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Abstract :

Shaft weaving is to tapestry what poetry is to prose ; the technical constraints are strong, and their overcoming generates a structured graphic language.

The weave structures are a source of graphic inspiration for me. The work on threads crossing, which generates an additive color mixture, allows the emergence of original images and a particular treatment of colors and light.

The creation of a fabric supposes in advance the choice of the warp colors and the loom setting, which will determine the possible graphics. There is therefore a prior programming and thereby weaving is similar to algorithmic arts.
When weaving, greater freedom is possible with the choice of colors and materials for the weft.
Thus weaving is much closer to music than to painting ; these are variations on a theme.

By creating fabrics, I have the feeling at the same time to share new images, resulting from the technical constraints particular to the shaft weaving, and also to be registered in a process of creation practiced by the men of all the cultures since millennia.
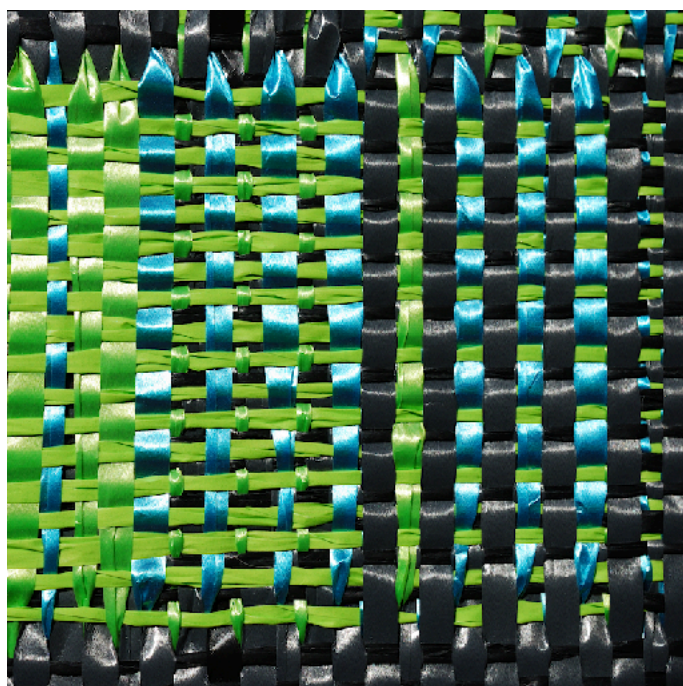
We often hear that tapestry is painting with threads.
This is both true and not true; I would like to explain to you why.

For that we will have to talk a little technical.

To start a work, the painter just needs a frame.

The weaver, to weave a tapestry, "basse lisse" (Aubusson) or "haute lisse" (Gobelins) must first mount a warp on his loom.
By convention, we will consider that the warp threads are vertical (which is the reality in a "haute lisse" weave).
The work begins at the bottom of the tapestry ; the weft is deposited perpendicular to the warp, therefore by convention horizontally, color by color, progressing upwards.
Once the lower part is woven, you can't go back on it. This forces you to have an overview of the tapestry before starting. Most of the time we follow a picture painted beforehand. The warp is completely covered by the weft ; the visual appearance depends only on the different weft colors used. Here the expression "to paint with (weft) threads" corresponds quite well to the work.

The weaver, who like me uses a shaft loom, has much greater constraints.

He must also set the warp on his loom, but the warp threads will be visible in the weaving while they are not in the tapestry technique.
The color of the warp threads must therefore be defined in advance ; possibly gradients, oppositions or possible mixtures of color.
Of course he will always have to choose the weft colors, but only when weaving.

