled (Eastwood & Walton 1998, fig 3, 12)	CABLED
Method of working	In a continuous spiral	Knitted in rounds	ROUND
	Back and forth in the same plane - including turned/not turned	Straight rows (Phipps 2011, 50)	BACK AND FORTH
Form	Form of item	Tubular, conical, discoid, "square, rectangular, or otherwise shaped" (Emery 1994, 30)	As appropriate
Orientation	Top/bottom		TOP/BOTTOM
Fabric features	Starting edge	Casting on or binding on (Hemmons Hiatt 2012, 656)	CAST-ON EDGE
	Finishing (locking) edge	Casting off or binding off (Hemmons Hiatt 2012, 656)	CAST-OFF EDGE
	Unfinished edge	Cut/torn/decayed	EDGE
	Turning edge	Secure edge (ISO 4921:2000:3.3.2)	SELVEDGE
	Loop	Stitch	LOOP
	Column/s of vertically aligned loops		WALE/S
	Course/s of element through horizontally aligned loops		COURSE/S

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Concept		Discussion points, variables, references	PROPOSED TERM - English
	Gauge (US)/Tension (UK)		GAUGE
		Wales x courses per 10 cm square or inch square	LOOP DENSITY
		(W per cm x YD) + (C per cm x YD) divided by (W per cm x YD) x (C per cm x YD), where W is wales, C is courses and YD is yarn diameter	COVER FACTOR
	Surface of fabric	Right/wrong sides	RECTO/VERSO
	Surface of item	Inside/outside	INSIDE/OUTSIDE
	Flat side or worked loop	Right/knit/plain stitch in fabric	FACE LOOP
	Ridge side or worked loop	Left/purl stitch in fabric	REVERSE LOOP
	Shaping	Addition of wale/s	INCREASE (noun)
		Removal of wale/s	DECREASE (noun)
	Start/finish of round	Step/jog (Hemmons Hiatt 2012, 32; Stanley 2001, 31)	JOG
	Decoration worked as part of fabric structure, whether loop formation or colour changes	"Stitch patterns" (Stanley 2001, 19); "decorative stitch technique" Hemmons Hiatt 2012, 660	STITCH/COLOUR PATTERN
	Decoration applied to the fabric	Ornamentation	EMBELLISHMENT
Fabric structure (as observed)	One surface of face and the other of reverse loops	Plain/Stockinet[te]/Jersey	SIMPLE KNIT FABRIC
	Two surfaces each of alternate courses of face and reverse loops	Garter stitch	SINGLE RIDGE FABRIC
	Enumerated courses of face/reverse loops		RIDGE FABRIC
	Two surfaces of alternate wales of face and reverse loops	Single rib	SINGLE RIB FABRIC
	Enumerated wales of face/reverse loops		RIB FABRIC
	Fabric made with two elements of the same yarn in various configurations, one working and one carried across either surface of fabric		TWINED KNIT
Finish			MATTED
			FULLED
			NAPPED
			SHORN
Colour			**NATURALLY PIGMENTED**
			DYED
Process/action	Construction of fabric	Knit	WORK
Descriptor			KNITTED
Product		Under construction/finished	KNITWORK

Table 2: *Dossier de recensement* or protocol for recording early knitwork based on Centre International d'Etude des Textiles Anciens (CIETA)'s textile analysis system

1	**Item identification**	
	Location where the item is currently held	
	Inventory/accession number	
	Object name (in official record)	
	Source/find location (if known)	
	Provenance (if known)	
2	**Item material & yarn structure**	
	Details of each yarn, including those in fabric structure and sewing or embellishment, as follows:	
	Fibre: animal, plant, mineral, synthetic (wool, silk, linen, cotton, metal, acrylic etc)	
	Fibre diameter (in microns based on 100 measurements, if possible)	
	Yarn diameter based on at least 10 measures with range stated	
	Yarn analysis, as follows:	
	Single or compound elements	
	If compound, combined, plied or cabled	
	If compound, number of single component yarns	
	For each yarn:	
	Single yarn diameter/s based on at least 10 measures with range stated	
	Single yarn spin direction (Z, S, I) "I" indicates no visible spin	
	Single yarn spin angle/s (0-45 degrees) based on at least 10 measures with range stated	
	Plied yarn diameter/s based on at least 10 measures with range stated	
	Ply twist/s direction (Z, S, I)	
	Ply angle/s (0-45 degrees) based on at least 10 measures with range stated	
	If cabled, number of plied yarns, twist & twist angle based on at least 10 measures with range stated	
3	**Fabric structure**	
	One yarn:	
	Simple knit (yes/no)	
	Single ridge (yes/no)	
	Ridge fabric (with enumerated courses of face/reverse loops)	
	Single rib (yes/no)	
	Rib fabric (with enumerated wales of face/reverse loops)	
	Other combination of face and reverse loops (with chart/diagram, as necessary)	
	More complex structures (with chart/diagram, as necessary)	
	More than one yarn:	
	Twined knit (yes/no)	
4	**Fabric features**	
	Surface designated recto with reason (with chart/diagram as necessary)	
	Surface designated verso with reason (with chart/diagram as necessary)	
	Designated working direction with reason	
	Loop height (average based on a minimum of 10 loops)	
	Loop width (average based on a minimum of 10 loops)	
	Gauge: count wales and courses, as follows:	
	Wales (count horizontally) per 10 cm or inch	
	Courses (count vertically) per 10 cm or inch	
	Course to wale ratio = course count divided by wale count expressed as n:1	
	Loop density = wales x courses per 10 cm square or inch square	
	Cover factor = (W per cm x YD) + (C per cm x yd) divided by (W per cm x YD) x (C per cm x YD) W refers to wales, C to courses and YD to yarn diameter.	

