

Atlantic Spinners and Handweavers

Brief Introduction to Dobby Looms
and Multi-shaft Weaving

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Contents

- My looms
- Thinking about Weaving
 - Shaft loom weaving
 - Lift plans
 - Ideas to start multi-shaft design
- Some resources

- A word about Photoshop for shaft looms and Jacquard

Every weaver's journey is unique

Looms

AVL 16 Shaft Folding Dobby Loom



Mechanical Dobby
Box

Lag Chain

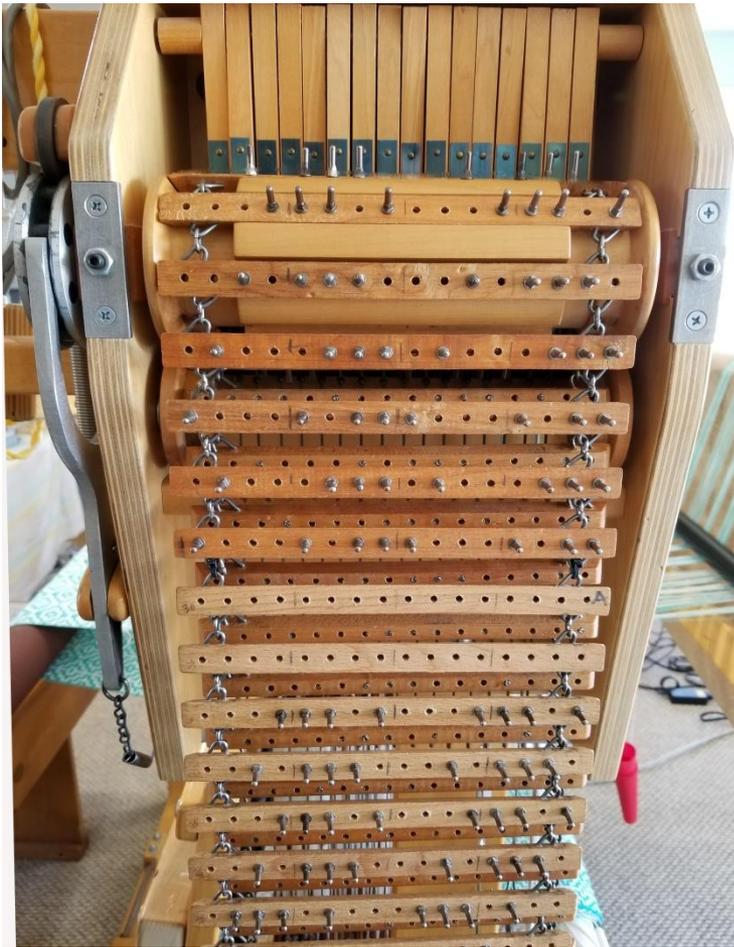
Sticky Beam

Cloth storage
system in back

AVL 16 shaft FDL

- 16 shafts gives considerable **design flexibility**
- Can use **all the lift combinations** of the 16 shafts
- Industrial features provide **good tension control**
 - **Sticky Beam** holds and spreads the warp securely
 - **Tensioned Warp Beam** for consistent tension
- **Cloth storage** system
 - provides lots of cloth storage at the back of the loom and
 - winds onto the cloth beam automatically as you advance the warp
- Works equally well for both **heavy and light warps** and fibres
- **Mechanical Dobby**
 - I can weave in any weather as it does not rely on electricity
 - Shafts raised and lowered by **two treadles** – the “up” treadle and the “down” treadle
 - The **lag chain** can go forward or backward and you can change the position of the chain manually if desired
- Help is always available from AVL.

Mechanical Dobby and Lag Chain



When you treadle a shot the cylinders holding the dobbie chain rotate one position clockwise
The little pins push in the paddles at top which engage the shafts that are to raise

Pegging the Lag Chain



Cloth take-up system



Cloth storage at the back



Weight, crank, crank and pulleys leading to the cloth beam pulley at back

Warp beam tensioning



Spring and adjustment cord



Large spring and cord around warp beam

AVL 40 Shaft V-Series



AVL V-Series

- 40 shafts provide extensive **design options**
 - Also, straight thread can be used as a mini-jacquard for 40 wide pictures or text
- Smaller format but very sturdy
 - Fits in a smaller footprint but is long enough for a good shed.
- The e-lift
 - uses a motor to **lift the shafts**, not the weavers muscles. Its strong. I've woven pieces where 36 shafts were lifted in every fourth pick.
 - The sheds are formed quickly and very cleanly.
 - Sewing machine like peddle to operate
 - Can operate as double action (one press to lower and lift) or single action (one press lifts, next press lowers)
- The warp beam tensioning system provides very **consistent tension**.
 - It uses a lever arm and weight to tension the beam. Its very adjustable.
- **Fibreworks software** interfaces with the Compu-Dobby to tell it which shafts to lift for each shed.
- You can **change the draft** that you are weaving for different design options on the same warp. (Of course the threading remains the same)
- I design on a larger workstation and monitor at my desk then load the final draft onto a smaller computer that I leave with the loom.

