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Norwegian double-cloth: warp-weighted loom experiments in a complicated technique

Abstract
The Norwegian reversible double-cloth tradition, known in areas of Scandinavia from the Viking Age to the Early Modern Era (eighth to 18th centuries), disappeared before it could be documented. Evidence indicates that surviving double-cloth coverlets were woven on the warp-weighted loom, raising the question of how the loom was utilised to produce these relatively complicated textiles. Building upon a prior study, experimentation in the width of a coverlet was conducted to determine the interaction between weight-row disposition and adequate shed formation, utilising four weight-rows placed in four separate configurations. Best results for shed formation were achieved with all rows behind the shed rod, but with the forward two rows attached to the shed rod at regular intervals. Heddle length was shown to impact both shed formation and pattern transfer, and heddle length together with weight-row placement revealed potential problems in accessing shed openings past the loom uprights.

Keywords: Warp-weighted loom, double-cloth, experimental, weights, heddles, coverlets, Norway

Introduction
The warp-weighted loom, an ancient weaving implement known in Europe from as early as the 6th to 7th millennia BCE (Barber 1991, 93), was thought to be extinct by scholars of the early 20th century (Crowfoot 1936/37, 38). However, it actually survived into the 20th century in Norway, where two weaving traditions were thoroughly documented (Hoffmann 1964). In both cases the loom was used for weaving weft-faced plain-weave coverlets. A less recognised source of information about the warp-weighted loom can be found in a third group of coverlets woven in a more complicated technique, the reversible double-cloth coverlets of northern Gudbrandsdal. The double-cloth tradition, described in numerous studies, has medieval antecedents in both Norway and Sweden (Sylwan 1928; Franzén and Nockert 1992), and survived into the 17th and possibly 18th centuries in central Norway (Engelstad 1952; 1958; Hoffmann 1958; 1964). Because the most recent reversible coverlet tradition disappeared before the technique could be documented, the exact method by which these textiles were woven is not known. Yet the relatively recent date of the tradition means that a sizeable group of textiles exists, many of which are in excellent condition.

Reversible double-cloth is a technique that allows free-form patterning. In the Norwegian tradition, it was created with two plain-weave warps that were placed on the loom at the same time and woven concurrently, each with its own weft. Light and dark contrasting colours were typically chosen for the two webs, wefts were woven alternately into the front and back layers, and patterns were created when corresponding warp threads in the two warp layers were exchanged. This produced light patterns on a dark background on one side of the developing web, and identical dark patterns on a light ground on the reverse (fig. 1).

A recent study of the 17th to 18th century Norwegian double-cloth tradition (from which approximately 80 coverlets survive, most held in the collections of the National Museum of Art, Architecture and Design, Oslo; Maihaugen Museum, Lillehammer; and the

National Museum of Decorative Arts and Design, Trondheim) established that these textiles were woven on the warp-weighted loom (Larson 2015, 201–206). Details within the weave structure were investigated to determine what they might reveal about loom function and/or weaver practice. These observations were combined with, and lent support to, experimentation on the warp-weighted loom to determine an effective method for weaving reversible double-cloth. A number of loom parameters were deduced from details in the

Fig. 1: Norwegian double-cloth coverlets are characterised by repeating patterns. Light and dark webs, with weft-striping in varying colours in the dark web, created light patterns on a dark background on one side and the reverse on the other. Accession number SS-02039, Maihaugen Museum; width 151 cm, length 160 cm (Image: Tone I. Egge Tømte, Maihaugen)

coverlets and from trial-and-error experiments, the latter of which clarified the challenge of warp-thread passage between two plain-weave layers (clear shed formation was impacted by the continual need to pass one layer through the other when bringing each to the front of the loom; the Norwegian double-cloth structure, a dense, balanced plain-weave in both webs, with slightly more warps than wefts per centimetre, contributed to the challenge). Despite these inherent problems, a successful method for weaving double-cloth was proposed in a recent study (Larson 2015, 207–219). However, one element of this result has been called into question.

The method at issue indicated that a slight fanning of the warp threads improved warp-thread passage between forward and back-layer warp threads. This method was inspired by findings from a study that experimented with weight-rows wider than the warp being woven, with the intent of determining possible impacts on the developing textile: despite some unevenness in the resulting textile's warp-thread spacing, edges of the weaving remained straight and shed changes were easy due to the slight fanning effect from the wider weight-rows (Mårtensson et al. 2009, 385). Although the warp fanning described in that study was an effect and not intended as a methodology, it suggested a method of expanding the weight-rows to improve warp passage that was found to be effective for weaving double cloth (Larson 2015, 179). No irregularities were noted in the double-cloth textile that was produced (30 cm in width), possibly because weight-rows were not crowded but held separate by their spacing chains, and the method was proposed as a possible element in weaving double-cloth.

Four of the six surviving medieval double-cloth textiles have a width of 30.5 cm or less (Franzén and Nockert 1992, 64–66; Engelstad 1958, 111), and thus it seems possible that the relatively simple warp-fanning method may have been used for weaving these narrower decorative textiles. However, in a subsequent study of double-cloth weaving at a wider width (80 cm) it became evident that the warp-fanning method would not have been effective in a coverlet-width textile. Warp fanning did not extend to the innermost warp threads, and attempts to increase the expansion of the weight-rows caused selvedge distortion (Larson 2019). The widths of surviving double-cloth coverlets range from 123 cm to 175 cm, with an average of 145 cm (Engelstad 1958, 111–113; Larson 2011, 150). The current study was therefore undertaken to determine how shed formation might be improved for weaving reversible double-cloth at coverlet width. With many loom-setup factors already supported by observations from surviving coverlets and by experimentation in the earlier study, the element that seemed most promising for achieving better loom function was the disposition of the weight-rows. Accordingly, the current study was designed to test four possible weight-row configurations.

Methodology

In designing this loom-function study, guidelines presented by the *Tools, Textiles, Texts and Context* (TTTC) research programme were followed where possible (Olofsson et al. 2015, 77). The exceptions were: tools were not precise copies of archaeological (or in this case ethnographic) originals, since physical evidence of the warp-weighted loom in northern Gudbrandsdal, aside from the textiles themselves, is lacking (Hoffmann 1958, 154); materials for the study were commercially available yarns, as discussed below; experimentation by two skilled craftspeople, while part of the original design, was prevented by the pandemic; and products were not evaluated by independent experts since testing loom function, not the products produced, was the goal of the study.

With the exception of the warp-fanning method described above, the basic configuration for weaving a coverlet-width warp drew on conclusions from the earlier study.

Loom setup

The following elements were used in the test loom:

- Four heddle rods, two for each warp layer
- Two pairs of heddle-rod-supports, each holding the heddle rods for one layer
- Forward-layer heddle rods positioned on the upper pair of supports, back-layer heddle rods on the lower supports
- Four weight-rows, two for each layer
- Weights of 1 kg each, with 15 warps per bundle and a weight per thread of 66 g

Weaving double-cloth: two processes

The method for weaving double-cloth followed that proposed in the prior study as well. In brief, two nearly identical processes separated pattern and background warps in one layer so that the opposing layer could be woven. When the process in one layer was completed, it was then repeated in the other with roles reversed.