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	Cast-on edges (yes/no & description)	
	Cast-off edges (yes/no & description)	
	Selvedges (yes/no & description)	
	Cut edges (yes/no & description)	
	Torn edges (yes/no & description)	
	Decayed edges (yes/no & description)	
	Shaping: number of increases (locations & type/s - cite evidence in full)	
	Shaping: number of decreases (locations & type/s - cite evidence in full)	
	Embellishment	
5	**Item form & construction**	
	Form/s: Tube - (two edges, two surfaces) or plane (one edge, two surfaces) Shape/s (disc, square, rectangle, triangle, otherwise etc) with diagram, as necessary	
	Designated top/bottom with reason	
	Dimensions of item (with diagram, as necessary), as follows:	
	Length (maximum/minimum, if appropriate)	
	Width (maximum/minimum, if appropriate)	
	Depth (maximum/minimum, if appropriate)	
	Designated inside	
	Designated outside	
	Weight (grams or ounces)	
6	**General overview**	
	Finish: Matted (yes/no)	
	Finish: Evidence of fulling, napping, shearing (yes/no & description of evidence)	
	Colour/s: Archaeological brown - yes/no (light, dark, further details)	
	Colour/s: Munsell, CIELAB or a similar colour recording system definition	
	Natural pigmentation (yes/no & description)	
	Dyed (yes/no & description)	
	Sewn seams, fastenings, evidence of wear or use, damage, repairs, mistakes/anomalies, marking, additions, writing, evidence of conservation work	
	Further observations (including number of parts, pattern sections, shaping, seams, hems, gussets, neckband, finishes)	
	Drawing/s completed (yes/no)	
	Photographs taken (yes/no)	
7	**Interpretation**	
	Deductions as to the technique/s used to make the fabric with appropriate evidence, as follows:	
	Hand/machine/indeterminate	
	Round	
	Back and forth (turned/unturned)	
	Working direction (with evidence from cast on, cast off, increases, decreases)	
	Fleece characteristics: modern fine fleece is usually interpreted as less than 20.6 µ, medium from 22 to 29.3 µ, coarse from 31 to 34.4 µ and very coarse more than 36 µ	
8	**Further information**	
	Object description (in official record): take photocopy, photograph or pdf, if possible	
	Comparable items (locations and accession numbers)	
	Relevant literature (full references)	
9	**Examination record**	
	Name of examiner (first name & surname, affiliation with contact details)	
	Place of examination	
	Date of report	

a continuous strand suitable for weaving, knitting, and other fabric construction" (Emery 1994, 10). This material may be identified as animal, plant, mineral or synthetic (Emery 1994, 4-5) or more precisely as **fibre**, such as wool, silk, cotton, metal or acrylic.

The **structure** of yarn for knitting may be **single** or **compound**, **combined** (two or more **elements** used as a unit but not twisted together), **plied** (two or more single elements twisted together to form a two-ply, three-ply etc yarn – Phipps 2011, 59) and/or re-plied (two or more plied elements twisted together – Emery 1994, 10) also known as **cabled** (Walton & Eastwood 1988, 12) and for each **spin or twist** its S or Z direction may be discernible (Emery 1994, 10). Conventional methods of indicating the hierarchy of the spin and ply may be incorporated in this system as in, for example, an uppercase S or Z for the final twist (Splitstoser 2012, 9) or represented diagramatically (fig. 1). "No high degree of accuracy is possible in the measurement of yarns in a fabric … [nevertheless] even such approximate measurements as are possible can be extremely valuable and are, in fact, necessary for full description and comparison" (Emery 1994, 10). Both the yarn and its component elements may be measured to provide their diameters and **spin or twist angles:** the spin angle of single and the twist angle of plied yarns. The diameter is measured perpendicular to the length of the yarn and the angle likewise (Emery 1994, 11-12). A loose spin/twist is up to 10 degrees, medium from 10 to 25 degrees and tight 25 to 45 degrees (Emery 1994, 12). Both these dimensions are best calculated as the average of at least ten measurements with the range of values stated.

While the above terms are helpful for discussing characteristics of the material which are visible to the naked eye, there are further features at the micro level which offer valuable data too. Conventionally, the diameter of the fibres or filaments which compose the yarn is recorded as an average of 100 fibre diameters (Ryder 1983 & 1984; Gleba 2012; Rast-Eicher & Jørgensen 2013). Such measurements may permit conclusions to be drawn about the source material – for example, wool fibre diameter is an indication of the quality of fleece used (which may be sorted and/or mixed), although there is still much debate about how wool types may be categorised accurately (Rast-Eicher & Jørgensen 2013, 1; Christiansen 2004). In industrial contexts today, fine fleece is usually interpreted as less than 20.6 μ, medium between 22 and 29.3 μ, coarse from 31 to 34.4 μ and very coarse more than 36 μ (Kott 1993, table 1), although in archaelogical interpretation, the distribution of fibre diameters in a histogram is used (for example, Bender Jørgensen & Walton 1986).

There are several ways of working a knitted fabric – **round** as a continuous spiral or **back and forth** in the same plane. In the latter case, the work may be turned (usual in handknitting) or the same surface kept towards the knitter throughout (usual in machine knitting). In contemporary craftwork, working round is termed circular knitting and working back and forth is termed flat knitting (Black 2012, 7) or straight knitting (Phipps 2011, 50). These terms distinguish the method of construction not the resulting object (Stanley 2001, 29-33). The direction in which the fabric is constructed, the working direction (known in industry as "technical upright"), is important and may indicate the method of constructing the item.

In describing a knitted item, its **form** is an important characteristic. In this context, flat is a problematic term because, strictly speaking, all finished knitted fabric is flat. An item may be three-dimensionally tubular, conical, discoid, "square, rectangular, or otherwise shaped" (Emery 1994, 30). The surfaces and edges are also important features (see below). A disc or "otherwise shaped" object has two surfaces and one edge (the circumference or perimeter), while a tube has two surfaces and two edges.

