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A PILE OF STICKS IN DRYAD FASHION: INTRODUCING THE COMPACT UPRIGHT WEAVING LOOM (CUWL)

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ABSTRACT

This article follows the iterative development of a bespoke upright hand loom, as a process of experimentation and modification to create a weaving instrument to fulfil personal requirements for new weaving projects. In the absence of any written research on loom design and loom mechanics for this particular style of loom, the studio methodology was to make and evaluate by trial and error, picking up ideas from photographs of looms in weaving blogs and looking at the sample weaves produced on each successive loom design to work out where the next change needed to occur, be it to create a stable tension, roll on, shed changing or thread packing. As a result, this article uses an autoethnographic approach in writing up resulting workshop and studio research.

INTRODUCTION

Weaving is an ancient technology, and one wonders what innovation one could possibly bring to the table after thousands of years of refinement. Here we introduce an iterative loom design project that has been ongoing for several years to answer my personal 'perfect-loom' challenge. For those unfamiliar with the technique, we will introduce some basic weaving vocabulary before a more in-depth look at the vagaries of tapestry weaving. The solutions were arrived at during two phases of development with an intermediary period of follow-up research online after Phase 1 to consolidate what we had learned in the workshop and to plan possible options before proceeding with Phase 2.

> Weaving is one of the oldest surviving practices in the world, with its history firmly rooted in the Neolithic period when the creation of woven textiles exploded, with most households producing their own cloth. Since then, weaving has influenced history and culture around the planet, becoming an indispensable skill connected to family traditions, farmed fibres and local production – spanning to modern times when the loom became mechanised during the Industrial Revolution … The loom is of course a tool for weaving, but it also becomes an object of veneration and reflection, a self-sufficient work of art. (New York Textile Month, 2022)

I began my weaving journey with the view of following in my family's footsteps of weaving and becoming a tapestry weaver (McKinlay, 2022). My grandfather built a hefty floor loom at home and worked in the Kaiapoi woollen mills after emigrating from Bradford in Yorkshire, where he had worked in the mills since he was a 10-year-old boy (not the legacy I was pursuing). On my great-grandmother's side of the family, there were stories handed down of our ancestors as renowned tapestry weavers from Flanders who had worked on the Hampton Court tapestries and in Welsh monasteries before that (Hart, 2017). Thread is in my blood. I began learning shaft-weaving from Master weaver Christine Keller at Dunedin's LoomRoom at its inception in 2014. In 2021, I was fortunate to get a space in Master tapestry-weaver Marilynn-Rea Menzies's workshop class when she made a visit to Ōtepoti Dunedin (Fox, 2021). Tapestry weaving at one level appears to be the most seductively simple of weaving styles:

> There are many kinds of looms that can be used to weave tapestry. Virtually any structure that can hold a set of warp threads in order and taut will work in some fashion. Kids weave them on cardboard boxes all the time. (Camezoff, 2015)

Weaving on a loom involves the interlacing of two sets of threads at right angles, with the loom being a device to keep one set of inelastic threads taut or stretched under tension (warp) while the moving threads are passed over and under. The basics can be learnt by the youngest of nimble fingers but attaining proficiency in the art is another matter, requiring long years and thousands of hours of practice and technique. At the other end of the spectrum are master weavers working in the fields of production, fashion, homewares, upholstery, flooring rugs, corporate commissions, and tapestry.

TAPESTRY WEAVING

The definition of the word tapestry today describes a range of textiles, including needlepoint and certain woven fabrics, but historically and technically it designates a textile woven by hand on a loom. The design might be figurative or abstract, but it is 'weft-faced' in its making, which means the finished weaving hides all the warp threads; this in contrast to shaft weaving where the revelation or hiding of a mix of warp and wefts make up the final pattern. Looms generally fall into two categories by the way they are warped, either high-warp (standing vertical) where the warp runs perpendicular to the floor or low-warp in which the warp runs parallel to the floor (or in a horizontal plane) as in the Flying8 loom shown in Figure 1. "High-warp looms are the looms most people think of when you say tapestry," comments Rebecca Camezoff (2015), "The warp runs mostly perpendicular to the floor and the work sits in front of the weaver much like it would when hung on a wall."

As an intermediate weaver I was ready to make the move from beginner portable table looms to a loom I could live with and I aspired to create larger tapestry style pieces. Loom choice is a very personal preference, depending on what it is one will be making and one's level of skill or ability. One of the biggest constraints in urban Aotearoa New Zealand is household space. For some, when your family has fledged the nest there are spare rooms to take over as hobby rooms in which to install floor looms; however, these are large, heavy cumbersome items and expensive to buy new. But what of the home-weaver who wishes to share living space within the demands and the normal flux and flow of family living. How does one bring a loom inconspicuously into the living room? To add to this challenge I needed a compact loom with multiple shafts. Additionally, I wondered, would it be possible to have an *upright loom* with multiple shafts?