AVL V-Series

Warp beam tensioning



Optional separately purchased UPS to allow graceful shutdown if power goes out



Computer with draft
Connected to Compu-Dobby

Compu-Dobby

Standard breast beam

E-Lift

AVL V-Series with Compu-Dobby



- Compu-dobby and E-lift
- Standard breast beam
- Warp beam tensioning via lever arm and weight
- Standard cloth beam in front



The Dobby Back



The bar goes up and down as you change sheds.
The little balls on the harness cables either engage with the bar or not depending on whether the shaft should be lifted.

Inside the Compu-Dobby



40 solenoids are located in the middle of the compu-dobby. They go in and out as dictated by the weaving file. They engage with the harness cables so that the appropriate shafts are raised



Warp Beam Tensioning



The E-lift motor and return spring



E-Lift motor box, e-Lift Motor Cam and Return pulley



Thinking about weaving



“Opportunity”

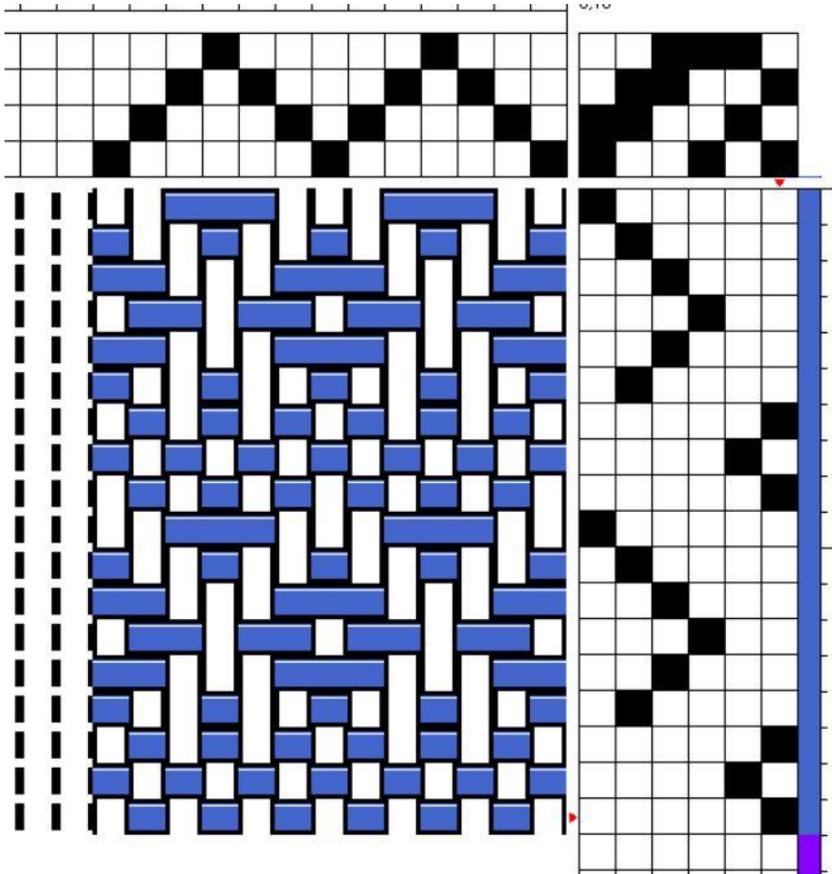
What is a lift plan

- For a shaft loom the lift plan is a diagram of the sequence of lift
- There is a column for each shaft, and
- A row for each pick of weaving
- It is used to create the lag chain for a mechanical dobby loom
- It is what tells a Compu-Dobby, through software, which shafts to lift for each pick
- In Jacquard work the lift plan has a column for each heddle because each heddle can be lifted independently of all the others