It is helpful to orientate the item by designating the top

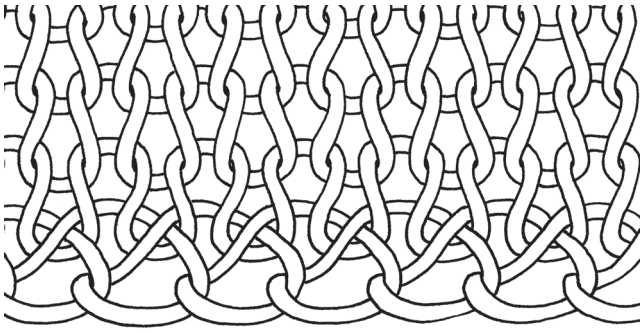

Fig. 2: An example of a starting edge: a one-strand knit on cast on (Image: Sarah Thursfield)

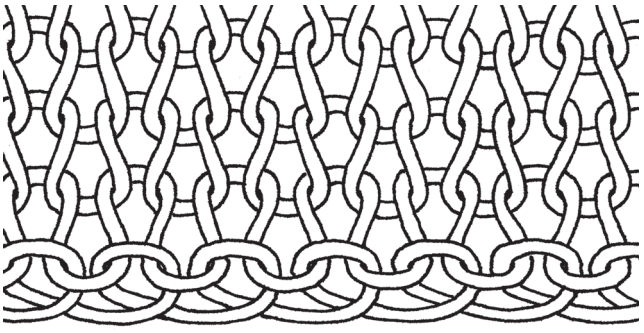

Fig. 3: An example of a starting edge: a two-strand "thumb" cast on (Image: Sarah Thursfield)

and bottom. If enough remains for a clear orientation to be determined, the evidence may be stated. Cast-on and cast-off edges (Rutt 1987, 13; Stanley 2001, 71) are often the distinguishing features or means of designating the top and bottom of an item (figs 2, 3 & 4). "A surprising number of techniques can be used for casting or binding on. Each produces an edge with unique characteristics" (Hemmons Hiatt 2012, 37). All interlooped structures require a row of securing loops to prevent unravelling, unlike linked and most looped structures in which each loop is secured as it is made (Emery 1994, 39). Casting off is the process by which loops are taken off the knitting needles securely to prevent them from unravelling, for which the historical term in English was bind off (Rutt 1987, 14). There are a number of ways of doing this using two needles (or a hook) all of which are based on the basic techniques for making loops (Stanley 2001, 82-91 & 72). The result is usually a chain, where each loop is pulled over another until the final loop has the broken end of the yarn drawn through it (Hemmons Hiat 2012, 80). There are other less conventional ways of casting off, which use a single sewing needle (that is, with an eye), whereby the yarn is drawn through all the loops to secure them (Hemmons Hiatt 2012, 80). The top and bottom may be identified through the evidence of the edges or shaping (see below). If there is no evidence for the top and bottom, an expedient decision is advisable since it makes further discussion of the item easier. A description of the top and bottom edges – for example, **cast-on**, **cast-off**, **cut, torn, decayed** – is necessary. Note that the orientation based on identification of a cast-on edge, which establishes the working direction or technical upright, may not be the same as the direction of the fabric in wear or use. The sides may also consist of cut, torn or decayed edges (for examples, see Black 2012, 20 & 14, fig. 5) and/or **selvedges** (Hemmons Hiatt 2012, 72; Stanley 2001, 62), which are the "secure edge[s] of a knitted fabric" (ISO 4921:2000: 3.3.2). Some fragments of

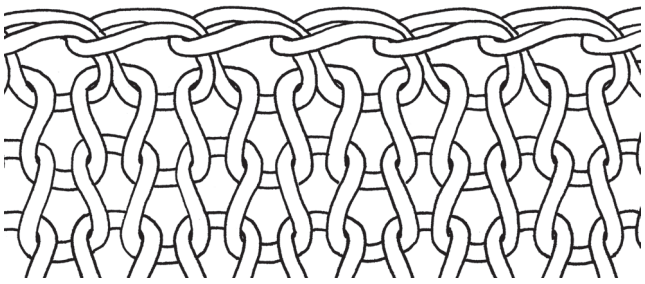

Fig. 4: An example of a finishing edge: a chain cast-off (Image: Sarah Thursfield)

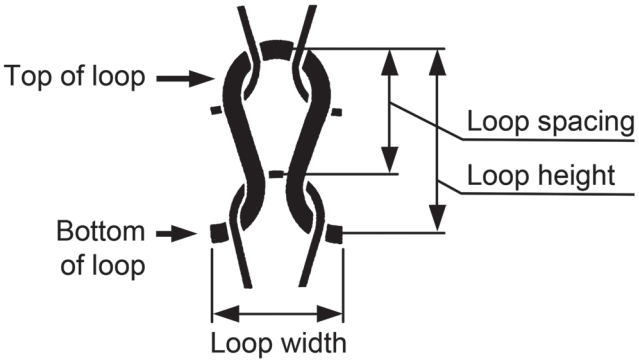

Fig. 5: Measurement of a knitted loop (Image: after Rikstermbanken, Swedish Centre for Terminology; with thanks to Hanna Bäckström & Sidsel Frisch)

archaeological and historical knitted material have edges which are all cut, torn or decayed. These may have been deliberately cut (as a decorative feature, for expediency in manufacture or to recycle all or part of the item) or accidentally torn in wear, storage, disposal or when excavated. It is useful to record these edges and to describe any evidence of finishing which has prevented the loops from unravelling.

The action of knitting creates loops, which are conventionally called stitches in knitting instructions. The term stitch more properly describes the action which creates the loop. This confusion is a particular difficulty of English. The word for stitch in other languages (for example, maske in Danish and Masche in German) refers only to the loop made in knitting. It is not used for the action of making a loop nor for a sewn stitch. The knitted loops can be measured as rectangles – often wider than they are tall (Eltahan et al. 2016). The length can be expressed either as the full height of the loop from top to bottom or the height of the interlinked part of the loop (fig. 5). The latter is proposed here as the more useful. These measurements are best recorded based on an average of at least ten loops (depending on the fineness of the knitted fabric) at different positions in the knitted item, and are essential details to note. These average measurements may be necessary in several sections of the knitted item if the loops are different sizes in different parts of an artefact or the fabric structure.