It is a fundamental trait of weaving. The appearance of a fabric results from the optical mixture of the colors of the warp threads juxtaposed with the colors of the weft threads.
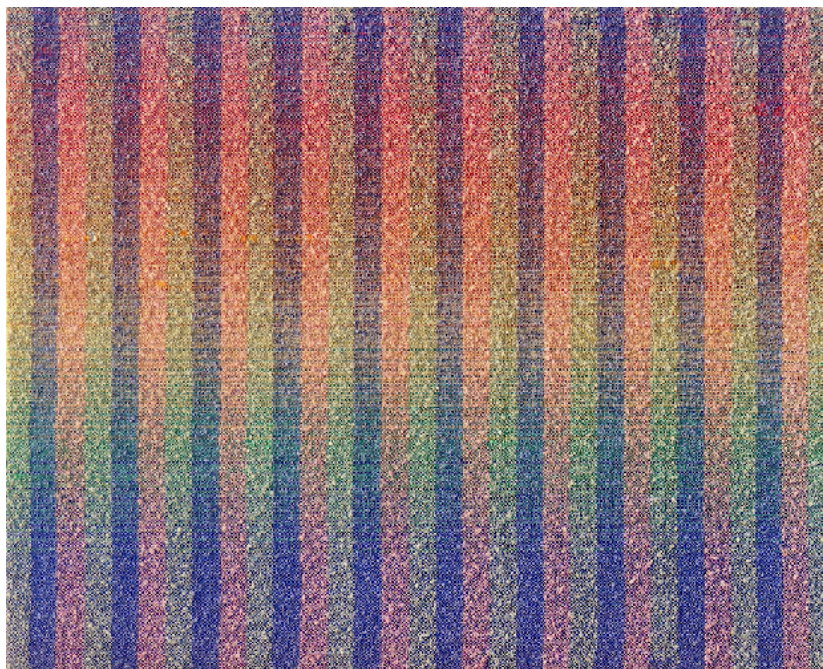
The colors of this tapestry are generated by 6 warp colors and 2 weft colors.
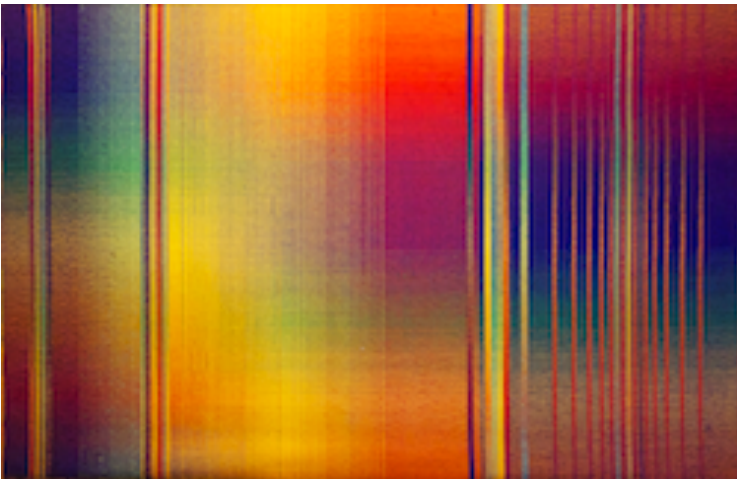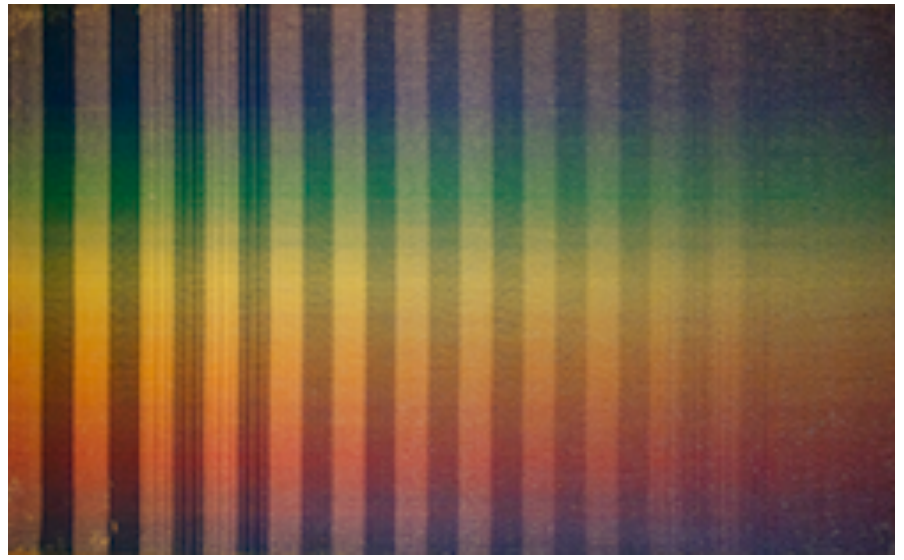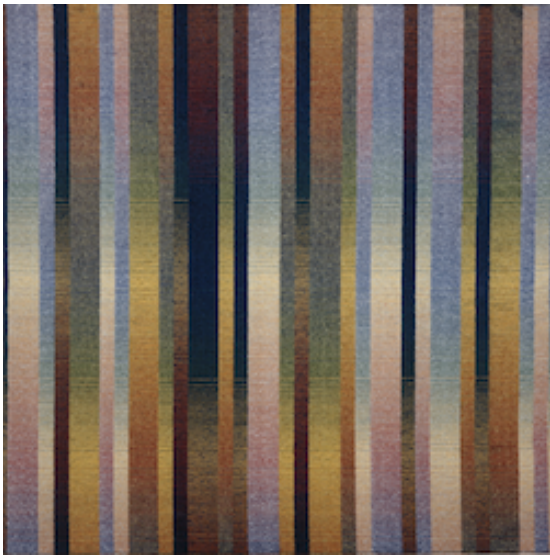
The proportion of color coming from the warp or the weft depends on the weave structure.
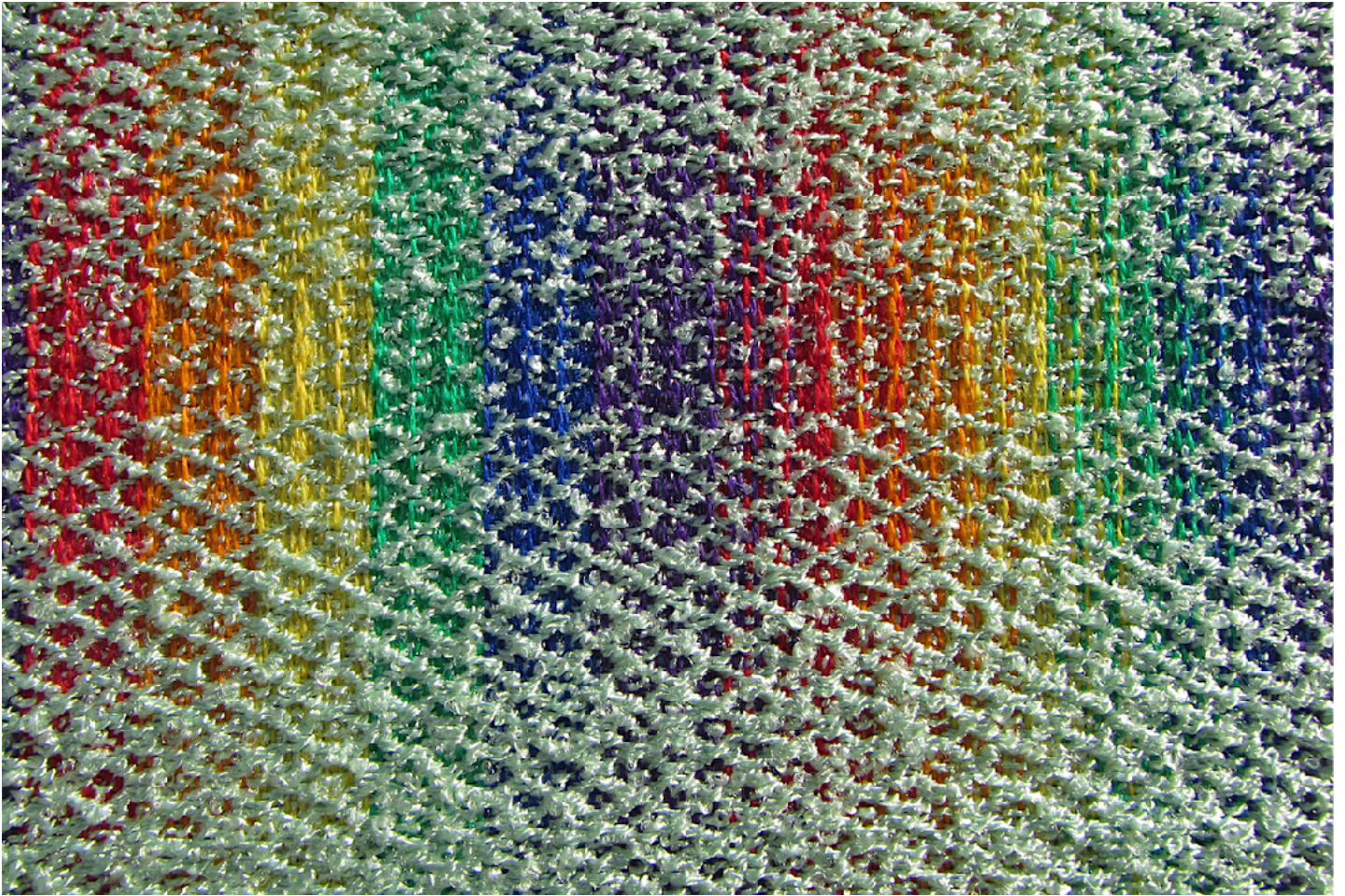
The weave structure here gradually shows the rainbow warp
which is mixed with the green-pastel weft.

The warp being the same for all the tapestries made with the same loom set, all the fabrics woven on this warp will therefore have a family resemblance :

These tapestries have all been woven on the same warp. It is made up of two layers of alternating threads, each layer having a gradation, the second gradation using the complementary colors of the first. On the two lower tapestries we can clearly see the two gradations used in the background, on the right side and on the back, while the pixelated design uses the other layer of threads.
At the top right, a single gradation is visible horizontally.
At the top left, the stripes alternately use a gradation and its complementary.
Each stripe is shaded from top to bottom, but the contrast with the next stripe is always constant as opposed to the complementary color.
In the middle, the stripes makes it possible to progressively pass from one gradation background to another, the background becomes decoration then the decoration becomes background, thus revealing spots of colors which are freed from the horizontal or vertical distribution.

The weaving of the weft can be different for each fabric but the base will be common. It is as if half of the color geometry was defined in advance by the warp, and the other half, the one defined by the weft at the time of weaving, was "free".