2/2 Twill Point with Plain Weave

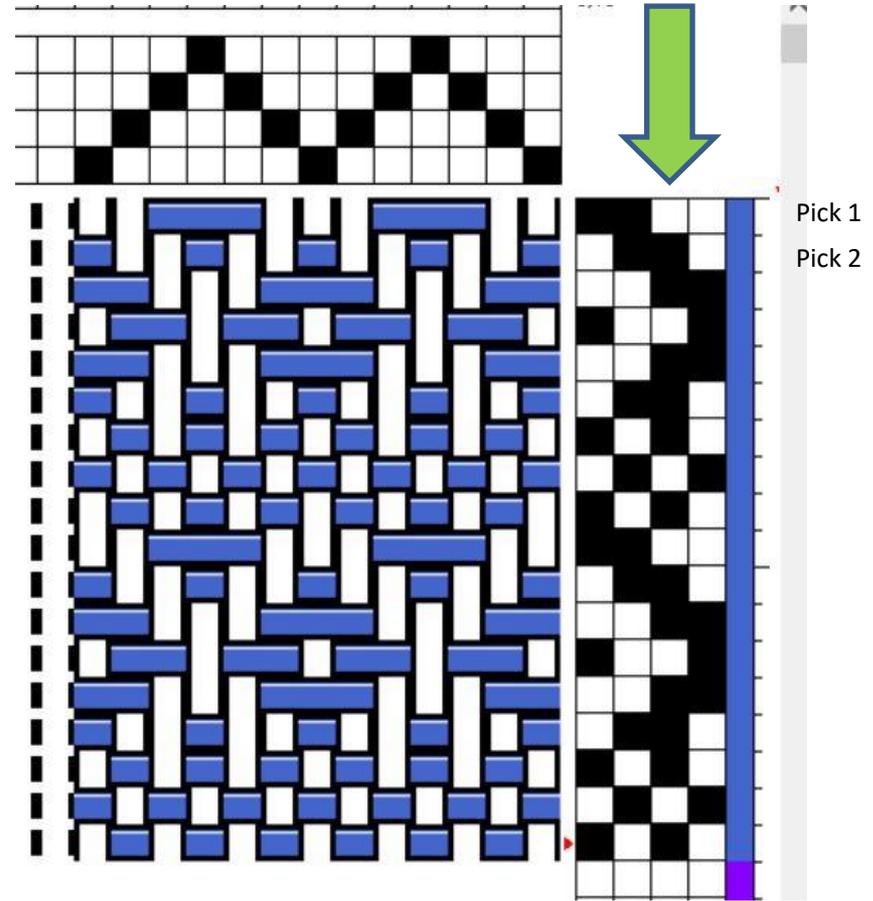
Tie up vs lift plan in Fibreworks

Tie up mode



There are 6 treadles, 4 for twill and 2 for Plain Weave.

Lift Plan mode



In the lift plan you have 4 columns. One for each shaft.

This is the lift plan

Treadle looms and Dobby Looms

Why would you use a doobby loom instead of a treadle loom?

- To take full advantage of the design potential available for the number of shafts on your loom.

You really couldn't operate a loom with a large number of shafts with treadles. At some point (perhaps at 16 shafts) it becomes impossible from a practical standpoint.

Think about this

- The cloth structure is formed by
 - The threading sequence combined with the sequence in which the shafts are lifted
- For a rising shed loom
 - A treadle is connected to the shafts that it will raise
 - Each treadle raises one lift combination of all those available for the number of shafts.
- On a 4 shaft loom
 - you have 14 possible lift combinations available
 - but only 6 treadles
- On an 8 shaft loom
 - there are 254 combinations in which you can raise the shafts
 - but you have only 10 treadles

What are all the possible lift combinations for a shaft loom

Lift combinations for a 4 shaft loom				
shaft / combo	1	2	3	4
1	Up			
2	Up	Up		
3	Up	Up	Up	
4	Up	Up		Up
5	Up		Up	
6	Up		Up	Up
7	Up			Up
8		Up		
9		Up	Up	
10		Up	Up	Up
11		Up		Up
12			Up	
13			Up	Up
14				Up

Possible lift combinations	
Shafts	
2	2
4	14
8	254
12	4,094
16	65,534
24	16,777,214
32	4,294,967,294
40	1,099,511,627,774

Formula: 2 to the power of the number of shafts minus 2

4 shafts with 6 treadles → 6 lifts, 8 unused
 8 shafts with 10 treadles → 10 lifts, 244 unused

Limitations on lifts available for a given number of shafts

- Treadle loom
 - The number of treadles or
 - Your willingness to manipulate them
- Dobby looms
 - All the combinations are available to you
 - You can use any or all of them
 - With a mechanical dobbie the length of the lag chain is a consideration
 - With a Compu-Dobby the lift plan can be as long as you like
- Lever operated table looms
 - You can lift any combination
 - The size and length of the cloth you can produce is a consideration

Your thoughts about these differences will help you decide which type of loom you would like to use.

Where to start

Start from your comfort level

Start with structures you know well and extend them over more shafts

- Block and Unit weaves
- Twills – Fancy, Advancing, networked, interleaved etc.
- Double Weave and the like
- Tied weaves

Also consider:

- Combining weave structures warp wise
- Straight thread and draw in the Lift Plan

You could easily spend your weaving life exploring any one of these options.

Use the resources available

- **Use weaving software** such as Fibreworks
 - It allows you to experiment “on screen” to test out your ideas and designs
 - Contains many tools to ease design
 - Contains error catching and productivity tools
- **Books, magazines, journals**
 - Weaving and design