Three steps were required in each of these processes:

1. Separation of pattern vs. background warps in one layer with a pattern stick, which then held the selection temporarily at the top of the weaving area; this separation was accomplished by either making a selection with a pattern stick (first use)

or transferring a stored selection from the lower warp threads into the weaving area (subsequent uses, described below)

2. Opening a weaving shed in the opposing layer
3. Bringing the pattern stick down near the heddle rods, with pattern warps held in front and background warps falling behind, thus transforming the weaving shed into the pattern shed for insertion of the weft

Steps in each process were the same but with warp designations reversed: pattern warps in one layer were considered background warps in the other.

Sheds were opened at the front of the loom for pattern weaving (fig. 2). Opening the two front-layer plain-weave sheds was relatively straightforward; in contrast, warps for each back-layer plain-weave shed had to travel through front-layer warps to present a shed for weaving (Larson 2015, fig. 2). In addition, the entire back-layer warp was regularly brought to the front of the loom to allow pattern selection.

Fig. 2: Pattern sheds are formed at the front of the loom when weaving double-cloth: a forward-layer pattern shed is open immediately behind the pattern stick; back-layer pattern warps (gold) are held on the pattern stick in front of the open shed (brown warps); back-layer background warps (gold) remain behind (Image: Katherine Larson)

Pattern storing

After a new row of pattern was selected in the weaving area, it was stored in the lower warp threads of each layer above the spacing chains. Transfer of the pattern up and down through the heddles was accomplished by using pattern boards measuring 152 cm long by 6 cm wide. Used in pairs, one board opened the shed sufficiently to allow the second to be inserted above (or below) the heddles.

Transferring pattern in the forward-layer warps was a straightforward process given its location at the front of the loom; transferring pattern that was stored in the lower back-layer warps to the weaving area at the front of the loom required several additional steps (Larson 2015, fig. 7). Two methods for the latter were tested, each of which required the back-layer heddle rods to be brought forward but at different times. The first involved transferring the pattern up the back warp through the heddles, then bringing it forward into the weaving area by pulling forward the back-layer heddle rods ("up/forward"): when the back-layer warp was pulled forward, back-layer warps held in front of the pattern board travelled through the front-layer and were saved on the pattern stick; warps held behind remained behind. The second method required first transferring the pattern from the back-layer warp threads forward below the heddles and then bringing it up to the weaving area ("forward/up"): the back-layer heddle rods were pulled forward at the start for this method, at which point the pattern board that held the stored pattern at the back of the loom was turned on its side, causing the pattern shed to appear in front of the front-layer warps in the constrained area immediately below the heddles. From there it was saved on a pattern board and, after releasing the back-layer heddle rods to remove tension on the warp threads, the pattern was transferred up through the heddles (in this case, both forward- and back-layer heddles) to the weaving area, where it was saved on the pattern stick.

Pattern storing, normally problematic on the warp-weighted loom due to its divided warp, was shown to be an effective method for weaving double-cloth in the prior and current studies, where all tested weight-row configurations relied on heddle rods rather than the shed rod to create a shed. This use of pattern storing was based on strong indications of the practice that were observed in both the medieval and more recent double-cloth traditions (errors repeated for an entire row of pattern; Larson 2015, 186). Evidence of the logical next step was more elusive: storing multiple rows of pattern for use in reverse order to create a symmetrical pattern. However, because storing multiple rows greatly simplified pattern selection, which was the most time-consuming part of the weaving process, and because approximately three

Fig. 3: Establishing the coverlet-width warp at Osterøy Museum: a – sewing the warp to the beam; b – separating warp threads to apply the first row of weights and spacing chain; and c – beginning pattern weaving (Images: Katherine Larson)

quarters of the coverlets recorded in the prior study contained symmetrical patterns (Larson 2011, 302–307), this practice was tested in the current study. Thin sticks for storing multiple rows of pattern (in addition to the active pattern, stored on the pattern boards) had been successfully used for storing several rows of double-cloth pattern at narrower widths (Larson 2018), but this practice rapidly began to interfere with shed formation at the wider width of the current study. Replacing these sticks with loosely inserted cords, which removed possible interference the sticks caused with adequate warp tension, proved successful for storing up to 13 rows of pattern. Access to both the front and back of the loom in the current study allowed storage of multiple rows in both layers, a significant saving in effort when weaving the second half of a symmetrical pattern. In a loom situated against a wall, storing multiple rows in just the forward layer would still simplify the pattern-selection process: in the current study, selection in one layer was regularly used as a template for selection in the other (a reduction in effort and in the rate of errors); thus, storing multiple rows in the forward layer alone would be beneficial.

Materials

The same materials as those used in the prior study were selected for the coverlet-width warp: *Hillesvåg Frid tynt vevgarn*, a blend of spælsau wool and hair (Larson 2015, 207–215). Use of the blended yarn was an approximation of what was considered typical of Scandinavian double-cloth, that is, a colourful wool layer vs. a layer of smoother warp. Surviving double-cloth textiles indicate that the choice of a smoother material evolved over time in Scandinavia. All surviving medieval textiles were woven with a wool layer vs. a (smooth) layer of linen (Sylwan 1928, 38), but based on observations in the later tradition, the Norwegian coverlets appeared to have a wool layer vs. a (smooth) layer of predominantly hair, tightly spun. Among other evidence observed in the earlier study, warp ends exposed as a fringe in one coverlet (the fringe likely reflecting a later usage) exhibited a sharp contrast: one layer retained its twist, while the twist in the other was markedly diminished (Larson 2015, 180).

In addition to a smooth-fibre layer, it is possible that warp passage in the double-cloth coverlets was aided by the use of a sizing material. Without any evidence of such use, however, and given the apparent importance of a smooth-fibre layer in surviving textiles, sizing was not tested in the current study.

Obtaining an all-hair yarn as a smooth-layer material was not possible for either the prior or current study, and therefore two semi-smooth layers of wool/hair blend were substituted. However, recognising the importance of warp passage in a test of double-cloth methods, this choice of materials was revisited in the current study. A smaller fibre-test warp was designed as part of the larger study to compare three fibre options: a wool/hair blend in both layers (semi-smooth vs. semi-smooth); linen (smooth) in one layer vs. pure wool (fuzzy) in the other, using *Klippan Yllefabrik Tuna* 7/2; and linen (smooth) in one layer vs. a wool/hair blend (semi-smooth) in the other.

Setting up the test warps

Weaving of the coverlet-width warp was conducted on two looms of approximately the same size and slant. The warp was set up and weaving begun at Osterøy Museum in Norway (fig. 3), and then the warp was transferred to a weaving studio in the Seattle area in the United States. The smaller fibre-test warp was woven on a slightly narrower loom in the Seattle studio. Initial plans for two weavers to work together in both locations were prevented by the pandemic. Experimentation by one author continued, as did discussion of results between authors.