The continuous yarn forms vertical and horizontal lines of loops in the fabric. These can be represented in a similar way to vertical and horizontal elements in woven fabrics and provide the means to describe the fabric in detail using the equivalent of thread counts. The vertical columns of loops (fig. 6) are referred to as wales (ISO 4921:2000: 3.3.1). The wales may also be

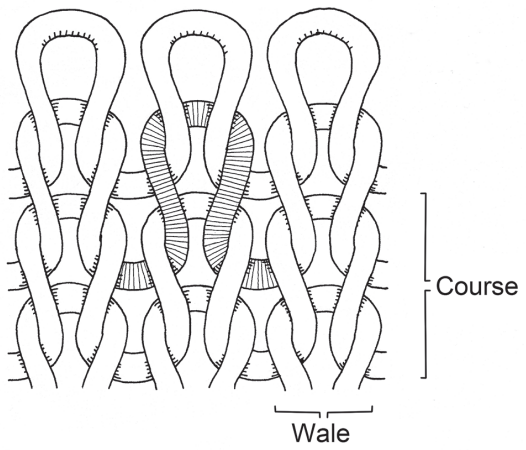

Fig. 6: Wales and courses in knitted fabric (Image: Sarah Thursfield)

expressed as a number per unit of measurement with the ruler placed perpendicular to them. The number of wales per 10 centimetres or per inch is a crucial descriptive detail for understanding a knitted item.

In back and forth knitting, the horizontal lines of loops in the fabric are conventionally known as rows whereas in round knitting they are named rounds. In other languages, a single word helpfully means both row and round (*rang* in French and *rij* in Dutch, for example). As it is very difficult to tell how archaeological fragments have been knitted, it is necessary to have a term which embraces the concept of the horizontal loops however they were made. In the knitting industry, these are known as **courses (**fig. 6; ISO 14921:2000: 3.3.3). It is also helpful to count the courses against a ruler placed perpendicular to the horizontal line of loops.

Counting wales and courses per 10 centimetres or per inch provides several helpful descriptors enabling comparison with similar items. Measurement over 10 cm is an ideal, but smaller measurements can be taken in several places and a calculated figure given, although this should always be stated. Achieving the appropriate number of loops per unit of measurement in the horizontal and vertical directions when knitting is a target known as the gauge (United States) or tension (United Kingdom). **Gauge** is the better term since tension more properly describes how tightly the knitter pulls on the yarn (Hemmons Hiatt 2012, 456). Multiplying the wales and course counts in a given square unit provides the "stitch **[loop] density**" of a knitted fabric (Miller 1992, 94). Dividing them gives the relationship of the height to the width of the loops, which may be of use in technical analysis. This **course to wale ratio** is calculated by dividing the course count by the wale count. These calculations provide useful evidence for identifying fragments which come from the same item, assist in the identification of techniques and provide parameters for comparisons between knitted fabrics.

A further useful parameter for comparing fabrics is the **cover factor**, which has been long used in industrial contexts (Russell 1965). It has also been proposed in the archaeological analysis of woven fabrics as "the ratio of the area covered by the yarn, to the total area covered by the fabric" (Hammarlund 2005, 115). By substituting the loop counts in the wales and courses for the warp and weft thread counts, it is possible to calculate a cover factor for a knitted fabric: (W per cm × YD) + (C per cm × YD) divided by (W per cm × YD) × (C per cm × YD), where W refers to wales, C to courses and YD to yarn diameter. The number so produced is the relationship between the fabric elements and the space between them. The higher the number, the closer the fabric, with a maximum of 1 for the complete cover provided by heavily finished fabrics. It is noteworthy that yarn diameter is often an approximation and that this calculation may exaggerate the inaccuracy. It is therefore advisable to record whether it is an estimate or a precise measurement.

Naming the **surfaces** in knitted fabric is a challenge. Some fragments make it obvious which surface was intended to be seen – for example, if a decorative design is more clearly visible on one side than the other (Rutt 1987, 38). However, without knowing which way a knitted item was worn or used, it is sometimes not possible to discern which is the "right" surface (the technical face) – that is, the one intended to be seen. In knitting instructions and in several languages, the difference between right/left and right/wrong is confusing (Hemmons Hiatt 2012, xiii). **Recto** and **verso** are clearer terms for this purpose. However, it is necessary to state which surface has been interpreted as one or the other with any evidence supporting this decision, if available. An item may have other features (for example, shaping, seams, remnants of a lining or fastenings) showing which surface was on the **outside** as opposed to hidden on the **inside** but fragments often lack these clues and it may be helpful for descriptive purposes to name the surfaces A and B or similar. The item may now be inside out, which makes the need for clarity even more important.

It is also not possible to say with any certainty which surface of a fabric was facing the knitter when it was under production or which way the knitter was working – from left to right or right to left (Thomas 1943, 53). In several languages, the loops are referred to as right/left loops and in English as knit/purl. "The terms purl and purling are essentially terms of