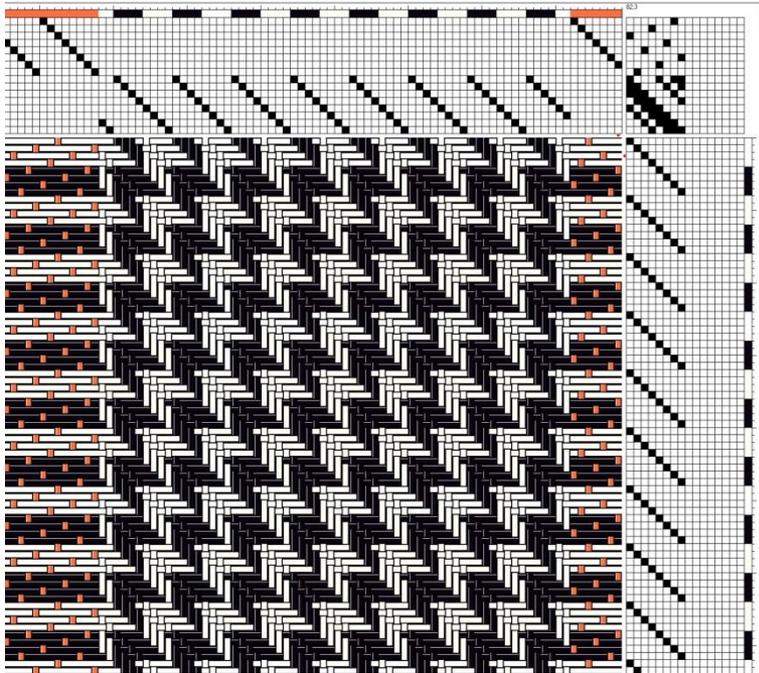
Develop your own style

- Create your own designs
 - A multi-shaft loom gives you increased design potential
 - You can make many different designs using the same basic structure
 - You don't need to know all the possible structures, or everything about a particular structure
- Learn to envision the cloth
 - Don't worry too much about terminology
 - Use your software to help you understand what each thread is doing
 - Allow yourself to develop naturally
- Trust your creativity
 - You can “colour outside the lines” as long as
 - you produce what you want to produce
 - the end product is well executed
 - Design in either Tie-up and treadling or directly in the Lift Plan whichever is easiest to understand and use

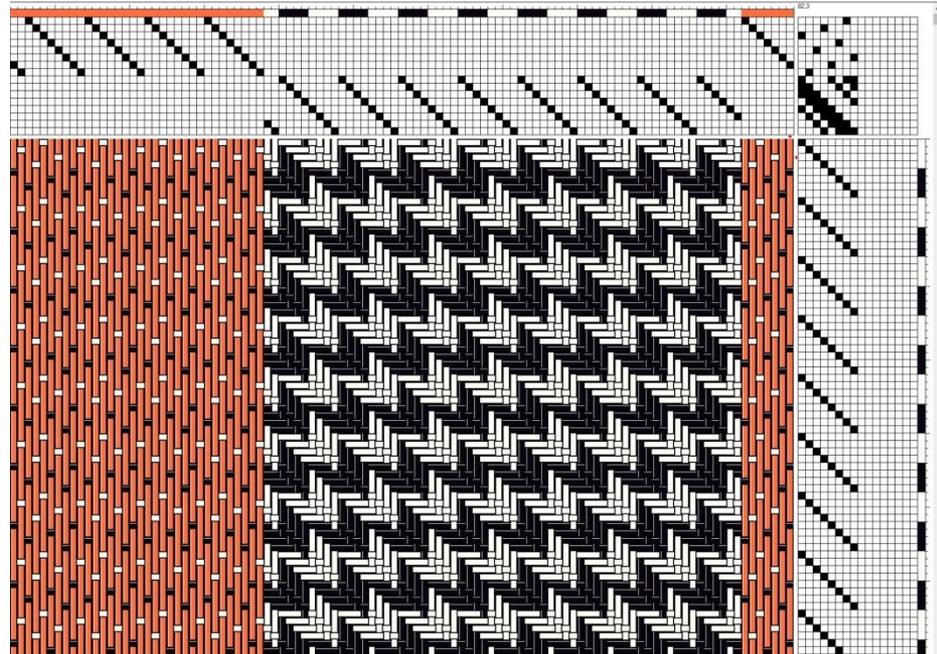
“Inspiration”



“Inspiration”