The design of a fabric therefore has two temporalities :
One before weaving, the time of the design of the warp and its assembly on the shafts. It defines a vertical geometry, a potentiality of weaving effects (weave structure) and color mixing.
The other during weaving, the time of the implementation of possible weft variations on this warp as well as the weave structure variations.

Of course at the start, before weaving a new project, we realize the complete design of several fabrics, warp and weft included. But very often, once we have made the planned fabrics we ask ourselves the question "What else could I be weaving on this warp ?".
It then comes other ideas, a change of material, a gradation, a rhythm of stripes which will perhaps create the most interesting fabric of the series.

Thus the work of shaft weaving is much more like music than painting ; they are variations on a theme.
The warp which is mounted first, which can no longer be modified during weaving, corresponds to the musical theme, to the harmonic structure, to the chord grid that the improviser follows. In weft the weaver has complete freedom to change color, material, weave structure. The only constraint is that a weft thread which goes into the shed on one side comes out on the other; it will be present across the entire width. Thus, if a horizontal red stripe is woven in weft, the red will be present over the entire width of the stripe. Thanks to the weave effects, it is possible to modulate this presence along this horizontal band, or even to make it disappear completely in certain places with the technique of multiple fabrics.
The art of the weaver is to fight against these constraints ; he first chooses the right color of the weft and then tries to make it disappear locally.
Rather than putting the colors forward, the art of the weaver is often the art of making them disappear.

This two-step creation requires a preliminary design, a programming ; program that is then executed.
This conceptual aspect necessarily entails a certain form of abstraction.
As we will see, geometric graphics are also subject to programming, to the implementation of algorithms.
The final work is then made up of a stack of abstract concepts which takes place in the material of the thread.
Emotion then arises from this diffuse perception of an order or an underlying structure that mixes both colors and graphics.

Let's get into the technique a bit more.

What is shaft weave fabric ?

It is a fabric woven with a shaft loom.

We have already spoken of the warp which is the set of threads set in advance on the loom.
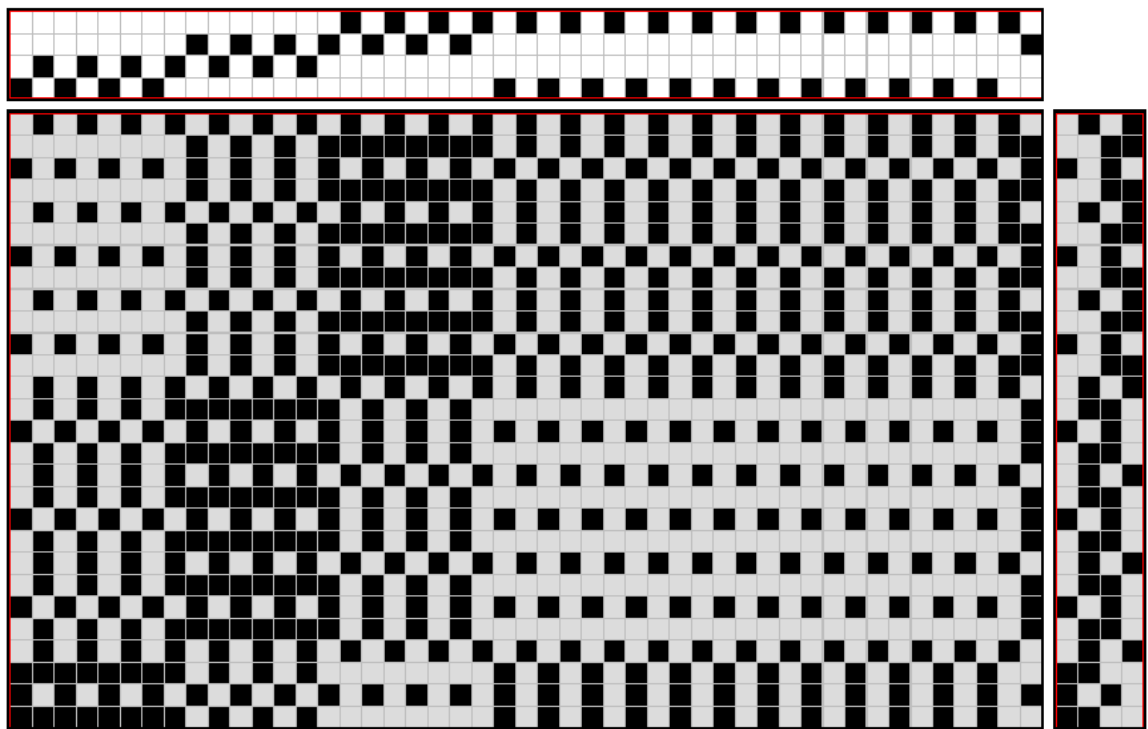Each warp thread is threaded into a heddle which is part of a shaft.

A shaft is therefore a subset of the warp threads. If the loom has four shafts, the warp consists of four groups of threads.

The shafts are maneuvered by treadles which are attached to a selection of shafts.
When you depress a treadle, all the shafts attached to that treadle go up, and therefore all the threads threaded into these shafts are lifted. The other threads remain at the bottom and the shuttle is passed, which unwinds the weft thread between these two layers of threads. The lifted warp threads will appear on top of the fabric, while the weft thread will appear above the unlit threads.
Each deposit of a weft thread, which is then compacted with the comb is called a pick.

The important thing to remember is that we do not control the wires independently, but lift them in groups ; the groups of elementary threads being those which are threaded in the same shaft.

The whole art of weaving is to produce designs with this very strong constraint.

To visualize a fabric we use a diagram

The threading at the top indicates which shaft each warp thread is threaded into.
The card on the right shows which shafts are lifted in each pick.