For home loom-builders, the go-to plans are for the Flying8 DIY loom, designed and sold by Estonian loom creator Andreas Möller. First developed in 2009 as a 'space-saving' counter-march style loom, the Flying8 loom has become a valuable tool in start-ups and social enterprises all over the world including developing nations (Weberei Hamburg, n.d.). As you can see in Figure 1, this Dunedin example built by Master weaver Christine Keller, the Flying8 DIY loom is still a room sized piece of joinery with a big footprint (Keller, 2013). Floor looms by design are meant to be a permanent fixture in a room and are not designed for moving quickly without dismantling them. Both its size and weight made it unsuitable for sitting quietly amongst a family at work and play. This was not going to be a suitable loom for my situation.

Figure 1. The Flying8 DIY loom design by Andreas Möller.

Figure 2. An example of a simple rack or upright loom. This piece was made for an Art+Science collaboration with Dr Anna Kluibenschedl (left) whose research area is coralline Algae. Dr Ro Allen on the right. (McKinlay with Kluibenschedl, 2019).

Figure 3. Navajo-Weberinnen in der Navajo Nation Reservation, Mai 1972. Holdings of the National Archives and Records Administration, cataloged under the National Archives Identifier (NAID) 544416. Environmental Protection Agency image in the Public Domain.

The simple free-standing vertical or upright loom in Figure 2, is the simplest of constructions. It is basically a rectangular frame with an upper and lower beam between which the threads are wound and stretched. This kind of loom, which can be used for tapestry, was the basis for the developments described in this article. The loom in this photograph also pulls apart for easy storage between projects. Many of the available manuals such as *Vertical Loom – Principles and Construction* (1989), by Jules Kilot, were also based on a single top bar loom as pictured, such as used in Navajo weaving, an example of which can be seen in Figure 3.

Tapestry weaving involves a technique where each warp strand is manipulated by hand, which is very time-consuming. I looked for answers on how to speed up this process, with the creation of additional weaving 'sheds' in traditional weaving books. The perceived wisdom was that two shafts could be created easily using a combination of a weaving 'stick' and leashes (see Figures 4–6). The first shed is easily achieved by weaving a long stick through every second thread and turning it on its side. The second shed is made by looping and knotting a series of leashes to every second thread which when pulled creates the opposing shed. When a shed is made, one or more shafts move in opposition to each other to create an open space through which to pass the weft thread.

SOLUTION PHASES

CREATING THE LOOM: PHASE ONE

The development of this upright loom began innocently enough with a request to Joanna Wernham, joiner and designer, for "two long weaving sticks" to create this shed effect. The ensuing request inevitably snowballed into discussions and experiments, which eventually led to the progressive development of the loom that inconspicuously fitted into my living room. But could there be multiple shafts and how would we create that shed to weave through?

It immediately became clear that rollers would be the first item to be added onto the existing rack loom. Rollers allow longer lengths of cloth to be woven but also enable sufficient tension to be applied to the warp. Spare parts salvaged from old and broken looms were used for the ratchet handles, and rollers were created as bespoke pieces to suit the given dimensions (Figure 4).

Figure 4. The addition of rollers to the rack loom, using recycled loom parts.

Figure 5. The use of a stick and pole to create a shed.

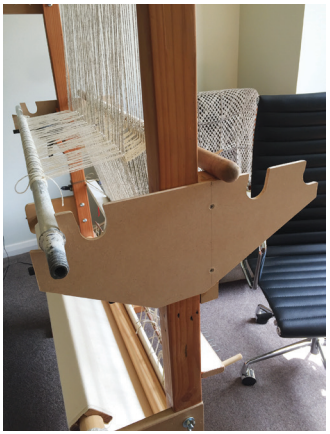


Figure 6. We explored a range of frames for holding the "sticks" to create a shed in the weaving.

Figure 7. Tying leashes.

Figure 8. Shafts moving in two directions to create shed.

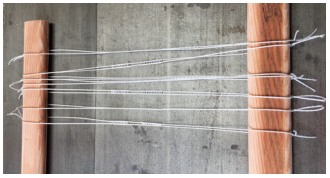


Figure 9. Textsolv heddles.

Figure 10. (Left) Finding alternatives to leashes: "steam punk".

Figure 11. (Right) Exploring and testing the various options was all part of the fun.

Resolving the problem of creating an easily managed shed, took weeks of exploration, simply because we could, we were having fun!