Coverlet-width warp

The coverlet-width warp was 125 cm in width and held on a heading cord with 6 warp threads per cm in each layer and both layers arranged alternately on the heading cord. Space between the warp and the loom uprights was approximately 15 cm on each side. Spacing chains were knitted around pairs of warp threads (based on paired warps from the warping process) and an empty loop was knitted between each pair, except between neighbouring weight bundles (thereby reducing the tendency for bundles to separate). Chains were knitted in each half of each plain-weave layer, a total of four chains. Although the warp was initially weighted with sandbags (Osterøy), these were soon replaced with coin-bag weights (Seattle) that were 4 cm to 6 cm in thickness. The resulting weight-rows were 124 cm before spacing chains were attached to the uprights, 127 cm after chains were slightly stretched to do so.

Fibre-test warp

The smaller fibre-test warp was 68 cm in total width, with space between the warp and the uprights of approximately 14 cm on each side. The warp was actually comprised of three separate 22 cm wide sections with a 1 cm gap between the sections. In all other respects (aside from 3 individual weft treatments corresponding to the warp fibre in each section), these three sections were treated as one warp, following the same parameters of the coverlet-width warp regarding spacing of warp threads, size and arrangement of weights and weight-rows, knitting of spacing chains, number and placement of heddle rods, and knitting of heddles.

Heddle length

The importance of heddle length when weaving double-cloth was not fully recognised at the beginning of the current study. In the earlier study, results had been effective with uniformly sized heddles measuring 11 cm from heddle "nose" to heddle rod, but heddle tangling had been noted as a problem with the forward-layer warp threads (Larson 2011, 230). Double-notched heddle-rod supports, known from medieval finds in Trondheim (Nordeide 1994, 230), have been described as a possible implement used for weaving twill on the warp-weighted loom (Batzer and Dokkedal 1992), and these varying cleft distances (or rather the use of blocks on the heddle-rod supports to mimic the same) were considered as a possible solution for slack heddles. However, this idea receded in importance when the warp-fanning method was applied in the earlier study and heddle tangling was no longer an issue.

In the current study, the coverlet-width warp was initially set up with heddles of the same length as in the earlier study, and a return to the idea of double-notched heddle rod supports (as before, using blocks to remove slack in the heddles) was envisioned as a first step. Significant heddle tangling ensued, however, and it was noted that heddles that were merely held forward (that is, without visible slack) but not held taut by their warp threads still had a tendency to tangle. Shortening the forward-layer heddles seemed like a reasonable next step.

In a small interim study conducted during the hiatus when the coverlet-width warp was moved from Osterøy to Seattle, it was noted that heddles (in either layer) that were too short risked impeding the passage of the stored pattern up and down through the heddles (Larson 2020). Therefore, when the coverlet-width warp was put back on the loom in Seattle, forward layer heddles were shortened to 8.5 cm, a length that held the heddles taut but still allowed sufficient leeway for passage of the pattern shed, and back-layer heddles were lengthened to approximately twice that size, 16 cm, a distance that similarly held those warps taut and slightly forward of plumb, but still allowed pattern transfer in that layer as well (it should be noted that these lengths were based on the slant of the Seattle loom, approximately 75°).

The revised heddles in the coverlet-width warp remained constant throughout the remainder of the study, with all tests of weight-row configurations utilising these sizes. Heddle lengths for the fibre-test warp conformed to the revised sizes. The approximation of optimal heddle lengths occasionally called for additional measures in both the coverlet-width warp and the fibre-test warp: inserting blocks to hold the heddle rods away from the uprights or adjusting cleft distances from the uprights. These slight adjustments corrected for the varying location of the forward-layer warps.

Weight-row configurations

Four weight-row configurations were tested on both the coverlet-width warp and the fibre-test warp, each involving a different placement of the two forward-layer weight-rows (fig. 4): configuration 1, in front of the shed rod; configuration 2, straddling the shed

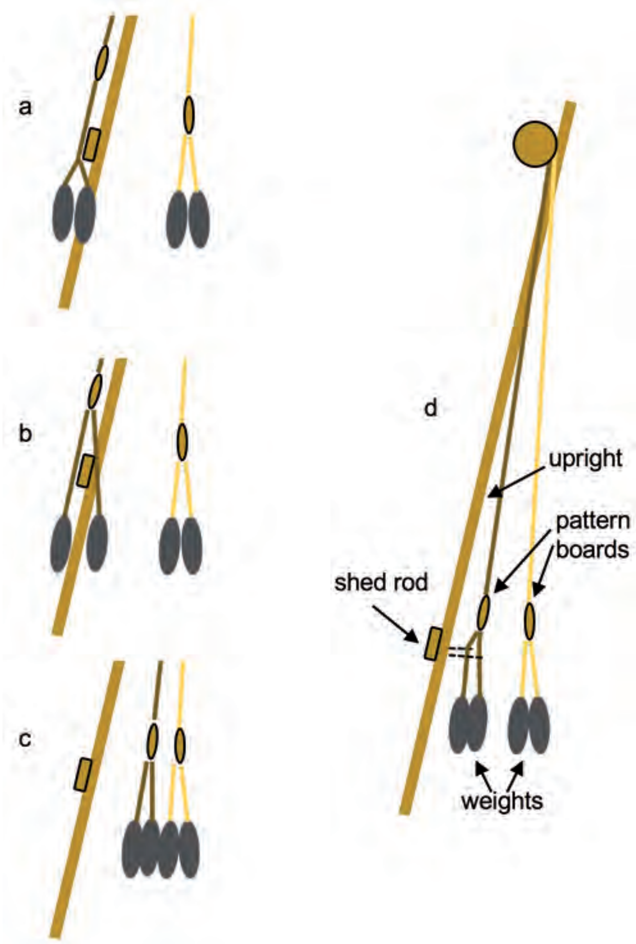

Fig. 4: Simplified view of forward-layer weight-row configurations (spacing chains, located beneath the pattern boards, are not shown): a – configuration 1; b – configuration 2; c – configuration 3; and d – configuration 4 (Image: Katherine Larson)

Fig. 5: Weight-rows in the coverlet-width warp, configuration 4: the two forward-layer rows are attached by their spacing chains to the shed rod; a pattern board is stored in the warp threads above (Image: Katherine Larson)

rod (one row in front, one behind); configuration 3, behind the shed rod (hanging straight from the beam); and configuration 4, behind the shed rod (held forward by attachment to the shed rod). Note that in configuration 2, the pattern board stored in the lower warp threads of the forward layer effectively kept the two weight-rows of the forward layer close to one another and to the shed rod. Note also that in configuration 4, the spacing chains above each of the two forward weight-rows were attached to the shed rod with approximately 3 cm separating the shed rod from the attachment points of the foremost row and 3 cm separating the foremost row from the second row (fig. 5). These attachments separated the forward and back-layer weight groups by approximately 10 cm. In the coverlet-width warp, the attachments created five gentle arcs of approximately 25 cm in width, measured in a straight line between attachment points; three arcs of similar size were formed in the smaller fibre-test warp. In all four configurations, the back-layer weight-rows remained hanging straight from the beam.