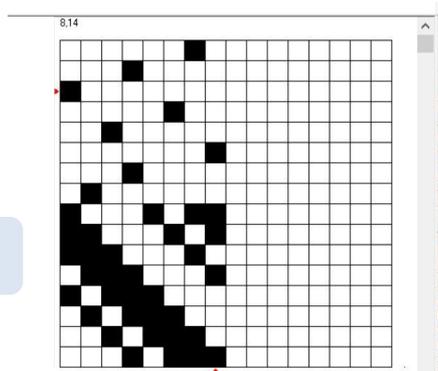


Facing up on loom



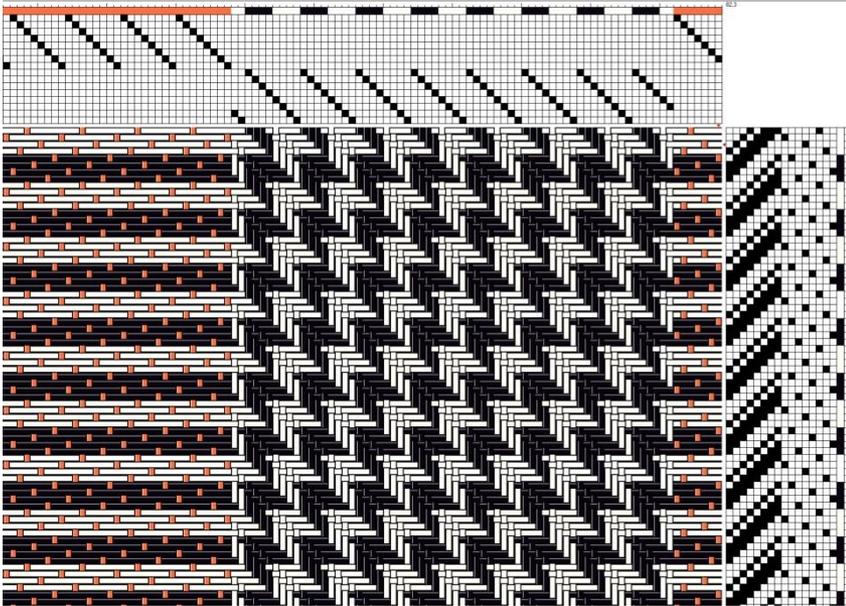
Back view on loom

Combine 2 structures across warp

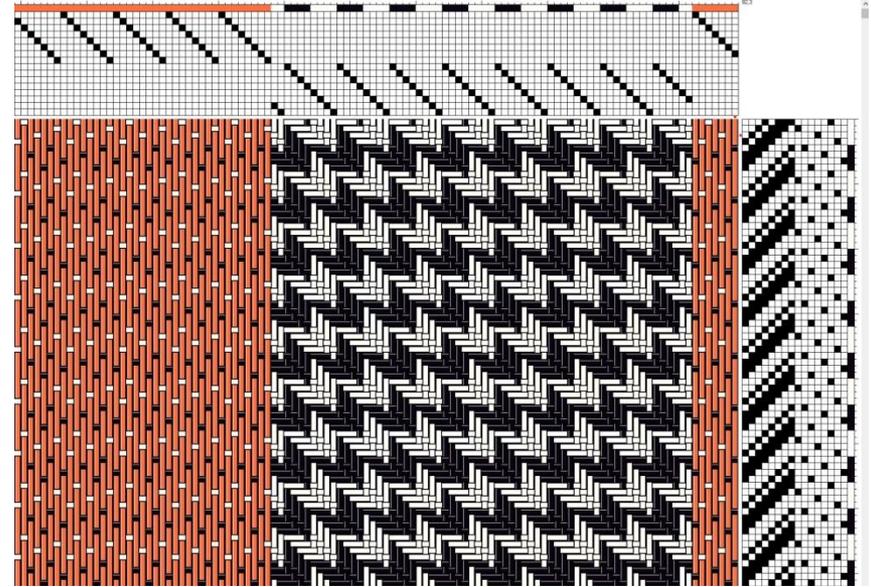


Take care to maintain clean lines between sections

“Inspiration” Lift Plan



Facing up on loom



Back view on loom

“Simply Sassy”



Reuse a lift plan. This is the same lift plan as “Inspiration”

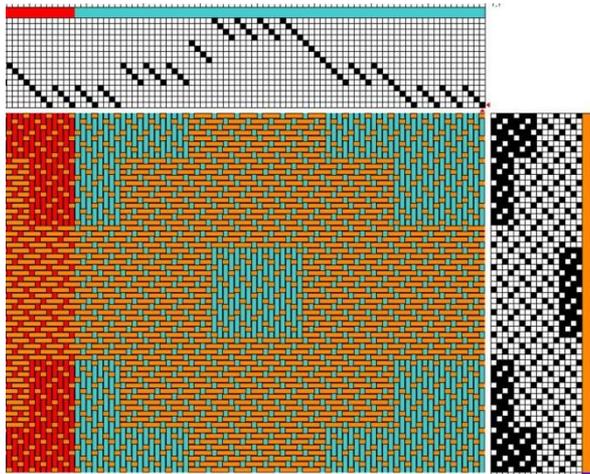
Same lift plan different threading



"Earth and Sky"