The first iteration was the initial request of a 'stick' and leash pole (Figure 5). The second iteration used leashes and creation of a range of frames into which the sticks were placed to open the shed. One idea was to have two leash poles working on opposite sides of the warp, but really, how would you operate this in practice! (Figures 6 and 7). The third iteration was to create what we called our *steam punk* system to insert each warp thread into (Figure 10). These wooden heddles could be moved backwards and forwards to create the shed. It was cool but quickly dismissed as a viable option, because actually how would they be connected together in such a way that could be easily operated?

We did play with a few other options, but the final iteration was the obvious, *"why didn't we do that in the first place!"* addition of two shafts using Texsolv heddles (Figure 9) to hold the warp threads. (Figure 12).

With the wisdom of hindsight, it now looked remarkably like an upright version of a rigid-heddle loom (Ashford Wheels & Looms, n.d.).

The sheds in this two-shaft upright loom were created manually by pulling one or other of the shafts towards the weaver and held in place by a manually inserted piece of curved wood until the next shed change. This was great for plain weave and several tapestry style wall hangings were created on this loom (Figure 12).

Following this success, we wondered whether we could add more shafts and thereby increase the complexity of the weaving and weave patterned rugs and twills in the Scandinavian style. See Bengtsson, Bjoerk & Ignell (2016) for examples of this style of weaving.

RESEARCHING THE OPTIONS

Our process again was iterative as there was little information available about the actual practical mechanics of loom design that we could find. Research in weaving forums uncovered an upright loom design from Leicester from the 1930s called the Dryad loom (British Museum, n.d.). (Dryad is the Greek name for a tree spirit – *dryaed*). This loom is no longer made but some accounts record it had similarities to the LeClerc or Tissart Cantilever loom. Every recollection I have read of these looms describes them as being a very solid piece of furniture (some described it as the "battletank" of looms. This did not bode well for a loom that could sit inconspicuously at the centre of our household):

> Sturdy as hell, which well they should be. The beater doesn't slide but instead is on rails and is held up by springs, you pull it down to beat the shed. If you live in an upper storey, you'll drive your neighbours mad, but you could make a bunch of rugs to insulate the sound. The shafts move forward and backwards rather than up and down obviously. It's a very convenient system, but if you want to make your own and wish to simplify things you could try replicating the ancient warp-weighted system, which is similar in principle to the typical tapestry system (Kiernan, 2016).

Figure 12. Loom with roller and two shafts containing Texsolv heddles. The shafts were manually operated and held open by a piece of curved wood.

PLATE 3. DRYAD FOOT POWER RUG LOOM.

Figure 13. The Dryad Loom – a solid piece of kit. The Dryad Works also published a series of leaflets covering various crafting techniques including several on loom weaving which featured its looms. Image source: Dryad Press series 85.

Figure 14. Amasis Painter, ca, 550–530,
black figure terracotta with scene of textile work.

Figure 15. Christina Petty at her loom –
Most tapestry looms have a triangular brace for stability, but this increases the footprint.
Here Christina uses a tree, which would also be unsuitable for a living room solution.

The writer in this account continued that if they wanted another loom such as this, they would make a warp-weighted loom. To follow this clue, I would need to go back in time to uncover the workings of warp-weighted looms, which is as it turned out is a highly active area of practical archaeology.

All cultures have a history of weaving. Many will be familiar with the legend of Penelope in ancient Greece through to the many goddesses of weaving in countless pantheons such as Frigg (Norse). It is suggested by Postrel in *The fabric of civilization: How textiles made the world*, that the stone age could be renamed the 'string age' to honour the place and importance of textiles in the development of trade, economy and civilisation (Postrel, 2020). It is one thing to consider the imagery of Penelope on an ancient Greek pot and quite another to encounter reproductions of warp-weighted looms created by practical archaeologists. Penelope's loom is depicted in another ancient Greek pot (Penelope at her loom with Telemachos, Athenian red-figure cup, *c.* 440 B.C.E., by the Penelope Painter), which is the subject of practical reconstruction. The Penelope project aims to integrate ancient weaving into the history of science and technology. There is also the pracademic research of Alexandra Makin and Christina Petty, who have created a multi-shaft, warp-weighted loom for achieving simple twills as well as plain weave. While there is an active global community researching warp-weighted looms and techniques from antiquity, their research and loom design had resolved a longstanding mystery between how ancient textile fragments in museum collections were created and the longstanding view that these would have been impossible to produce on warp-weighted looms (but then how to explain the twill fragments that exist – a prehistory and archeology paradox) (Makin, 2020). While intellectually fascinating, the shifting of the weight of the weaving sticks and clanking of heavy stone weights in my living room was also not going to be a solution.