Findings

Tests of the four weight-row configurations in the coverlet-width warp were assessed based on how well the loom functioned for the three basic steps in each of the two double-cloth processes (table 1). In the fibre-test warp, tests of the same four weight-row configurations were evaluated according to the occurrence of errant warp threads in the sheds, which clarified the effect of fibre content in double-cloth layers while comparing its importance relative to weight-row configuration. Other factors emerged as a result of the two test warps, notably the importance of warp layer position relative to the uprights and the related relevance of heddle length in arriving at a workable loom configuration.

The coverlet-width warp

Several general comments regarding the steps in each process and the basis on which they were evaluated will clarify the analysis:

Step 1: Transferring the pattern in the two processes encountered different problems. For the forward layer, pattern sheds during transfer were not impacted by errant warps; instead, interference from heddle size or from the uprights was noted. For the back layer, varying degrees of success in transferring the back-layer pattern warps through the front layer were noted, in other words in forming a shed large enough or clear enough to receive a pattern stick (or pattern board in the forward/up method) at the front of the loom.

Step 2: Weaving sheds were assessed as very small (1 cm or less), small but adequate (1 cm to 3 cm) and comfortable (3 cm or more).

Step 3: Pattern sheds were assessed using the same size characterisations as those for weaving sheds, and any difficulties in bringing the pattern stick down towards the heddle rods were noted. In both processes, once the pattern shed was opened, enlarging the shed with a pattern board turned on its side was found to be an effective practice. This both provided a platform for sliding the weft bobbin through the shed with the help of a long stick, and regulated the size of the shed, allowing the weft to be more evenly arranged. A common occurrence in step 3 of the second process in all configurations was the need to clear errant warps from the pattern shed. This was easily and quickly accomplished by flexing the pattern stick at the front of the open shed, a simple practice reminiscent of the shed-clearing process described in weaving Icelandic twill, where a stick was left in the warp for that purpose (Gudjónsson 1990, 171).

Each of the four weight-row configurations exhibited some difficulties, although configuration 4 clearly was the most effective. Nonetheless, findings can be grouped into two categories according to similarities in results: configurations 1 and 2, with weight-rows in front of (or straddling) the shed rod, and configurations 3 and 4, with weight-rows behind (or attached in arcs to) the shed rod.

Configurations 1 and 2

These two configurations, with their close proximity to the shed rod, had very small pattern sheds in both the forward and back-layer processes. Additionally, there were problems with the back-layer sheds, both in opening a weaving shed at the front of the loom (pulling forward one heddle rod) and in clearing the entire back warp to the front of the loom during pattern transfer (pulling forward two heddle rods). In these steps in both processes, it was noted that forward-layer heddles jammed or tangled, impeding the opening of the back-layer shed at the front of the loom. A contributing factor may have been the inability to fully correct for slightly slack heddles in these configurations (with blocks and/or cleft distance changes), but it is worth noting that correcting this issue by further shortening the heddles would risk impeding pattern transfer upwards through the heddles.

In configuration 1, the position of the warp relative to the uprights hindered forward-layer pattern transfer,

Configuration	Process	Steps	Notes on loom function
1. In front of shed rod	Select FL/ weave BL	Transfer pattern	Hindered by uprights
		Open weaving shed	Difficult to open, forward-layer heddles tangled
		Open pattern shed	Very small shed
	Select BL/ weave FL	Transfer pattern	Forward/up and up/forward both problematic due to difficulty clearing back-layer shed forward
		Open weaving shed	(impossible to continue)
		Open pattern shed	" "
2. Straddling shed rod	Select FL/ weave BL	Transfer pattern	No problem
		Open weaving shed	Difficult to open, forward-layer heddles tangled, comfortable shed once cleared
		Open pattern shed	Very small shed, clear
	Select BL/ weave FL	Transfer pattern	Up/forward very difficult; forward/up possible with added effort (plucking pattern threads for transfer forward)
		Open weaving shed	Comfortable shed, clear
		Open pattern shed	Very small shed, clear after flexing pattern stick
3. Behind shed rod	Select FL/ weave BL	Transfer pattern	Hindered by forward-layer heddles
		Open weaving shed	Comfortable shed, heavy to open
		Open pattern shed	Easy to bring pattern stick down, minimal clearing
	Select BL/ weave FL	Transfer pattern	Forward/up: forward no problems, transfer up hindered by forward-layer heddles
		Open weaving shed	Adequate shed, heavy to open; improved by reducing cleft distance to uprights
		Open pattern shed	Difficult to bring pattern stick down; improved by reducing cleft distance to uprights, shed clear after flexing pattern stick
4. Behind shed rod, attached in arcs	Select FL/ weave BL	Transfer pattern	No problem
		Open weaving shed	Comfortable shed
		Open pattern shed	Comfortable shed after minimal clearing
	Select BL/ weave FL	Transfer pattern	Forward/up, no problems
		Open weaving shed	Comfortable shed
		Open pattern shed	Adequate shed, somewhat difficult to open, clear after flexing pattern stick

Table 1: Observations from varying configurations of two forward weight-rows relative to the shed rod. Notes: FL = forward layer; BL = back layer

while severe difficulties in back-layer pattern transfer using either the forward/up or up/forward method made the second process impossible to complete. Without the ability to bring pattern from the back-layer warps forward to the weaving area, testing in configuration 1 was discontinued.

In comparison, configuration 2 functioned better overall despite its similarly small (but clear) pattern sheds: where forward-layer pattern transfer had been hindered by the uprights in configuration 1, it was unobstructed in configuration 2, and while transferring the back-layer pattern up/forward was not possible in configuration 2, the alternate method of forward/up did work, albeit with extra effort (the back-layer pattern shed only partially appeared through the forward-layer warp below the heddles, requiring pattern warps to be plucked forward to receive the pattern board). However, the combination of very small sheds and difficulties in clearing the back-layer warp threads forward made configuration 2 problematic as well.

Configurations 3 and 4

These two configurations, both behind the shed rod but to varying degrees, had adequate to comfortable shed sizes. However, several significant problems that were noted in configuration 3 were largely removed in configuration 4.

In configuration 3, adequate to comfortable weaving and pattern shed sizes were impacted by other problems. Heddle rods for both layers were heavier to move, with the feeling of excessive weight especially noticeable when pattern boards (holding open a shed during pattern transfer or for weft insertion) regularly snapped shut. In addition, pattern transfer was hindered by short forward-layer heddles that restricted the size of the transfer shed for both processes.