The fabric diagram, lower left, is calculated from these two diagrams to represent warp threads up and warp threads down. A black dot is a raised warp thtead, which will appear above the fabric. A white point is a lowered warp thread, it is the weft that will appear at this point of the fabric.
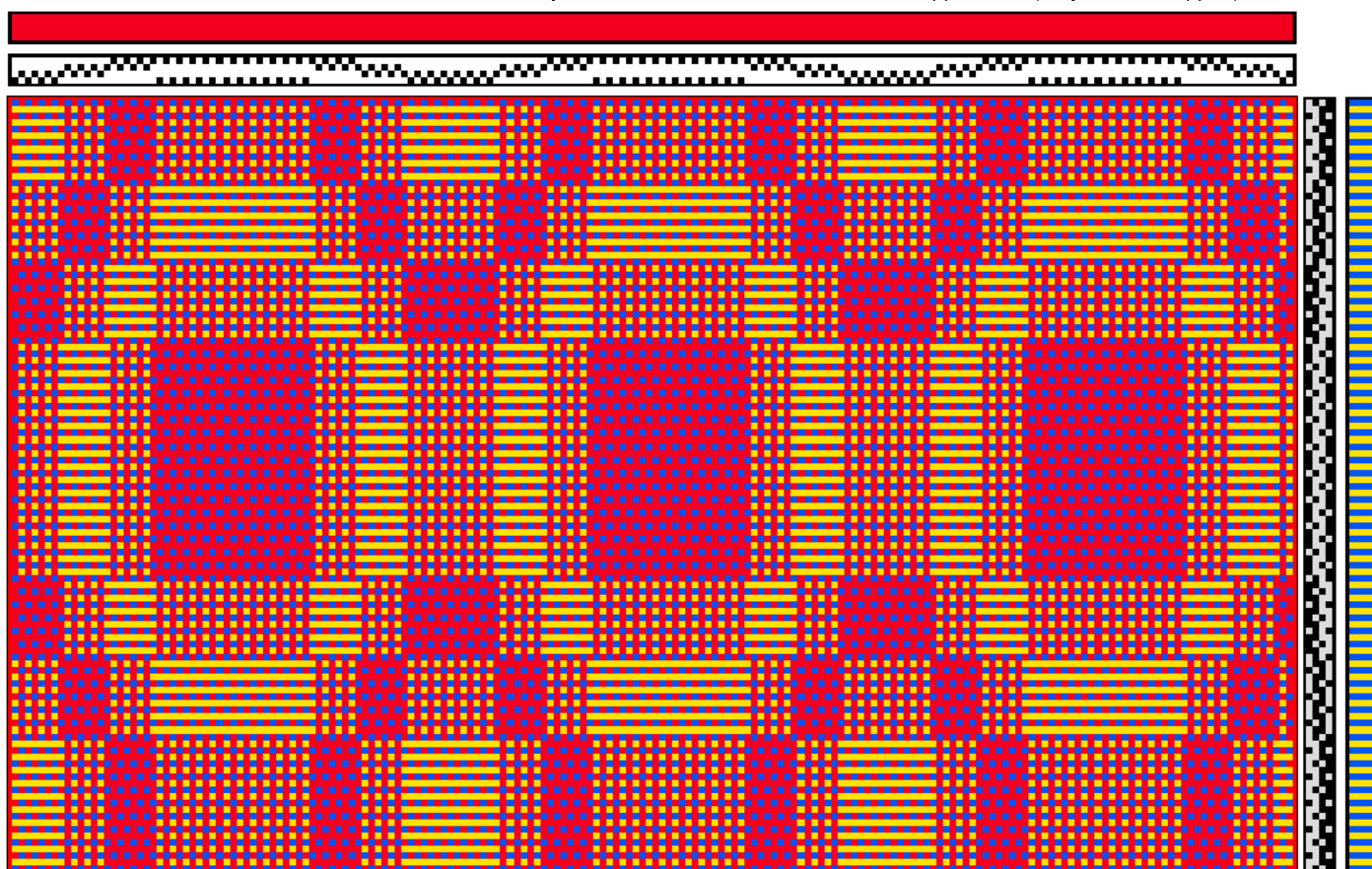
These diagrams were hand drawn on squared paper ; now we usually use a computer.

The fabric diagram therefore represents the intersection of the threads, we must see the warp threads as vertical lines and the weft threads as horizontal white (gray) lines:
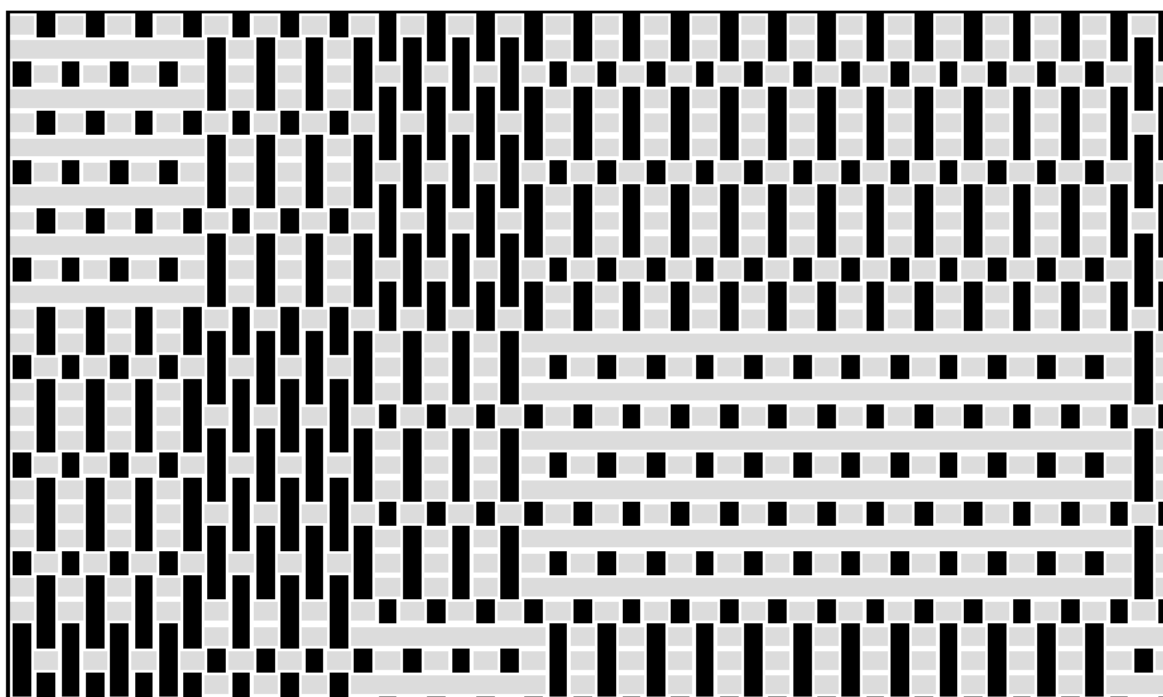
You can visualize the colors with the warp-color and weft-color diagrams (top and right):