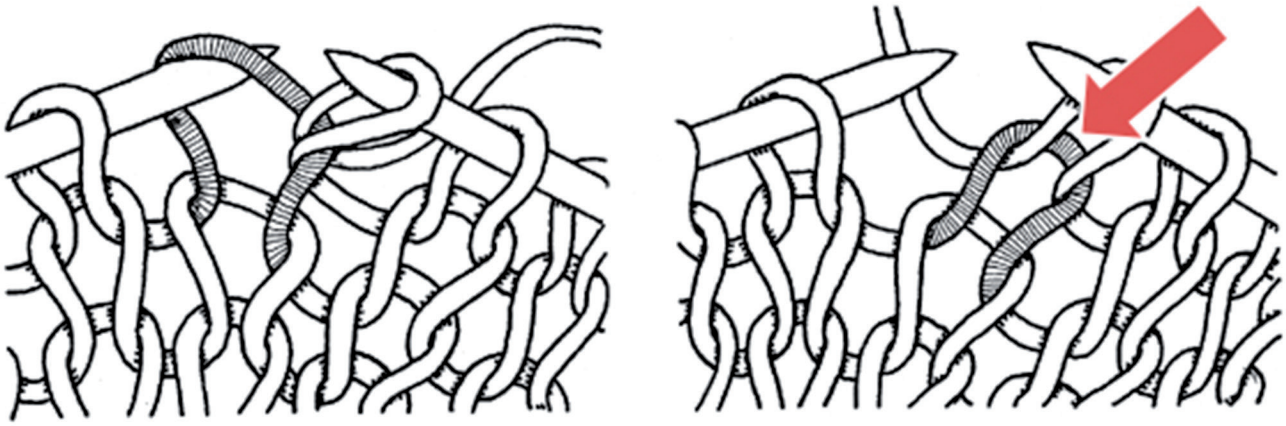

Fig. 7: Working a face loop on the recto of simple knit fabric – commonly called knit stitch (Image: Sarah Thursfield)

construction. They indicate the way the loop is made in relation to the implements being used. They do not describe anything about the actual structure of the fabric" (Emery 1994, 41). A right/knit stitch and a left/purl stitch produce exactly the same result – what differs is the loop's relationship to the face of the fabric. Therefore, the terms right/knit and left/purl belong to descriptions of the process not descriptions of the fabric. They are not helpful in the reportage of a knitted item because they simply guess at how it was made.

The distinguishing feature between the surfaces is the shape of the face and reverse of the loop in the knitted fabric (Rutt 1987, 12). These are described in several languages as smooth versus ridged or raised. The origin of the term purl in English reflects this defining feature, as it derives from its purled appearance, that is, rippling or uneven (*Oxford English Dictionary*). A surface with the smooth V shapes is usually interpreted as the face of the fabric. The other side of these loops, the bars making a ridged surface, are usually interpreted as the reverse of the fabric. The industry terms are therefore **face and reverse loops** (ISO 4921:2000: 3.1.2). It is possible for an item to have been worn or used with the reverse loops on the recto, the surface intended to be seen. Despite this potential confusion, face and reverse loops are adequate terms for describing the appearance of loops in a knitted item (figs 7 & 8). The production of face/reverse loops and the resulting recto/verso surfaces cause confusion for knitters when describing an item. This is because the effect of turning the work between courses when knitting back and forth alters the effect of working a knit or a purl stitch in relation to the fabric surfaces - and this is easily overlooked.

Most **shaping** in knitting is achieved by altering the number of wales (columns of loops) either by **increasing** or **decreasing**. It is not always easy to see in which direction the work was done (particularly with fragments and sometimes with entire garments)

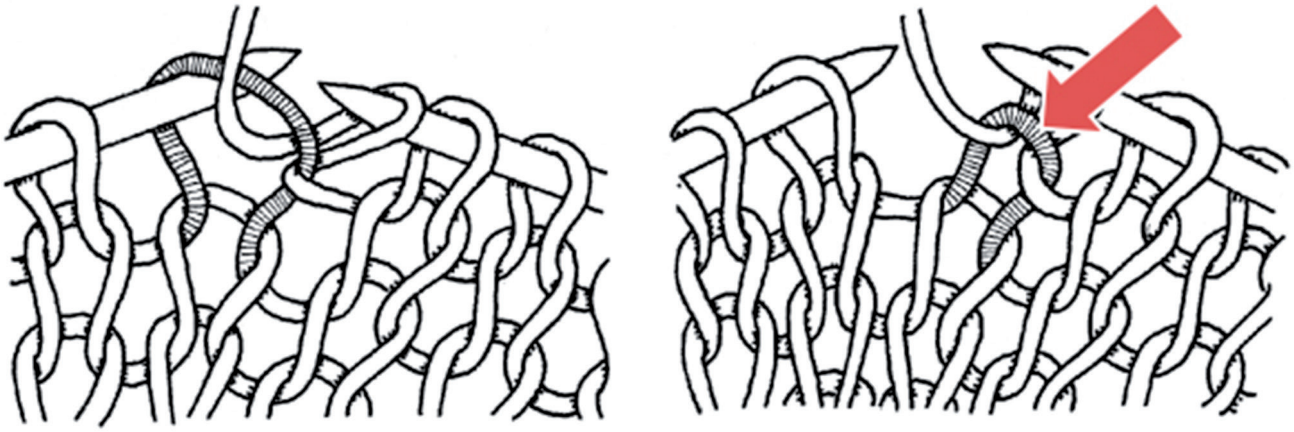

Fig. 8: Working a reverse loop on the recto of simple knit fabric – commonly called purl stitch (Image: Sarah Thursfield)

and this makes the distinction between an increase and a decrease hard to deduce. There are at least five methods of increasing the number of wales, which leave evidence in the finished item such as a small hole, the elongation and/or twisting of a loop (Rutt 1987, 14-15). Decreasing can be achieved by knitting through more than one loop at once (Rutt 1987, 15). This leaves evidence such as a loop leaning to the right or left or a hole where a loop has been slipped rather than knitted as part of the decrease (Stanley 2001, 117; Hemmons Hiatt 2012, 216-221). A guide to identifying increases and decreases in knitted fabric states (Ringgaard 2018, 35, in this issue) "A knitted loop has a head and two legs … When a new wale of loops is added by increasing, the loop head will be at the upper end of the first loop in this wale. If the number of wales is reduced by decreasing, the loop heads will be towards the point where the wale ends (Ringgaard 2018, 36, fig. 3, in this issue).

These features are hard to identify in worn fragments and it is often impossible to positively identify working direction from shaping. Often, these clues are not clearly visible because of deterioration, wear and tear in use, or the finishing process (see fig. 9 top left). Stress generated by distortion is often the cause of damage to archaeological textiles and this is evident in breakage at points where increases or decreases have been made. However, it is helpful to record the presence of increases/decreases if possible, with their locations in the knitted item.