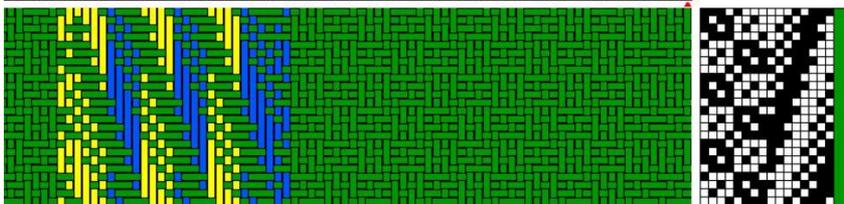
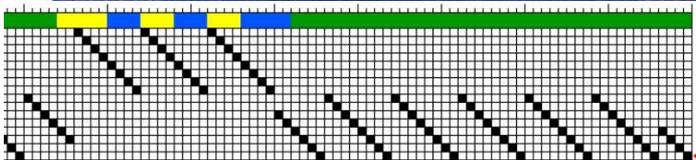
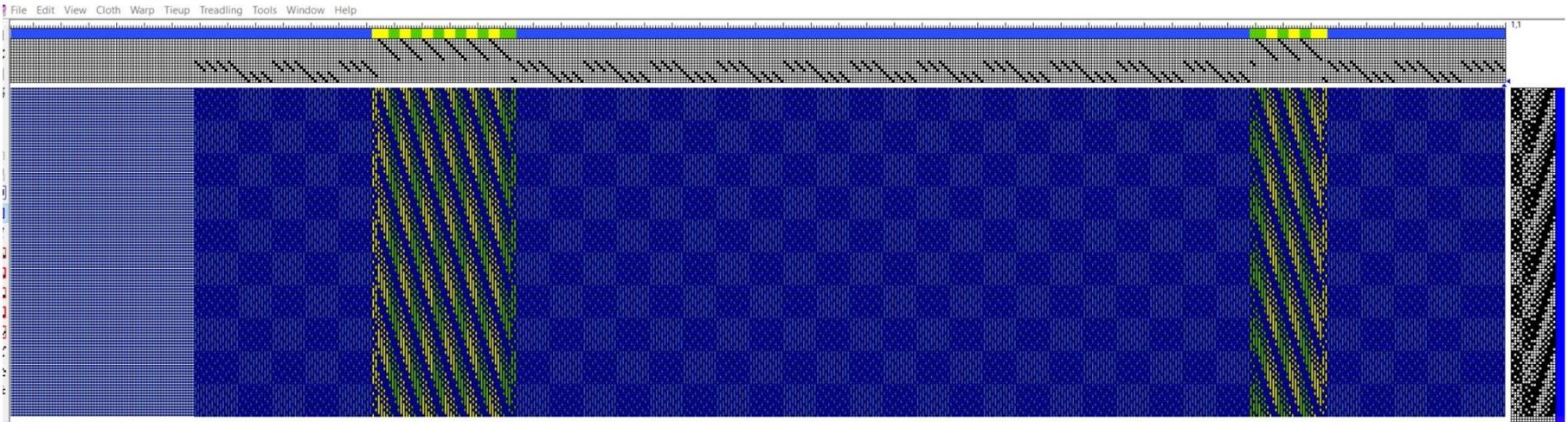


"Confetti"



Two structures across the warp

Twill and mock damask



The 2 outer threads provide clean break

4 shaft broken twill turned and 8 shaft advancing twill

Diverse designs in simple block weaves



Double Weave



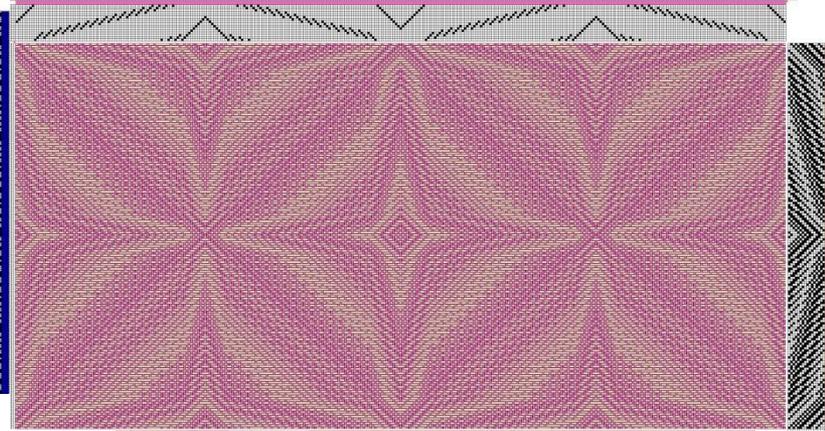
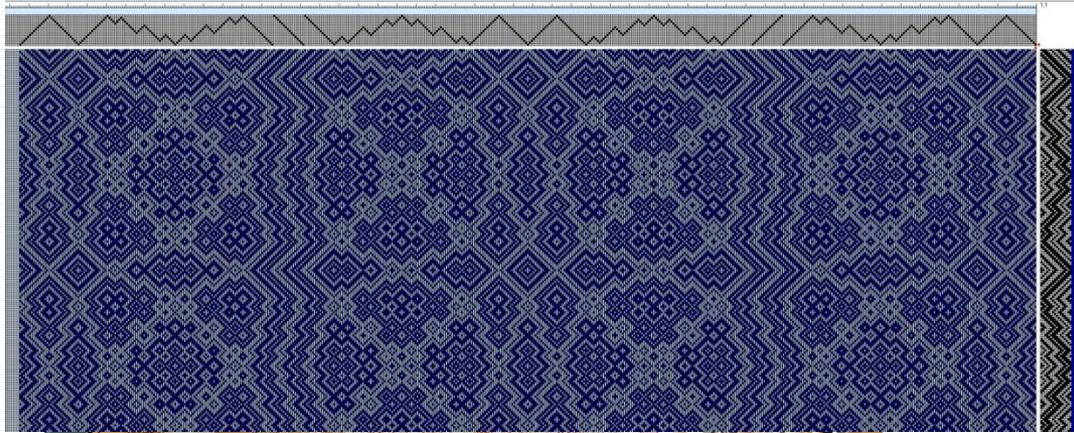
“And Red All Over”



Heddle Counts by Shaft Number:

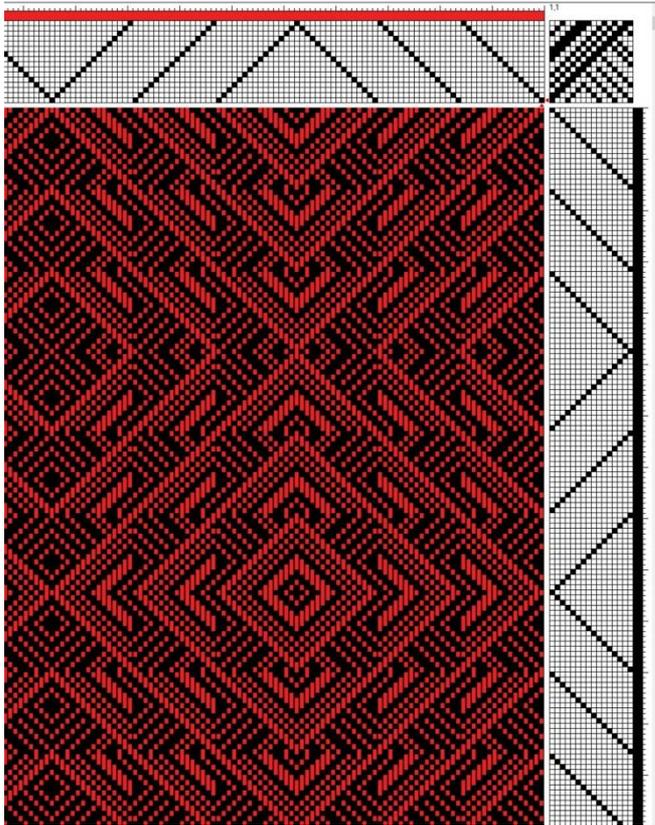
Shaft	1	2	3	4	5	6	7	8
Count	88	88	88	88	32	32	32	32
Shaft	9	10	11	12	13	14	15	16
Count	44	44	44	44	6	6	6	6
Shaft	17	18	19	20				
Count	10	10	10	10				