Finally, the simulation of the fabric makes it possible to have an image much closer to the real fabric ; it takes into account the threads that appear above the fabric and those that remain hidden.
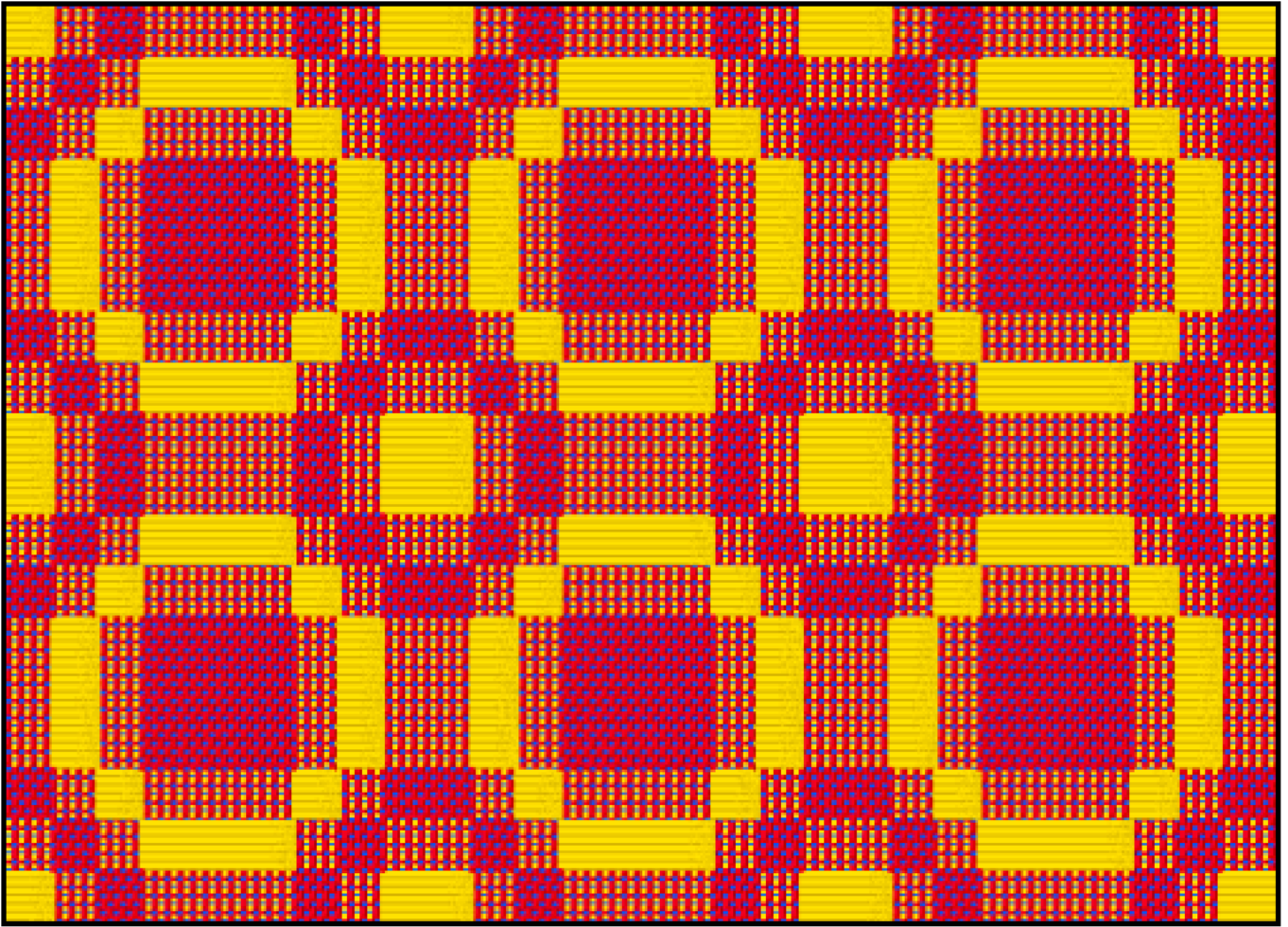
What you have to understand is that the fabric is built in advance. The work of creation is therefore essentially programming.

The properties of symmetry or repetition of the threading are imposed on the entire woven warp.

If the threading and the warp threads are the same for the whole series of fabrics, if this set-up cannot be modified any more, the weft may change during weaving.
We therefore have the freedom to recreate other fabrics, on the same warp, during work. In particular other ideas may arise, often as interesting or even more so than the initial design.

In this example, the threading is constructed as a series of repeating patterns over a number of threads. It follows that on the fabric we will see vertical bands with the same effect. By using the same repeating technique, horizontal bands will be obtained. The combination of the two gives rectangular effects ; we are talking about "block" fabrics.

We can only focus on the block design and later choose the type of effect that each rectangle will contain in the fabric.

Aa Dd Cc Bb

a
d
c
b

c
d
a

We have 4 warp blocks A B C and D and 4 weft effects a b c and d.

If we combine the block X with the effect x we obtain the main effect Xx, shown in black in the diagram.
This effect is made up of yellow frame floats:

Aa Bb Cc Dd :

If we combine a warp block X with a weft effect x + 2 we get the reverse of the first effect :

Ac Bd Ca Db :

If we combine an X warp block with an x-1 or x + 1 weft effect, we get a last effect :

Ad Ab Ba Bc Cb Cd Dc Da :

This is typical of weaving. The initial design deals only with the main effect, the blocks in black, the rest follows from the technique used. There is therefore a strong constraint but also the possibility of declining a graphic idea, here the drawing in blocks, in different layouts with different weaving points.

The effects are called weave structures.
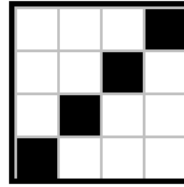
For example, on 4 shafts, a basic weave is twill 1 3

We call repeat the number of columns and the number of lines from which we repeat the pattern.
Twill 1 3 has a repeat of 4 x 4
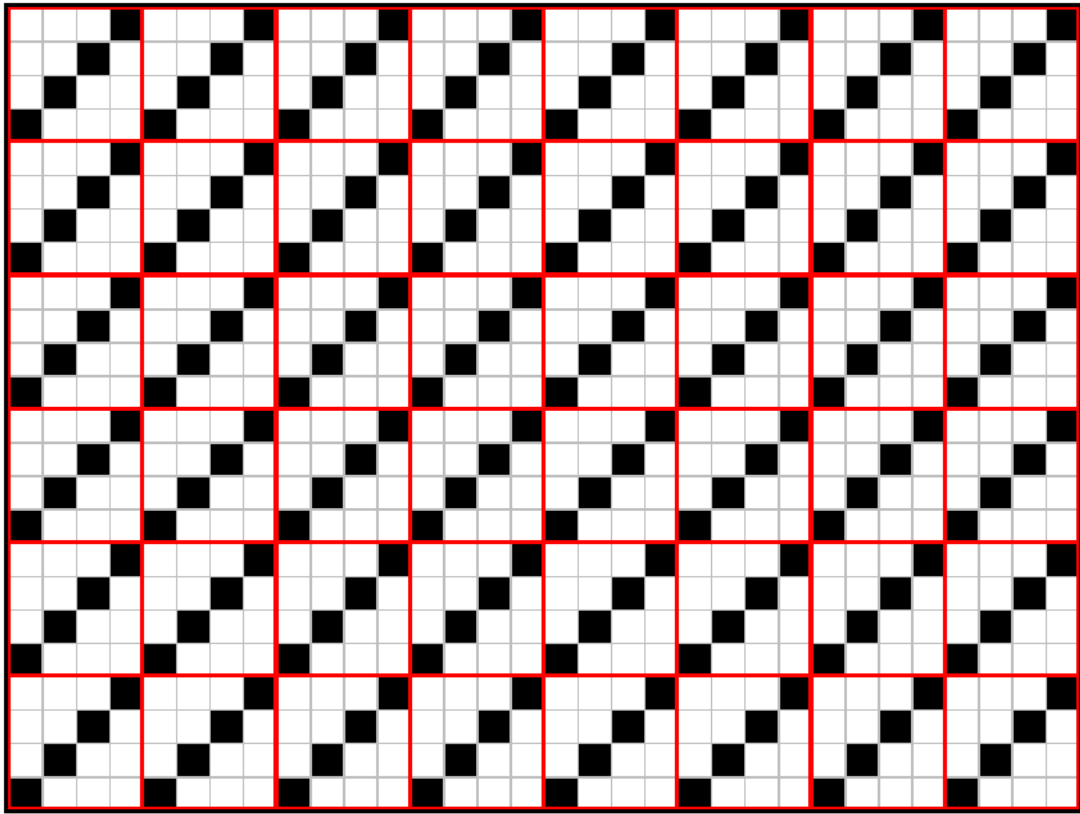
If you want to calculate how much 4 x 4 weave structures there is, you just have to calculate how many different designs of 16 squares (4 x 4) there are, each square dot being either black or white.