The issue of heddle size identified two other problems in the second process of configuration 3 that highlight the interplay of warp position, heddle length and the uprights. First, forward-layer heddle rods were excessively heavy to pull forward due to both heddle length and the position of the forward-layer warp (further back than in any of the other configurations): one heddle rod engaged the other halfway to the clefts, ultimately pulling the weight of two rows forward when opening a shed (possibly identifying an additional concern with shorter heddles). Secondly, the pattern stick, holding back-layer warps, was difficult to bring down from the top of the weaving area due to the forward angle of the open shed resisting the weight on the pattern stick. Both problems were resolved by a revision in which the cleft distance on forward-layer supports was halved (from 23 cm to 12 cm). This eliminated the second heddle rod with its added weight from riding forward, and it reduced the angle of the open shed for bringing down the pattern stick. The resulting pattern shed was comfortably sized, but a new problem arose: access to the shed was completely blocked by the uprights. Increasing the cleft distance brought a return of the aforementioned problems, while reducing it further diminished the size of the pattern shed without an appreciable improvement to shed access past the uprights. In addition, the feeling of excessive weight when manipulating the back-layer heddle rods remained. Thus, the initial and revised versions of configurations 3 both experienced significant problems.

Better overall loom function was found in configuration 4, where pattern transfer for both layers was problem free. Furthermore, attaching the forward-layer weight-rows to the shed rod had two effects. First, it provided a separation between the forward and back-layer weight-rows, thus relieving the feeling of excess weight when manipulating the back-layer heddle rods. Second, the arcs formed by the attachment points actually lengthened the overall spread of the warp in the two forward weight-rows, from approximately 127 cm to 145 cm (measured along the curve of the arcs). This was an effect reminiscent of the warp-fanning method described in the prior study. It seems likely that this added length resulted from the latent stretch present in the spacing chains, enhanced to some extent by the empty loops between warp pairs (without such stretching into arcs, the spacing chains remained a neutral presence above the weights).

Weaving sheds in both the back and forward layers were adequate to comfortable in configuration 4, with the forward-layer pattern shed being somewhat smaller than that of the back-layer. This was the result of some resistance to bringing the pattern stick down fully into the weaving area when forming the forward-layer pattern shed in the second process (the pattern shed becomes wider the further down the stick is drawn). This problem was similar to that noted in the second process of configuration 3 but much less severe. It was clear that the angle of the open shed still presented a challenge, being held forward at the same cleft distance as initially used in configuration 3 (23 cm), but resistance to the pattern stick in configuration 4 was lessened due to the separation between forward and back weight-groups in this configuration: the pattern stick was now only working against the resistance of the back two weight-rows rather than the weight of all four rows. Thus, while involving many steps, weaving

Fig 6: Coverlet-width warp in progress (Image: Katherine Larson)

with configuration 4 fell into a rhythm that was easy to maintain (fig. 6).

Interaction between the shed openings and the uprights
The position of the uprights relative to weaving and pattern sheds became an issue in some configurations. From a side view, sheds could occur in front of the uprights, in back of the uprights, or be blocked by the uprights. In most cases the sheds opened in front of the uprights, although in configuration 3 they opened both in front and in back, and were completely blocked when cleft distance was reduced. Pattern transfers upwards from the lower warp threads were more variable, with the uprights blocking transfers for both layers in configurations 1 and 2, transfers occurring in back of the uprights in configuration 3, and both in front and in back of the uprights in configuration 4. Problems arose when the uprights were either very close to the shed opening or when they blocked the opening entirely. In both cases inserting the pattern boards or pattern sticks became difficult but not impossible: the implements could be introduced into the shed at an angle and the leading edge of the board or stick depressed from the front of the loom to insure that it followed the shed opening as it was pushed through the shed. However, partial blockage by the uprights did render visual inspection of the sheds for errant warp threads difficult, and complete blockage made visual inspection impossible.

The fibre-test warp
Weaving in the smaller fibre-test warp utilised the same four configurations, each with two processes consisting of three steps. Results were primarily judged on how well the warps passed through the opposing layer, with the frequency of errant warp threads characterised as none, several and many. The two side sections, each of which had one layer of linen warp, regularly had a lower number of errant warp threads (generally found to be none or several) compared to errant warps in the centre section, where both layers were a wool/hair blend (generally found to be several or many). This meant that additional shed clearing was required more often in the centre

Fig. 7: Fibre-test warp with a forward-layer weaving shed open (third heddle). Note layer separation close to the pattern stick below the fell: sections with linen-layer warp threads (left and right) cleared opposing-layer warps slightly better than in the blended wool/hair section (centre); observation of errant warps in both left and right sections of this shed: none; in centre section: several (Image: Katherine Larson)

section. In spite of this finding, as weaving progressed it became clear that weight-row configuration had a greater impact on loom function than the fibres being compared: when a loom configuration worked well, the additional clearing required in the centre section was relatively minor compared to those on the sides; when a loom configuration did not work well, results in shed formation were the same across all three combinations of fibres (fig. 7).

Results from the four weight-row configurations in the fibre-test warp supported those found in the coverlet-width warp, and mostly divided into the same two categories. In configurations 1 and 2, the back layer was difficult to pull through the forward layer to form a shed at the front of the loom, both for the steps of opening a weaving shed and for transferring pattern. In configurations 3 and 4, weaving-step results were similar to those in the coverlet-width warp, with comfortable sheds but a feeling of greater weight on the back-layer heddle rods, and with the same exception noted in configuration 3: opening a pattern shed in the second process was difficult, due primarily to the open-shed angle in the forward layer. In contrast, configuration 4 had comfortable sheds and no problems in forming the forward-layer pattern shed by drawing down the pattern stick. The difference in this latter finding to the slight resistance experienced in configuration 4 of the coverlet-width warp no doubt reflects the narrower overall width (and therefore lesser amount of weight resistance) of the fibre-test warp.

Discussion

The results of this study primarily concern the relative merits of different weight-row configurations for weaving double-cloth on the warp-weighted loom, with ancillary observations on the effects of heddle length. However, two overall impressions from weaving at coverlet width are worth highlighting. First, minor deficiencies in loom function, some of which were barely noticeable at a narrower width, became major and sometimes insurmountable problems at a wider width. Secondly, in the relatively complicated steps required to create this weave structure, adjustments to one element of the configuration affected other elements, making isolation of specific effects a challenge.

Errant warp threads and yarn fibre

The choice of fibre is a logical place to start discussion of the current study's findings, given the historic importance of a smooth-fibre layer in counteracting the inherent problem of double-cloth, namely two plain-weave layers attempting to interact in a space best suited to one. A few stray warps were not unusual in most sheds of the coverlet-width warp, and not an unexpected occurrence given the many slight errant-warp weaving errors observed in the coverlets of northern Gudbrandsdal (Larson 2015, 215). Based on results from the fibre-test warp, it seems likely that the number of errant warps experienced while weaving the coverlet-width warp would be reduced if a layer of predominantly hair (tightly spun) were used in one layer, rather than two layers of a wool/hair blend. However, this was considered to be a difference of degree rather than of kind, with the impact on overall loom function unlikely to change.