An irregularity called a **jog** may be visible at the start/finish of the courses (Hemmons Hiatt 2012, 32; Stanley 2001, 31). As the yarn passes from the last loop at the end of a course to the first loop at the beginning of the next, it "creates a step at the intersection, which makes its first appearance at the cast-on edge and continues the entire length of the fabric" (Hemmons Hiatt 2012, 32). It is most noticeable if there are horizontal stripes, although there are techniques which can disguise this (Hemmons Hiatt 2012, 33). In addition, finishing processes can obscure the tell-tale irregularity. Close examination of a medieval Egyptian fragment (Victoria & Albert Museum T.201-1929) showed that, even though it is now a two-dimensional, irregular form, it was knitted round. Its construction is evident from "the typical mismatch of knitting courses that occurs when this technique is employed" (Black 2012, 11 & plate 4).

It is also necessary to describe the arrangement of loops in the knitted item, which define the structure of the fabric. This is often referred to as the pattern or "stitch technique" (Hemmons Hiatt 2012, 660) but the term pattern is also used for a complete set of instructions for making an item (Black 2012, 124). **Pattern** may be used for a decorative elaboration of the fabric structure, as distinct from **embellishment** (such as lace or embroidery) applied after the fabric is complete.

A knitted fabric with one surface composed entirely of face loops has the other surface composed entirely of reverse loops. If the recto is a mix of face and reverse loops in a sequence along each course, such as: three face loops, three reverse loops, then the other surface shows the same sequence reversed. A knitted item made up of several different arrangements of loops may be divided into sections (indicated by a stated number of wales and courses) and each described separately. All the above may be represented as charts, on grids or in diagrams and there is a growing consensus on a system of symbols for contemporary stitch and colour patterns in craft work, which it may be helpful to adopt for describing archaeological and historical knitwork (Thomas 1943, 17; Stanley 2001, 296-300; Frederiksen 1982; Hemmon Hiatt 2012, 391-426).

Words are also required for the fabrics produced by knitting. The fabric known as stocking stitch, stockinet, stockinette and jersey has one surface of face loops and the other of reverse loops. It may be made by round knitting (although using purl alone gives the same end result) or working alternate rows of knit and of purl stitches. **Simple knit fabric** is the proposed term here because "plain knitting", which has been used as an equivalent to "plain weave" (Emery 1994, 40-41; Seiler-Baldinger, 1994, 24-25) already has different meanings in different contexts. Likewise, the French term *jersey* has a host of other meanings. Terms which carry implications of left/right (such as *glatt rechts stricken* in German) are also problematic. "Garter stitch" refers to fabric with identical faces consisting of alternate courses of face and reverse loops. This is made by knitting (or purling) back and forth throughout, or by knitting and purling alternate rounds. The proposed term for this is **single ridge fabric**. For fabrics featuring more courses of one or the other, these may be enumerated and the result referred to as **ridge fabric**. This equivalent for vertical patterns is **single rib** which refers to alternate wales of face and reverse loops. For fabrics featuring more wales in the ribbed pattern, these may be enumerated and the result referred to as **rib fabric**.

International equivalents for simple knit, single ridge and single rib are required (*Nordiska Textillärarförbundet* 1979). Simple knit is known as *Glattgestrick*t (German), *Glatstrikning* (Danish), *Jersey* (French), *Tricot* or *Tricotsteek* (Dutch). Single ridge is known as *Kraus*

Fig. 9: A split-brimmed discoid now brown wool cap (Victoria & Albert Museum, inventory number 1562-1901) in simple knit with double-layered brims (crown diameter 25.4 cm; head circumference 54.61 cm; brim widths 6.35 cm & 5.08 cm) and a separate lining found in Worship Street, London (UK) features in the online database at www.kemeresearch.com with details for both objects recorded according to the draft protocol for reporting evidence for Early Modern knitting. There are 36 wales & 52 courses per 10 cm in the crown and 32 wales & 56 courses per 10 cm in the brims. Clockwise from top left - detail of the remaining silky nap at × 25 magnification on the recto showing how it prevents accurate measurement of the yarn, although it appears to be approximately 1.25 mm in diameter, Z spun and composed of two separate yarns (0.63 mm) which are not plied together; measuring the fibre diameters (average 22.7 µ based on 100 fibres); the cap as it is now displayed with the facing turned inside the brim; the cap as it used to be displayed with the facing outside the brim before comparative analysis with other similar caps suggested the arrangement shown is more appropriate; inside the cap showing the cut edge of the facing (shown vertically), the ridge at the brim/crown edge (shown horizontally) and the now red lining. (Images: © Jane Malcolm-Davies, except bottom right © Victoria & Albert Museum, London)

gestrickt (German), *Retstrikning* (Danish), *Point Mousse* (French), *Ribbels* or *Ribbelsteek* (Dutch). It is important to note, when describing a knitted fabric in an historical or archaeological context, that the fabric does not necessarily show how the work was done.

More terms will be required as the protocol grows to accommodate knitted fabrics with more complex patterns of loops – for example, fabrics made with two elements of the same yarn in various configurations, one working and one carried across either surface of fabric, which is designated **twined knit** here.

Fabric finishing or fulling is often called felting because these are erroneously assumed to be the same processes and to create the same effects (Phipps 2011, 33; Hemmons Hiatt 2012, 361). Felting coheres and combines dissociated fibres which have not been previously interworked to create fabric. Subjecting woven or knitted fabrics to finishing is more properly called fulling (Emery 1994, 20 & 22), which "aims at changing the touch (hand) and the appearance of textiles" (Desrosiers 2013, 33 & 39). The visible effect of fulling is the nap and this appearance is described as **matted**, although sometimes the word felted is used (for example, Crowfoot et al. 2001, 35). It is also possible that this matted appearance is the result of wear and/or long burial rather than deliberate **fulling**.

It can produce a surface entirely obscuring the knitted loops or woven threads, which may be raised to a **nap** and **shorn** (Emery 1994, 173). Fulling may also shrink the fabric (Emery 1994, 22) and reduce its elasticity (Hemmons Hiatt 2012, 362).