By choosing the color of a dot we define an application of the set of 16 boxes to the set of two elements, black and white.
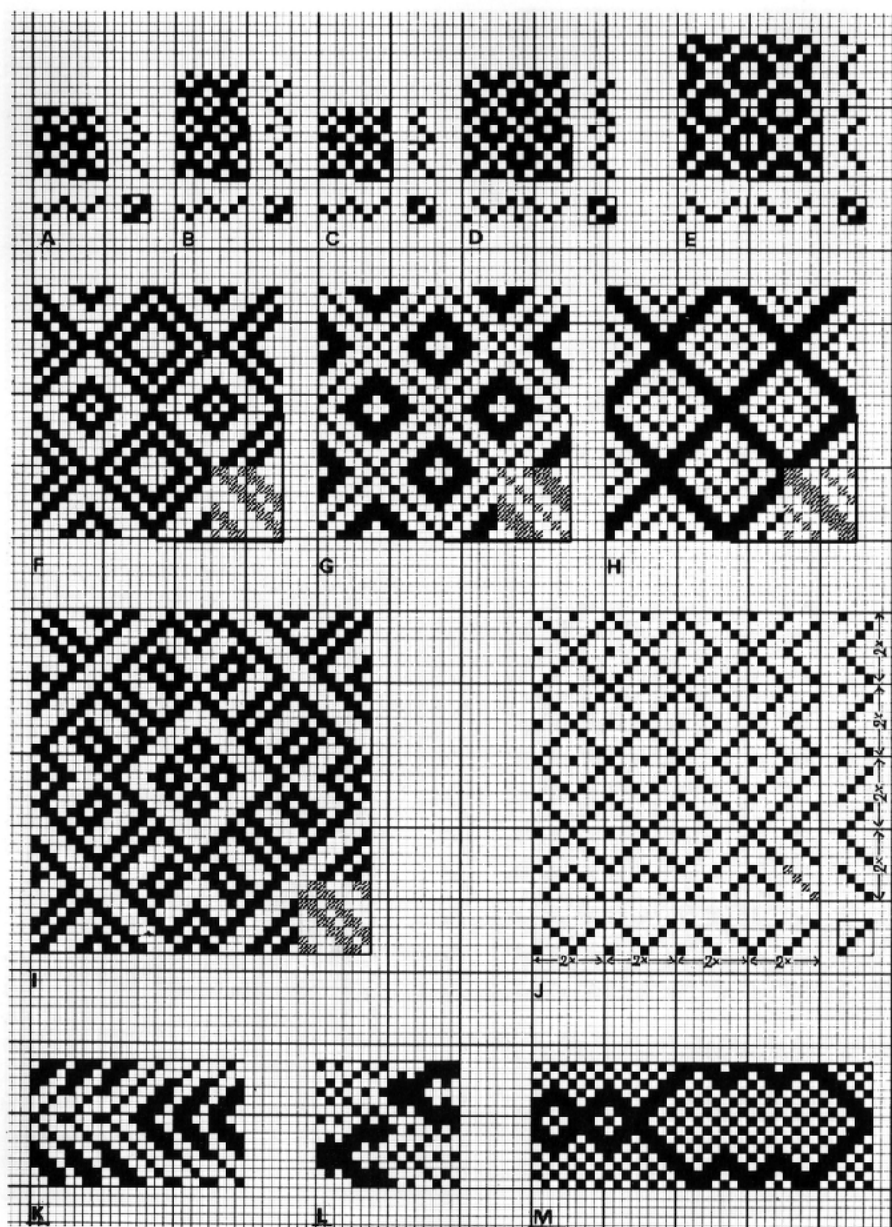
The number of such apps is $2^{16} = 65536$

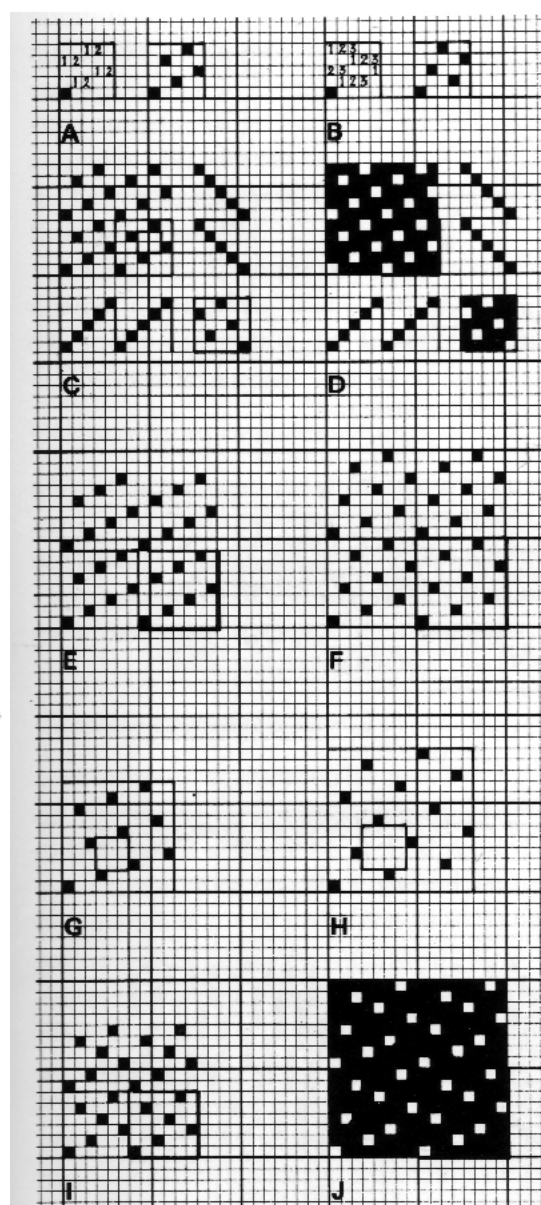For 8 x 8 weave structures got 2^{64} = too large a number to write here!
Most of these 8 x 8 black and white drawings are of little use, but there are still a lot of interesting ones left.

So we classify them by families, like here the diamond twill and satins :


43. Sergés losangés.

49. Satins réguliers et irréguliers.

Plates taken from the book of Ulla Cyrus-Zetterström

We understand that the study of weave structures is a world in itself. For me it is above all at the level of the graphics, more than for their texture property that they interest me.

In general, satins are defined by their smooth and shiny texture. Only the warp (or weft) is visible, this because the bindings disappear in the middle of the floats.
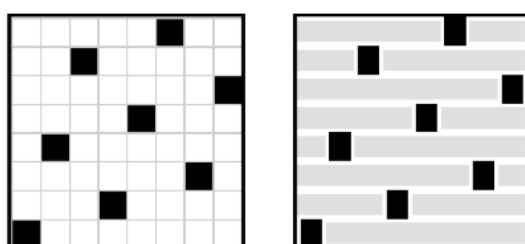
For me the satins are a graphic where the black dots are as dispersed as possible, as far apart as possible from each other, the diagram having only one black dot per row and per column.

We can also recall the mathematical relation which links the shift and the repeat which are prime between them.