Weight-rows close to the shed rod

Weight-row configurations 1 and 2 that placed the forward layer weights in front of or straddling the shed rod had a common problem: the forward-layer warp impeded the basic requirement of pulling the back-layer warp threads to the front of the loom. This step was necessary for opening the back-layer weaving shed in one process, and for bringing the back-layer pattern warps to the front of the loom for weaving the forward-layer weft in the second process. While this ultimately made weaving in configuration 1 impossible, in configuration 2 the problematic sheds could usually be cleared with extra effort, at which point the weaving sheds produced were comfortably sized and the pattern sheds very small but clear. This agreed with results from the prior study, where weight-rows had straddled the shed rod: the method of fanning the warp threads significantly improved warp passage to the point that comfortable weaving sheds were regularly formed (Larson 2011, 225). Although pattern-shed size was not recorded in the earlier study, no problems were noted. It is worth mentioning, however, that a small but clear pattern shed on a narrow textile can be less problematic than on a wider textile.

The similarity between results in the prior study and those noted in configurations 1 and 2 draws attention to the problem of warp-thread passage (resistance of forward-layer warps to the passage of back-layer warps) when the forward layer partially or fully passes over shed rod. It seems possible that a contributing factor to this difficulty may have been a slightly reduced tension on the forward-layer warps, caused by a slightly reduced pull from the weights located below the bearing surface of the shed rod (all front-layer warps passed over the shed rod in configuration 1, half did so in configuration 2).

While other factors not considered in this study could

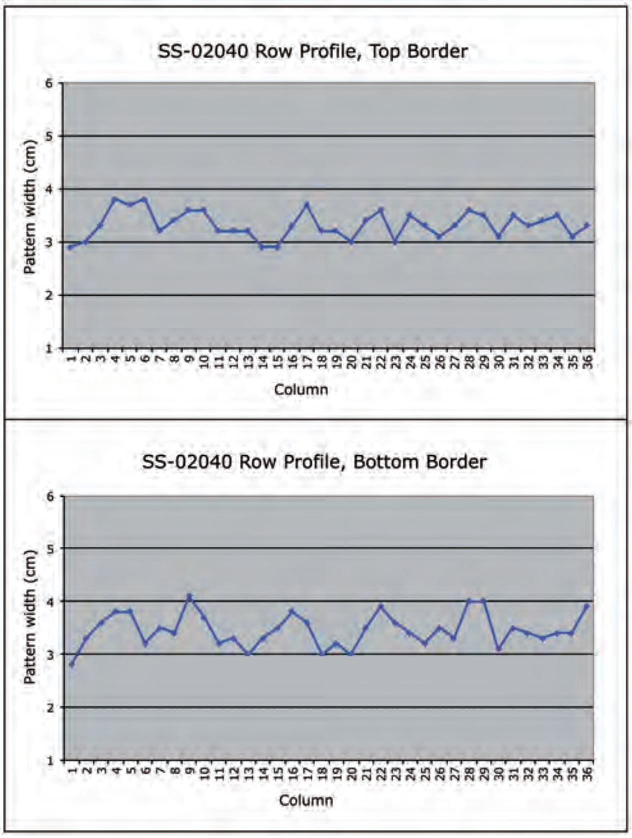

Fig. 8: Graph of warp-thread spacing variability in repeating pattern elements from the top and bottom borders of a double-cloth coverlet. Regularly occurring areas of greater warp-thread spacing grew more pronounced at the bottom of this coverlet (Accession number SS-02040, Maihaugen Museum, Norway; adapted from Larson 2011)

produce different results, it was concluded that the impaired ability to bring back-layer weaving and pattern sheds to the front of the loom made both configurations 1 and 2 unlikely candidates for use by the double-cloth coverlet weavers.

Weight-rows behind the shed rod

Both warp layers were positioned somewhat closer to one another behind the shed rod in weight-row configurations 3 and 4. A possible negative effect (reduced warp tension) from the warp threads passing over the shed rod was removed, possibly contributing to improved warp-thread passage in both configurations. Adequate to comfortable sheds were possible for each layer, and back-layer pattern transfer was also effective using the forward/up method, a procedure likely to cause less wear on the warp threads than the up/forward method due to the pattern transfer occurring beneath the heddles where the warps were somewhat less constrained (excess wear on the warp, producing fuzzier threads, appeared to increase resistance to warp-thread passage over time). The main difference between the two configurations was the feeling of excessive weight experienced in configuration 3, which created an impediment to smooth loom function. The excess weight was caused by all four weight-rows hanging together, with back-most rows bearing the weight of their forward neighbours as they were pulled towards the front of the loom. This problem was resolved by separating the two weight-row groups in configuration 4. The extent to which the further slight fanning of the warp threads (held in crescents attached to the shed rods) may have contributed to the ease of shed formation is not clear. While the relatively smooth loom function experienced in configuration 4 might benefit from further testing, this unusual use of the shed rod offered a reasonably effective method for weaving double-cloth at coverlet width on the warp-weighted loom.

The case for a novel use of the shed rod

Use of the shed rod as an attachment point for the forward-layer weight groups was the logical final choice in the weight-row configuration sequence of the current study. Other evidence indicates possible reasons for, or results of, such separation.

Wear

Observations from the coverlets in the prior study indicated that wear on heddles and warp threads may have been a problem, especially in the back layer: weaving irregularities were noted towards the bottom of several coverlets, where back-layer warp threads appeared together out of plain-weave sequence, likely the result of a broken heddle or warp thread (Larson 2015, 184). It is reasonable to assume that the back-layer warps and heddles, regularly pulled further forward to open a shed, and moreover pulled through the opposing layer, experienced greater wear than those in the front layer. Such wear would become more pronounced if all the weight-rows were hanging together, with back layer warps and heddles pulling the added weight of all rows ahead of them. It therefore seems likely that weavers sought to minimise the possibility of wear by separating the two weight groups.

Warp-thread spacing irregularities

The idea of attaching the forward weight-rows to the shed rod came from contemplation of the possible causes of warp-thread spacing irregularities noted in several coverlets. In a study of overall warp-spacing variability, measurements were taken of small repeating pattern elements across the width of selected coverlets (Larson 2015, 202). Line graphs of the results showed the general irregularity expected from a textile woven without a reed, but in some coverlets an unusual pattern emerged: among the peaks and valleys of warp-spacing irregularity (representing widely and densely spaced warp threads), some textiles exhibited areas of wider spacing that occurred rather regularly across the textile (fig. 8). After considering possible causes for this phenomenon (among them uneven attachment to the beam and irregular weight-rows), a theory was developed that back layer spacing chains might have been attached to the shed rod in an attempt to reduce wear on back layer warps and heddles; the pull from these attachment points could have increased warp spacing at the spacing chain attachment points, which would then be reflected as warp-spacing irregularities in the textile (Larson 2015, 185). With the realisation in the current study that all weight-rows may have been placed behind the shed rod, the possible cause for these areas of wider spacing was revisited. The shed rod was now envisioned as providing a crosspiece to which the forward weight-rows could be attached at regular intervals, thereby holding them separate from the back rows, but having the same effect on the warp threads as theorised in the prior study: regular areas of wider spacing in the spacing chains and in the textile.