Twills

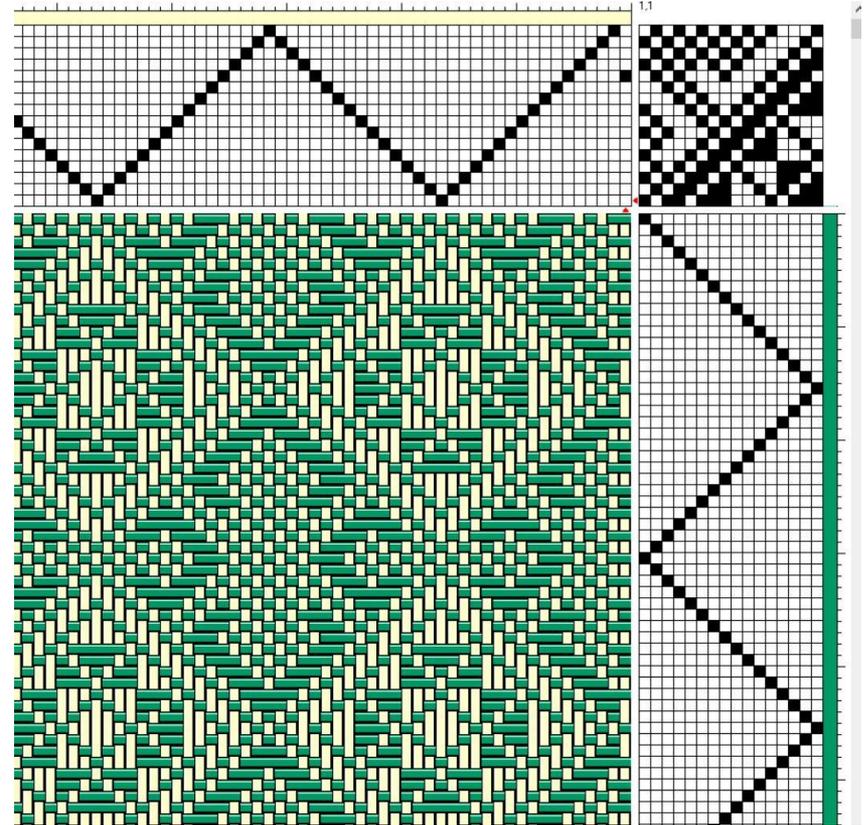


Design in Tie-up

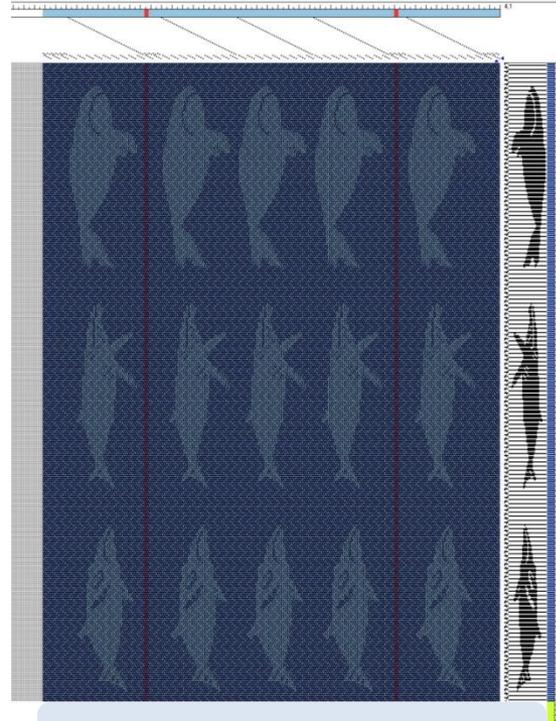
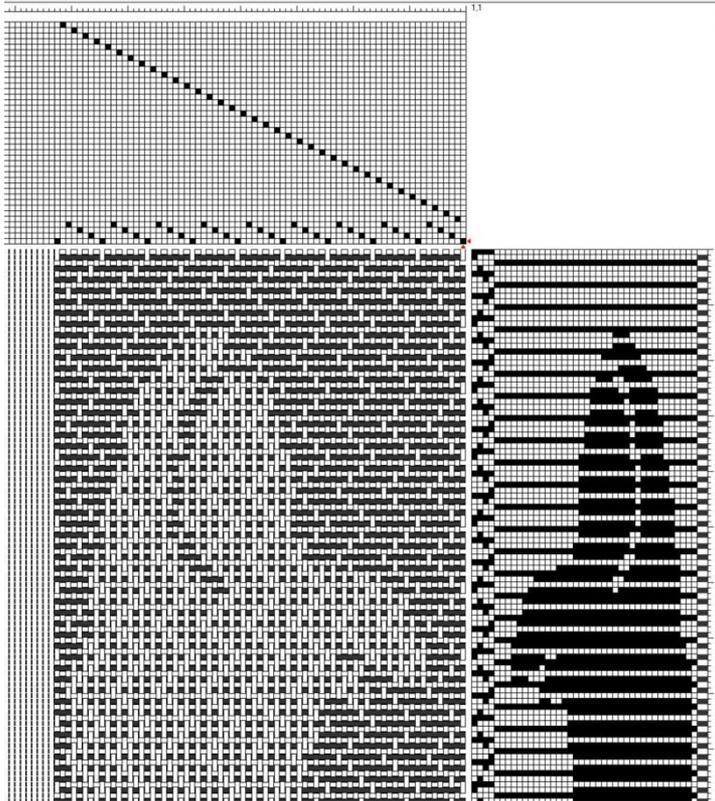
“Twill Illusion”



“Piazza”



Designing in the Lift Plan



Woven with the back of fabric on top.



- Determine design desired and tie structure desired.
- Allocate 36 shafts to design and 4 shafts for the ties.
- Draw whales
- -- in Photoshop then import to Fibreworks or
- -- directly in Fibreworks lift plan

- Add the ties in point tread to lift plan in Fibreworks.
- Add tabby.
- Sample in same threads and width as final weaving.
- Adjust Aspect Ratio – by going back to Photoshop or directly in the lift plan

Some things to watch out for

- Float length
- Clean Blocks
- Consider the lift and weave the cloth wrong side up if required
 - For treadle operated lifts its easier on the weaver
 - Prevent sagging cloth especially if wide heavy cloths with multiple wefts
- Rearrange shafts in your design so least used in back (with exceptions)
- Compatible interlacements
 - Structures that take up at the same rate
 - Ensure there are no long floats across structures
- Structures can be different sizes (with some care)
- Aspect Ratio
- Multi-shaft looms allow for planned selvages
 - Ensure selvedge has same take-up as the cloth itself

Study and Experiment

- Study, study, study
- Think until you “get it”
- Practice and try things out with your software

Resources you may find helpful

- “Mastering Weave Structures” by Sharon Alderman
- “The Complete Book of Drafting for Handweavers” by Madelyn van der Hoogt
- “The Liftplan Connection” by Alice Schlein
- “Complex Weavers Journal”
- “Heddlecraft” edited by Robyn Spady
- “Exploring Multishaft Design” by Bonnie Inouye
- Fibreworks and its manual
- “The Woven Pixel” by Alice Schlein

Design in Photoshop



The shell was drawn freehand.
In Photoshop, create a layer for each weave structure.
Then apply a pattern preset to each layer.

A pattern preset is the lift plan for the structure extended to cover the whole canvas.

The structures used here are 5 shaft shaded satin/sateen.
After sampling, I adjusted the Aspect Ratio in Photoshop.
You can see that the background is the 1 up sateen and the darkest area is the 4 up Satin.



Shell

- The lift plan was developed completely in Photoshop.
- This is woven with 3 wefts
- Each visible row of cloth requires 3 shots. Weft 1 appears on the surface on some areas and is behind the cloth in others. Etc.
- The visible structures are 8 shaft satin/sateens shaded to get 13 shades for each weft (not 7 as usual)
- Where the weft is not seen and carried behind the structure is a 16 shaft satin. The one weft dot each 16 warps is hidden behind the visible wefts
- The weave structures are 16 wide by 48 long to accommodate the 8 shaft satin/sateen, the 16 shaft satin, and the 3 wefts.
- There are 39 possible weave structures (3 wefts x 13 shades = 39)
- The cloth is woven wrong side up.
- 10/2 mercerized cotton wefts. One weft paired with a filament.
- Warp all black 16/2 cotton 40 epi. 1700 threads.
- Aspect ratio was adjusted in Photoshop after sampling.
- Lift plan 2976 picks.