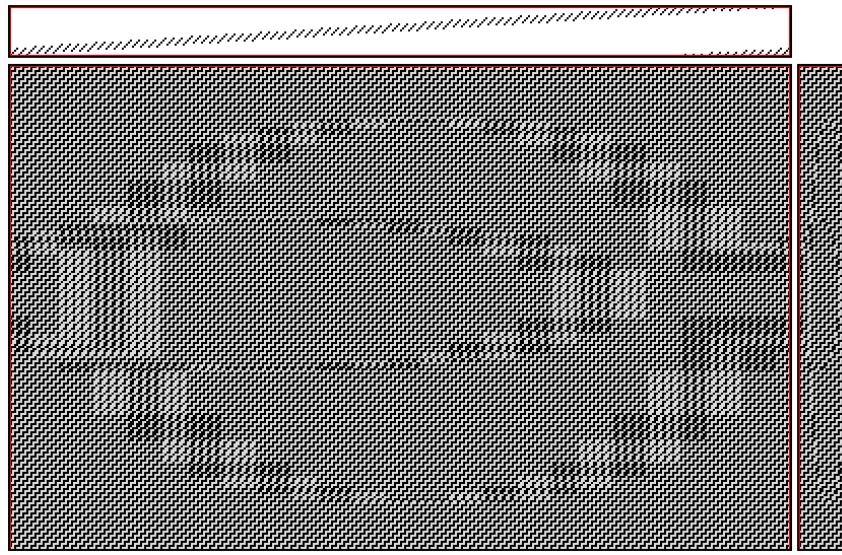A satin of 6 used as the graphic basis of this tapestry

Blocks fabrics is an area that has been explored for many centuries. The majority of so-called "geometric" designs fall under this style.
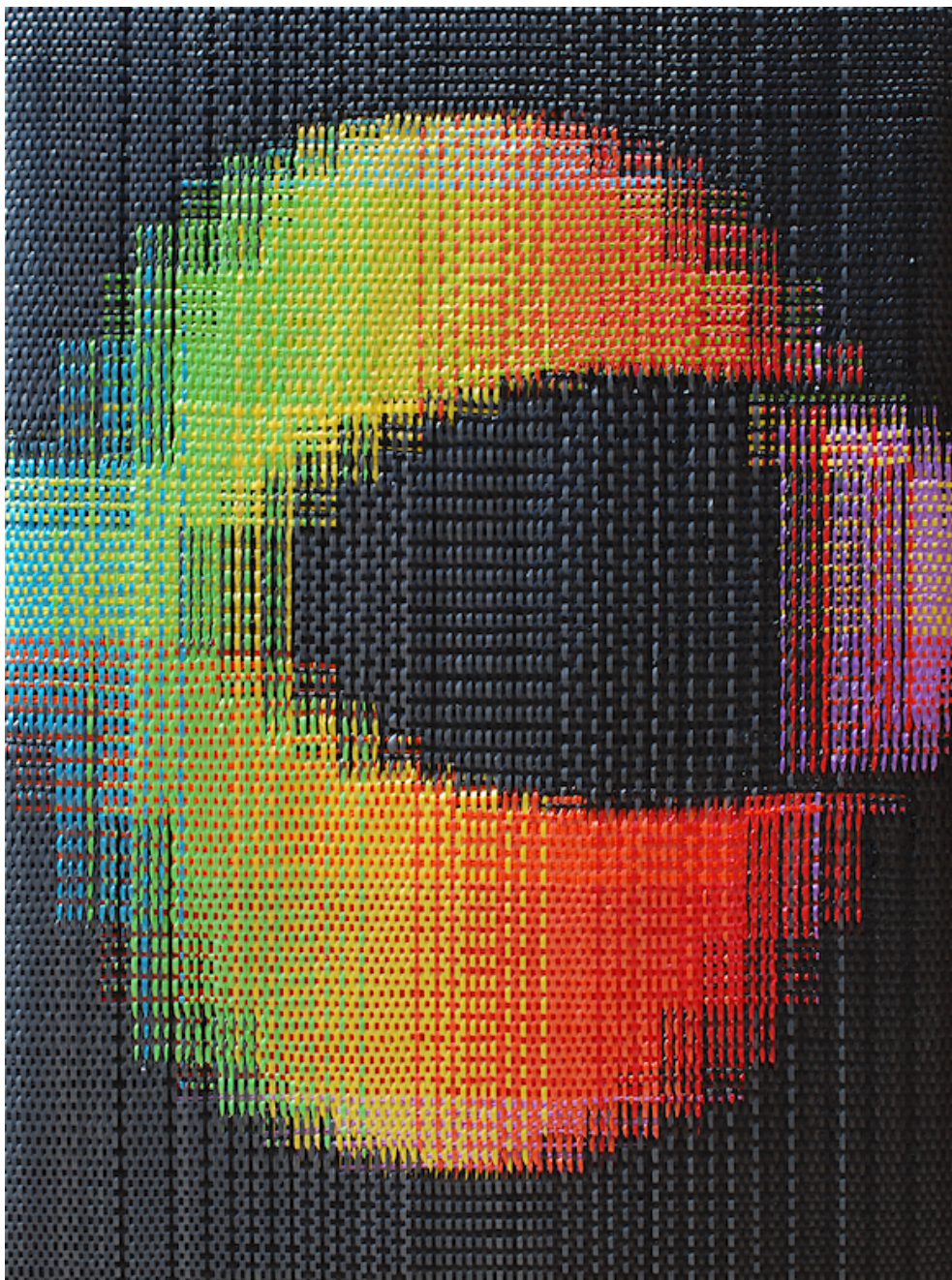
Fabric on 4 blocks

It's not just block fabrics in weaving. Many different techniques exist and each generates its own graphic styles.
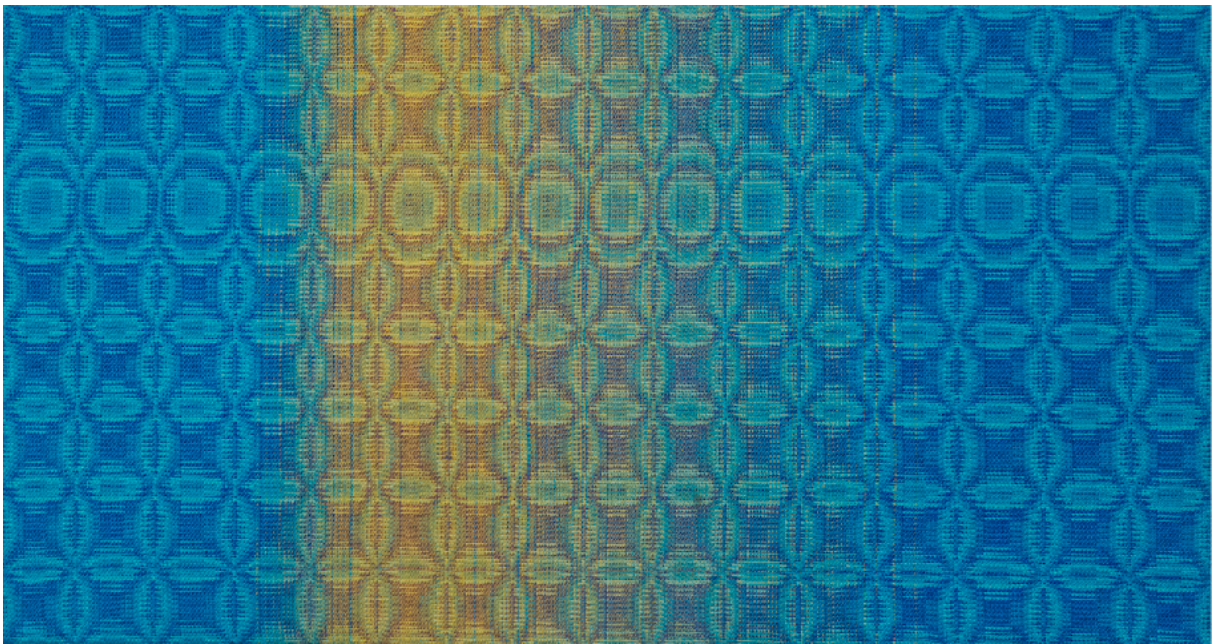
A threading on initial 4 (on a twill network 1 3) without blocks
A technique that is easily implemented since the arrival of computers


Double-face weaving on initial 4

The weaver works with a limited number of colors, those of the threads he uses.
To produce effects of intermediate colors, he cannot, like the painter, mix his colors, he must use a "battage".