It should be noted that after the spacing chains were attached to the shed rod in the coverlet-width warp, corresponding areas of more widely spaced warp threads did not appear in the textile. This could reflect the various weight-row configurations undertaken while weaving the study textile, but there may be other explanations. It is possible that the coverlet irregularity could have resulted from some unknown factor, weaver practice being one likely possibility. For example, habits of weft insertion and weft packing with a sword beater can produce uneven results that, repeated over time in the same areas of a developing textile, could conceivably produce areas of wider and narrower warp spacing. However, it should be noted that the coverlet weavers seemed relatively adept at maintaining a proper weaving width (Larson 2011, 152–153), a testament to their skill at handling the imprecisions of the warp-weighted loom, and they were thus likely aware of practices that might create further problems.

The lack of warp-thread irregularity in the coverlet-width warp could also reflect the method utilised for knitting the warps in the spacing chains: in pairs separated by empty loops. While this provided even warp spacing, the empty loops between pairs may not reflect the practice of the coverlet weavers. Moreover, evidence of possible warping methods observed in the coverlets can be interpreted as either two or four strands taken together in each layer (Larson 2011, 142–43). The number of strands can impact the number of warps selected for spacing-chain loops. Four strands, and thus four warps in each loop, would require individual loops to be larger, with less even warp spacing a likely result, and the pull from attachment points on a less-even chain might then have a greater effect on the textile. Further experimentation with this point might demonstrate such an effect, but despite the lack of irregular spacing in the study textile, the effectiveness of separating the weight-rows by attaching the forward group to the shed rod would seem to argue in favour of this being a likely method for achieving weight-row separation.

The importance of heddle length

The adjustment in heddle size undertaken early in the current study resulted in a significant reduction in the problem of heddle tangling. This improved the ability to test the effect of weight-row configurations in creating adequate sheds for weaving double-cloth, which was the goal of the study. However, by clarifying one issue, the adjustment in heddle size revealed the interrelated nature of other aspects of loom setup involved in achieving a workable method for weaving double-cloth. It is possible that a careful calibration of heddle size, cleft distance and loom angle could accommodate the conflicting priorities affecting warp placement relative to the uprights, all of which underscores the preliminary nature of the results presented in the current study.

Heddles and loom angle

Although variations in loom angle were not tested in the current study, it is possible that adjusting the angle of the loom might improve loom function, but not necessarily shed formation. With the corresponding adjustments to heddle length that a different loom angle would entail, especially keeping in mind the twin constraints of overly long heddles (increased heddle tangling) and overly short heddles (hindered pattern passage through the heddles; both plain-weave weight-rows engaged when pulling forward one heddle rod), it seems more likely that instead of improved shed formation, a different loom angle might allow better access to the sheds past the uprights.

While the loom angle was not changed during the study, the angle of the warp relative to the uprights did change slightly when the beam was advanced for the first time. The textile was wound away from the weaver, as documented in surviving warp-weighted loom traditions (Hoffmann 1964), but the slightly more slanted angle of the warp relative to the uprights had little effect on performance of the heddles or on shed formation. Its most noticeable effect was a slight improvement in the relationship of shed openings to the uprights.

Heddle length, the uprights and shed visibility

Within a given weight-row configuration it was noted that the position of the warp layers relative to the uprights was affected by the related factors of heddle length and cleft distance. This was recognised as a problem in the current study due to a loom setup where the weaving width maximised the available loom space. Even when sheds were judged to be accessible in the various configurations tested, they were often quite close to the uprights. This meant that when the sheds were partially or fully blocked, the uprights impeded smooth loom function by complicating insertion of the pattern boards and pattern stick. Although this was not an insurmountable problem, the ability to visually check for errant warp threads was of greater concern, as it impacted the quality of the weaving. This was a simple matter to correct if the sheds were visible, and it prompted further consideration of the conditions under which the coverlets were woven.

This study was carried out in a well-lit environment, which made it easy to detect errant warp threads. In an earlier study (Larson 2016), weaving double-cloth under lower light levels was tested, specifically the conditions found in an open-hearth house, the older type of home common in Norway prior to the 17th and 18th centuries (Anker 1998, 81–86). This type of home had a smoke hole in the roof to let smoke escape and daylight enter. The transition to an interior with a chimney and windows occurred unevenly in Norway, but at approximately the same time period that the double-cloth coverlets were woven, leaving open the possibility that the coverlets were woven under the low-light conditions found in such a dwelling. An experiment was conducted in a 16th century hearth-house at Osterøy Museum in Norway to test weaving under those conditions. In the approximately 5 m sq interior of the hearth-house, the loom was placed near a corner to take maximum advantage of daylight from the smoke hole above. Such placement would not be unusual in a small interior, especially considering that pattern boards for weaving a double-cloth coverlet were quite long, and space would be needed to insert them; in other words, significant room was needed on one side of the loom, making placement in or close to a corner likely. Of particular concern in that study was the need to select warp threads for pattern weaving, a necessity made more difficult by the nearly uniform use of dark brown in one layer of the double-cloth coverlets. However, it was found that daylight coming through the smoke hole was entirely adequate for pattern selection, and in fact that the difficulties inherent in close work with dark threads were even aided by light coming from above (fig. 9). Not considered was the weaver's ability to visually check the open sheds in a coverlet that maximised loom space, a necessity recognised in the current study. The hearth-house test warp was relatively narrow (26 cm), which allowed ample space between the uprights and the side of the warp to both insert the pattern boards and to check for errant warp threads. This would not be the case when weaving at coverlet width. Furthermore, the shadow cast by the forward warp threads on the long tunnel of a coverlet pattern shed, plus the likelihood that a brown wood wall was at the far end of that shed, could have made visibility an issue. It thus seems likely that a loom configuration giving the best possible shed visibility may have been an important factor in setting up a loom for weaving double-cloth.

Fig. 9: Weaving double-cloth under the low-light conditions found in an open-hearth house, Osterøy Museum (Image: Katherine Larson)

Weight conformation

Beyond meeting the TTTC-recommended parameters of providing adequate tension on the warp threads and conforming to a weight-row size neither too narrow nor too wide (Olofsson et al. 2015, 88, 92), the shape of the weights themselves was not considered further in this study. However, it was noted that the two rows within each weight-row group, held together as they were by pattern boards that bridged both halves of each plain-weave warp, tended to mingle with one another. In configuration 4, the most successful weight-row disposition, it would be interesting to consider what effect the loom weights described as typical or "classic" in a medieval context in both Bergen and Trondheim might have on such close weight-rows (Øye 1988, 60–61; Hagen 1994, 214, 335). These generally flat-sided, slope-shouldered weights, usually of soapstone, could be relatively thin, with an average thickness of 3 to 4 cm (fig. 10). Given the close proximity of the two weight-rows inherent in each of double-cloth's two layers, perhaps thinner weights would perform less like two individual rows and more like a blended single row, with an unknown effect on how the weight-row groups functioned.