CREATING THE SL-LOOM: PHASE TWO

Joanna Wernham (mentioned earlier) picks up the story:

"So, if we could make a two-shaft loom, why not make it four? How hard could that be, and how would the shafts be operated? The initial trial maintained the shaft 'castle' in the horizontal plane, now including hand operated levers to control the action (Figure 16). Trying to figure out how to do this using foot operated pedals was not really an option to incorporate into the original rack loom design. So recycled lever components clamped in place, different methods of making each shaft move forwards then back again was the challenge. Having the shaft move forwards was one thing using the lever, to have it return quite another. Maybe a spring or possibly bungee cord? But the tension required to get the shafts back into the castle proved too much for the system to function fluidly. The clue was in the Dryad loom, by putting the castle on an angle and to allow gravity to help in the return process, the shafts almost slid back into place once released by the levers. The next innovation was to add weights to the shafts to assist in this process."

"Having the castle on an angle was the solution, thank you to the Dryad designer! But in doing so the heddles also needed to be aligned vertically for the warp to run through the four shafts to work properly and using my grandfather's brass plumb-bobs were essential in that alignment process. The second plumb-bob (to the left, Figure 17) was used to work out the placements of a series of screw-eyes for the lead weight lines to be run. This maintains an even tension and clean shed. The inspiration for this was taken from the ubiquitous double hung windows found throughout the Edwardian houses in Ōtepoti Dunedin – double hung windows in which the upper and lower window sashes slide vertically. The movement in early double-hung sash windows was produced by counterbalanced cylindrical weights suspended on cords that run to the top of the frame and into a cavity beside the window. However, our movement was in two planes hence the requirement for a pulley system to distribute the movement (Villa Windows, n.d.)."

Figure 16. Horizontal castle, demonstrating using the lever with bungee cord.

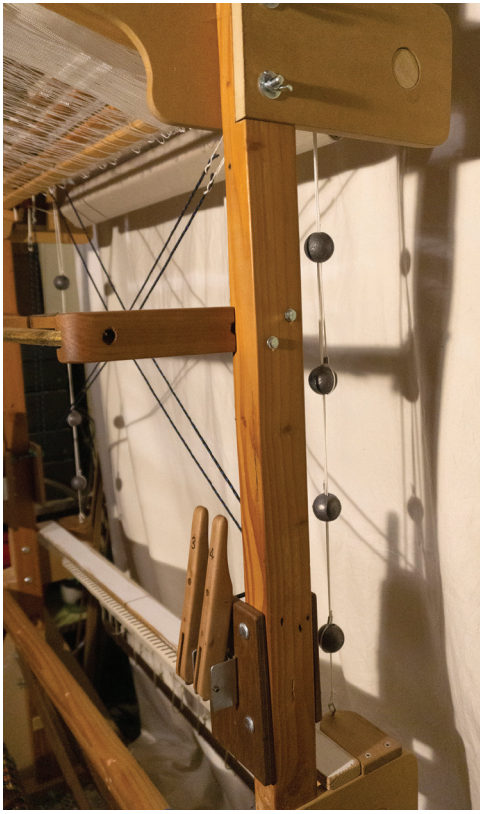
Figure 17. Angled castle, showing the use of plumb-bobs to align the heddles and setup the lead lines.

CONCLUSION

This article followed the iterative development of an upright hand loom. As written records were scarce, the loom was designed by a process of experimentation and iterative changes to the design in the workshop, followed by threading the loom and weaving a sample to see how the loom was performing at the thread-face. Given that written accounts of loom design are so poorly represented in design and weaving literature and we were unable to find any useful direction from the writing we could find, we give an account here with detailed illustrations of our working findings so that others may follow, make their own changes and improve upon this design, without needing to reinvent the wheel as it were.

Tapestries require a high-tension warp to allow the weft to flow around the warp instead of deflecting it. And so here we have the final result after much trial and error, many cups of tea and remarkably little swearing. It is a sturdy and uncomplicated loom. We have used a metal reed in a wooden batten frame (usually used to beat the threads) as a means to separate the threads and keep them evenly spaced but not as a beater. Beating is done with a wooden rug fork. The rug fork I use is a heavy wooden implement with the handle at an angle to the head. The warps are on rollers for tension and moved forward by a pawl and ratchet system adjusted by a hand crank/wheel.

This loom has fulfilled the goal of creating an apparatus to weave more complex patterns at a larger scale. The loom is compact and quiet. The design is bespoke. It has beauty with function. We present the CUWL loom and have woven our first samples.



Figures 18–19. Photographs of the final solution – the compact upright weaving loom.

ACKNOWLEDGEMENTS

The project on which this article was based was a creative partnership with **Joanna Wernham**. Joanna has an extensive background in design, in print, hard media and product design. She has worked in the past for the Design Studies and Foundations Studies, University of Otago. Joanna is a member of Dunedin's LoomRoom as both a weaver and loom technician and is also renowned in Dunedin for her creativity in the world of miniature furniture making.

Pam McKinlay is a weaver and textile artist with a background in applied science and history of art.
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