A note as to the current appearance to the naked eye and under magnification (if possible) is desirable. "Archaeological brown" may be all that can be documented about the **colour** without further analysis (Ringgaard & Bruselius Scharff 2010, 221). Reference to appropriate standards such as the Munsell or CIELAB colour system is helpful. Natural (undyed) colours are usually confined to those of sheep's fleece for wool: grey, black, white. Further evidence for **natural pigmentation** may be viewed using transmission electron microscopy (Bruselius Scharff 2017). It is useful to note if there is a suggestion that the fabric has been dyed.

The word knitting in English is used for both the verb (the process) and the noun (the fabric) (Emery 1994, 41). It also refers to the manner of making a face loop on the recto the fabric which in other languages is designated a "right" loop (as opposed to left): for example, *rechts stricken/arbeiten* (German), *endroit* (French) – that is, not purling. These three different meanings make knit a potentially confusing term. In other languages, the distinctions are better made (although there are variations to these terms in current use): *Strikning/Strik* (Danish), *Stricken/Strickarbeit* (German), and *Tricoter/Tricot* (French). Simply using the verb **work** for the making of loops in whatever manner is proposed here.

In Swedish, there is no single term for a finished **knitted** item. The adjective *stickad/stickat* is required. The term knitware has been coined in a discussion of the development of knitting (Thirsk 2003), although it has the disadvantage of sounding the same as "knitwear" (which implies clothing). Another potential term is **knitwork**, which is a helpful direct translation from other languages. In Danish and Swedish, the equivalent term refers to knitting which is being created (*Strikketøj/Stickning*). This would only apply to an unfinished knitted item, which is a rare archaeological or historical find.

Interpretation of the evidence

All the data collected must be treated with caution given that items which were subjected to finishing processes, wear and tear, and/or distortion by burial or storage may not now have the same dimensions or characteristics as when new. Knitted fabrics should not be diagnosed as the product of round knitting or back and forth in the same plane without clear and incontrovertible evidence. A knitted item with evidence of a sewn seam parallel to the wales suggests it was knitted back and forth and the selvedges joined to create a tube or cone. The distinguishing feature of round knitting is the lack of any seam, although there may be a jog (see above), and an item knitted round may be cut and sewn. It has been suggested that a number of fragments of medieval and earlier knitting "that are now flat can be shown to be the remains of round knitting" (Rutt 1987, 24). Without the fragments being identified or the clues provided, such an assertion cannot be corroborated. Only under very specific circumstances is it possible to state that an item was knitted round or back and forth. Fragments usually lack the clues which allow this to be stated with certainty. They key to the continued scientific study of early knitting is the presentation of evidence for all assertions stated in agreed terminology.

Conclusion

Specialised communication relies on consistency. This paper has argued a rationale for a systematic approach to the evidence for the development of knitting as a craft and an industry. It proposes a terminology for the discussion of knitwork with the aim of encouraging a scientific approach to describing the evidence whether the examination is undertaken by a textile analyst, a non-knitter or a non-expert volunteer. The proposed terminology for identifying, describing and analysing archaeological and historical knitwork appears in table 1 and a protocol for recording the observations in table 2. There are many more features and characteristics of knitted fabric needing unambiguous description which have not been discussed here. More work is required to capture accurately the full sophistication of knitted items.

In the following artices the authors have applied the terminology to a range of knitted items from museum and archaeological collections. These represent a first step towards developing a more sophisticated approach for describing knitwork and a diagnostic tool. Comment on the scope and usefulness of these materials to the study of the early evidence of knitting is welcomed and it is hoped that they "have not added to the confusion".

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Bibliography

Bender Jørgensen, L. & Walton, P. (1986) Dyes and fleece types in prehistoric textiles from Scandinavia and Germany. *Journal of Danish Archaeology*, 5, 177-188.

Black, S. (2012) *Knitting: fashion, industry, craft*. London: V&A Publishing.

Bruselius Scharff, A. (2017) The assessment of natural pigmentation in archaeological wool. In Bravermanová, M., Březinová, H., & Malcolm-Davies, J. (eds), *Archaeological textiles - links between past and present*. NESAT XIII. Liberec: Archaeolingua 34.

Burnham, D. (1972) Coptic knitting: an ancient technique. *Textile History*, 3, 116–24.

Cooke, W. & Tavman-Yilmaz, M. (1999) Hand Knitting, Frame Knitting and Rotary Frame Knitting in the 17th, 18th and 19th Centuries. A Question of Identification. *Textile History*, 30, 2, 199-206.

Christiansen, C. (2004) A reanalysis of fleece evolution studies. In Maik, J. (ed), *Priceless invention of humanity – textiles. North European Symposium for Archaeological Textiles VIII.* Acta Archaeologica Lodziensia 50/1: Łódzkie Towarzystwo Naukowe, Łódz, 11-17.

Claßen-Büttner, U. (2015) *Nålbinding - What in the World Is That?: History and Technique of an Almost Forgotten Handicraft*. Norderstedt: Print on Demand.

Crowfoot, E., Pritchard, F. & Staniland, K. (2001) *Textiles and Clothing c.1150-c.1450: Medieval Finds from Excavations in London 4.* Woodbridge: Boydell

Desrosiers, S. (2013) Textile terminologies and classifications: some methodological and chronological aspects. In Michel, C. & Nosch, M.-L. (eds), *Textile terminologies in the ancient near east and Mediterranean from the third to the first millenia*. Oxford: Oxbow Books, 23-51.

Donner, M. & Schnebel, C. (1913) [1982 facsimile] *Handarbeiten wie zu Grossmutters Zeiten*. Ullstein.

Dury, P. & Lervad, S. (2016) Synonymic variation in the field of textile terminology. In Michel, C. & Nosch, M.-L. (eds), *Textile terminologies in the ancient near east and Mediterranean from the third to the first millenia*. Oxford: Oxbow Books, 1-9.