Fig. 10: Soapstone loom weights from medieval Trondheim, most under 4 cm in thickness. Medieval exhibition, NTNU Vitenskaps-museet, Trondheim, Norway (Image: Katherine Larson)

Conclusion

The Norwegian reversible double-cloth coverlets provide an excellent opportunity to consider how the warp-weighted loom may have been used to weave complicated textiles. While the exact method with which double-cloth was woven on the warp-weighted loom cannot be known, this study has described positive and negative aspects of various weight-row configurations and determined a configuration that worked well for weaving at coverlet width.

Despite the apparent simplicity of the loom, the study draws attention to the many variables to be considered when weaving double-cloth. It demonstrates how the interplay of these variables can affect the critical element of warp-thread passage in the formation of useable sheds, and identifies the importance of warp position relative to the uprights for both physical and visual access to the sheds. A number of areas for further study are suggested, among them adjustments to loom angle, the possible effect of sizing to improve warp-thread passage, and the use of thinner weights in such close weight-rows. Additional testing of various heddle lengths might also yield better shed access for double-cloth, and determining the exact fibre content of warp threads in surviving coverlets could provide the basis for further experimentation with more exact materials.

Perhaps the most intriguing finding from this study is the proposed use of the shed rod, not serving in its normal role as a crosspiece to separate the warp into weaving sheds, but instead serving as a crosspiece to provide an attachment point for separating the two double-cloth weight groups. Such a novel approach to using this key element of the loom may represent a flexibility in the way weavers of the past viewed this most basic of utensils. Over the course of the warp-weighted loom's long history, it is likely that other complicated structures were woven. It would seem that the Norwegian double-cloth weavers, by continuing their use of the warp-weighted loom into the modern era, provide us with an opportunity to consider those past practices, and invite consideration of weaving methods that have long since disappeared.

Acknowledgements

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Dear Reader,

The year 2022 became the one in which the pandemic finally lost its tight grip on our academic world and the world in general. Conferences could take place in person again and the previous good experiences with online participation made it possible for those still unable to travel to link up with old and new scientific communities. In this issue, we have news from some of these conferences. There are still fewer than usual but the number is increasing. Please remember that you are all welcome to report on all events relevant to our *Archaeological Textiles Review* readers in the future. Despite the pandemic, ATR has received a constant flow of contributions this year and we already have many exciting articles and project reports in the pipeline for the next issue (ATR 65) – but we are always ready for more. We do our best to process material for the next issue as promptly as possible and continue to be a route to relatively quick publication. However, the editors and peer reviewers are all volunteers and we are grateful for your patience, if the process is delayed or postponed. We, just like everybody else at the moment, struggle with difficult work conditions for international collaborative work.

Our cover for this issue pays tribute to Ukrainian refugees who are volunteering with our colleagues in Estonia in an extensive textile project. Jaana Ratas, textile conservator at the University of Tartu and Anu Lensment, a fashion designer working for Estonian TV, are part of a network of local coordinators all over Estonia who are recycling textiles into camouflage nets on university campuses, in museums, and at social centres. There are 3,500 members in the project, both locals and refugees, with more members joining each day. A Facebook group, Aitan Kaitsta (I help to defend), helps to coordinate the work.

Information about net making, including up-to-date colour schemes for them, is shared there. The Estonian specialists have all studied textiles, fashion, design, traditional crafts, or conservation to university level. They receive advice from engineers and military experts about the best techniques for making camouflage nets and use their own craft skills to develop step-by-step instructions, which are published as free downloads in Estonian, Ukrainian and English and in tutorial videos.

The handmade camouflage nets are considered better than the mass-produced ones because they blend into the environment more naturally and are more effective at disguising vehicles and people. Since March this year, nearly 1,000 m^2 of camouflage netting has been made in Estonia and sent to Ukraine making use of three tons of secondhand clothes, household textiles and sacks donated by clothing and coffee shops. They are made from old fishing nets, strips of the upcycled fabric, and unravelled jute. Sorting these materials, which must be categorised by colour for different kinds of camouflage, is a regular part of volunteers' work. Needles made for single needle looping are used for sewing fishing nets together and people with dyeing skills tint the textiles, if necessary. Despite 14-hour days at the beginning of the project and now three days a week away from their regular jobs for the Estonian coordinators, there are never enough nets. Other textile academics volunteer to work on the nets during their free time, including their lunch breaks, and some have started researching the history of camouflage to inform the project.

The Ukrainian volunteers add their own "magic" to the camouflage nets: prayers, rhymes, and greetings are written on the labels, and little dolls filled with herbs or cloth angels in blue and yellow are tied to them. Children's drawings, chocolate, and knitted woollen socks are also hidden inside the rolled-up nets. Many project participants also now knit socks for the soldiers, adding labels with their thanks and good wishes. There are benefits too for those making the nets. They make new friends, share stories, learn new languages, and experience the therapeutic effects of doing something useful with their hands which distracts them from their anxieties. Sometimes, the Ukrainian women sing while they work. Often, there is positive feedback from Ukraine which is very motivating for them. Some refugees have returned to Ukraine and continue to make nets there using the skills, knowledge and instructions they gained in Estonia. Despite the success of the project, Jaana says that she hopes "the war will be over some day and I could do textile research again."

This project is a timely reminder that textiles are key to human survival sometimes in ways we do not always appreciate. Whose current knowledge will prove crucial in the future? Our growing awareness of sustainable textile production makes its ancient and historical context ever more relevant – we can learn a lot from the past. We should all work on bringing our knowledge of the past to the fore in discussions about the future. Learning from the past also includes respecting the knowledge of those who have led our discipline down new paths. ATR 64 features the obituaries of three colleagues who have passed away this year. Even though this is sad, we must be glad that their legacies continue. Each in their own way brought skill and passion to textile research and we honour their memories.

This year's issue also includes eight articles which range geographically from north Africa to Norway, and from the 16th century BCE to the 17th century CE. Some are about specific new textile discoveries and others document continuing analysis of old finds. The reports section has interesting news about recently started projects and updates on projects coming to an end. They all illustrate the fascinating breadth of textile research underway in European academia today. We congratulate you all on attracting the necessary funding and managing these complicated collaborations. A tremendous amount of work goes into managing research in this field, we hope that these experiences will benefit all who are working in textile research in the long run.

We hope you all enjoy reading this open-source journal, which is free to download and share. This is only possible through the dedication of many enthusiastic hearts, minds and hands. Please do consider offering your services if you would like to help keep this journal alive and kicking or consider sending us a contribution for publication. The deadline for articles for every issue is 1 May each year but project and conference reports may be submitted by 1 June and 1 October, respectively. The deadline for news including doctorates awarded, new publications or awards is 1 November.

Please note that it is still possible to order a printed copy of ATR from the webshop at the University of Copenhagen in Denmark (www.webshophum-en.ku.dk/shop/archaeological-textiles-664s1.html).

The Editors

Fig. 1: Ukrainian refugees sort second hand clothing and household textiles for camouflage nets (Images: Jaana Ratas and Mark Raidpere)