Eltahan, E., Sultan, M. & Mito, M-B. (2016) Determination of loop length, tightness factor and porosity of single jersey knitted fabric. *Alexandria Engineering Journal*, 55, 851–856.

Emery, I. (1994) *The Primary Structure of Fabrics: An Illustrated Classification.* London: Thames & Hudson.

Frederiksen, T. (1982) *Tvebinding*. København: Clausen Bøger.

Gilbert, R. (2012) A Knitted Cotton Jacket in the Collection of the Knitting and Crochet Guild of Great Britain. *Textile History*, 43, 1, 90-106.

Gleba, M. (2012) From textiles to sheep: investigating wool fibre development in pre-Roman Italy using scanning electron microscopy (SEM). *Journal of Archaeological Science*, 39, 12, 3643–3661.

Hammarlund, L. (2005) "Handicraft Knowledge Applied to Archaeological Textiles" in *The Nordic Textile Journal*, 87-119.

Heathman, M. (1996) *Knitting languages.* Pittsville, WI: Schoolhouse Press.

Hemmons Hiatt, J. (2012) *The Principles of knitting: methods and techniques of hand knitting*. New York: Touchstone.

Humbley, J. (1997) Is terminology specialised lexicography? The experience of French-speaking countries. In *Hermes: Journal of Linguistics*, 18, 13-31.

Kott (1993) *Wool grading*. Montguide, MT 8380, I-1 (available at: http://msuextension.org/publications/AgandNaturalResources/MT198380AG.pdf, last accessed 5 July 2017).

Michałowska, M. (2006) *Leksykon Włókiennictwa.* Warsaw: Krajowy Ośrodek Badań I Dokumentacji Zabytków.

Miller, E. (1992) *Textiles: Properties and Behaviour in Clothing Use*. London: Batsford.

Nordisk kartläggning inom textilämnet [2]. (1979) *Terminologi i stickning och virkning*. Stockholm: Riksfören. Slöjd-och textillärare.

Nordiska Textillärarföbundet (1979) *Terminologi i stickning och virkning: Nordisk Kartläggning inom textilämnet*. NTF utredningsserie 3, Mediapaino: Hyvinkää.

Phipps, E. (2011) *Looking at textiles: A Guide to Technical Terms*. Los Angeles: J Getty Trust Publications.

Prown, J. (1982) *Mind in matter: an introduction to material culture theory and method*. Winterthur Portfolio, xvii, 1-19.

Rast-Eicher, A. & Bender Jørgensen, L. (2013) Sheep wool in Bronze Age and Iron Age Europe. *Journal of Archaeological Science*, 1-18.

Ringgaard, M. (2018) The church cap and the crypt cap: early modern knitted fragments found in Denmark. In *Archaeological Textiles Review*, 60, 34-41.

Ringgaard, M. & Bruselius Scharff, A. (2010) The Impact of Dyes and Natural Pigmentation of Wool on the Preservation of Archaeological Textiles. In Andersson Strand, E., Gleba, M., Mannering, U., Munkholt, C., and Ringgaard, M. (eds), *North European Symposium for Archaeological Textiles X*. Oxford; Oakville: Oxbow Books, 2010, 221-224.

Rikstermbanken, Swedish Centre for Terminology, available at: http://www.rikstermbanken.se/rtb/

visaIllustration.html?id=1929&termpostId=53059, (last accessed 4 July 2017).
Russell, H. (1965) Help for Designers. Construction factor: An aid to fabric evaluation and design. *Textile Industries*, June.
Rutt, R. (1987) *A history of hand knitting*. London: Batsford. Reprinted, Loveland, CO: Interweave Press.
Ryder, M. (1983) Wools from textiles in the *Vasa* a 17th-century Swedish Warship. *Journal of Archaeological Science*, 10, 259-363.
Ryder, M. (1984) Wools from textiles in the *Mary Rose* a 16th-century English Warship. *Journal of Archaeological Science*, 11, 337-343.
Seiler-Baldinger, A. (1994) *A classification of techniques*. Belair: Crawford House Press.
Spencer, D. (2001) *Knitting Technology*. Cambridge: Woodhead Publishing, 3rd edition.
Splitstoser, J. (2012) The Parenthetical Notation Method for Recording Yarn Structure. *Textile Society of America Symposium Proceedings*, paper 745 (available at: http://digitalcommons.unl.edu/tsaconf/745, last accessed 22 June 2017).
Stanley, M. (2001) *Knitter's Handbook: A Comprehensive Guide to The Principles and Techniques of Handknitting*. Newton Abbot: David & Charles.
Thomas, M. (1943) *Mary Thomas's book of knitting patterns*. London: Hodder & Stoughton.
Thirsk, J. (2003) Knitting and knitware, c1500-1780. In Jenkins, D. (ed), *Cambridge history of western textiles, 1*. Cambridge: Cambridge University Press, 562-584.
Walton, P. (1981) The textiles. In Harbottle, P. & Ellison, M. (eds), *An excavation in the castle ditch, Newcastle upon Tyne. Archaeologia Aeliana*, 5th Series 9, 190-228.
Walton, P. & Eastwood, G. (1988) *A Brief Guide to the Cataloguing of Archaeological Textiles*. York: Textile Research Associates, 4th edition.

Internet sources

ISO 4921:2000 Knitting basic concepts and vocabulary, https://www.iso.org/obp/ui/#iso:std:iso:4921:ed-2:v1:en (last accessed 27 April 2017).
ISO 8388:1998 Knitted fabrics, https://www.iso.org/obp/ui/#iso:std:iso:8388:ed-1:v1:en (last accessed 27 April 2017).
Vivian Høxbro, www.viv.dk/ord/ (last accessed 1 October 2017).
Oxford English Dictionary, http://www.oed.com (last accessed 27 April 2017).
textilnet.dk (last accessed 9 November 2018).

Authors: jane@jmdandco.com, plainweave879@btinternet.com, sl@kontiki.fr