Battage of yellow and blue threads

To go from one color to another, from red to yellow for example, the easiest way is to start with the first color, with red threads, then alternate one out of two threads, one yellow one red, then finish with the second color, yellow threads. We then obtain three stripes, one red, one orange (mixture of red and yellow) and one yellow.
For a more flexible passage, and especially which is spread over a given number of threads, I have developed a calculation technique which allows me to constitute a library of battages.
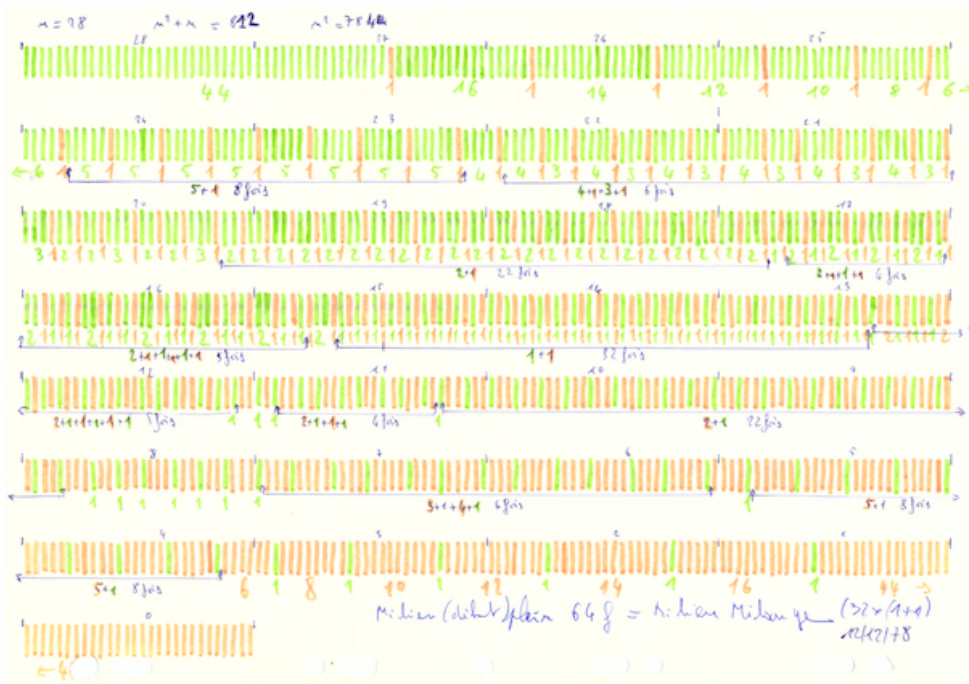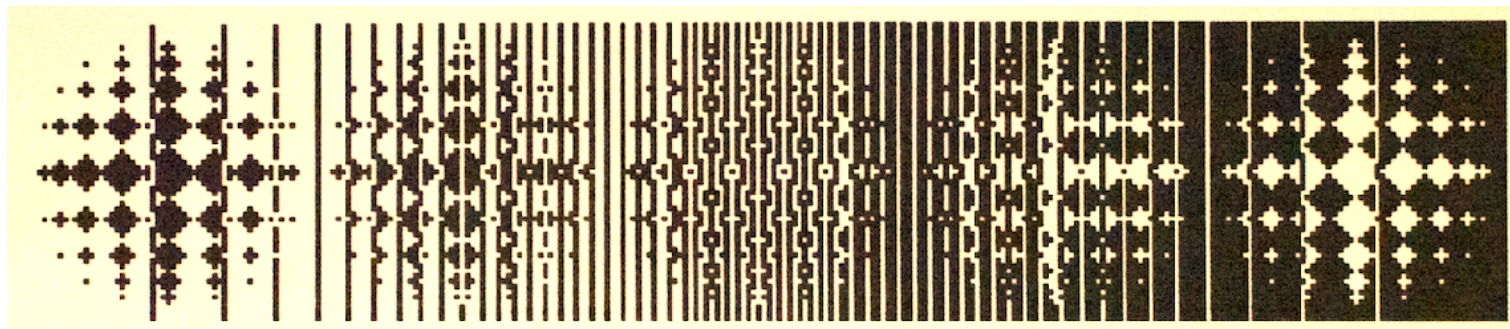

A battage from my library to go from one color to another on 612 threads
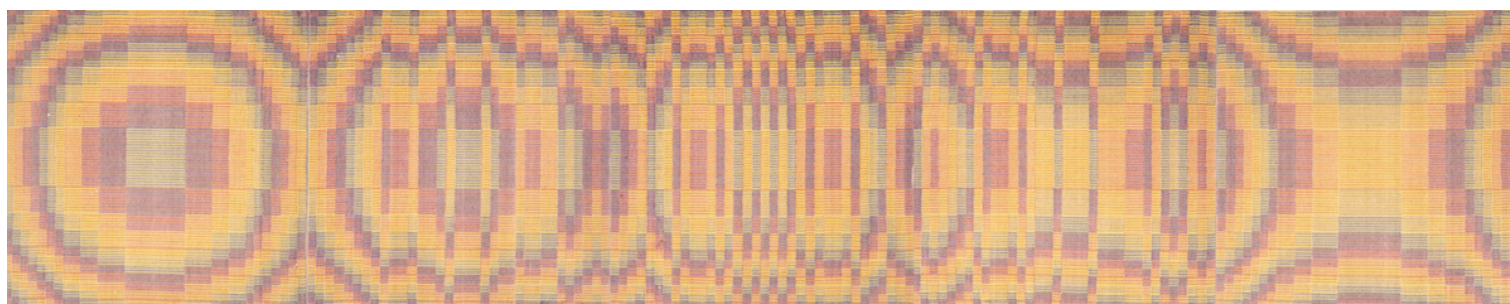
So when I need a battage I search my library; if it is not there I calculate it and add it.

I used this concept of battage in the graphics, to go from one drawing to another. The two colors are replaced by a stripe from each drawing.


We go here from the block drawing "Snowflake" to the left,
to this same inverted drawing (white on black instead of black on white)

We go here from a drawing of a circle on the left, to a drawing of a cross on the right

These drawings clearly show how back and forth between weaving techniques and graphic ideas operate.

In the finished work everything is given at the same time, the graphics, the colors, the materials. Yet the spectator feels an organization, an underlying structure ; several reading levels are possible. This comes in particular from the "programming" aspect of the work induced by the technique of weaving shafts ; the work is built in successive stages.
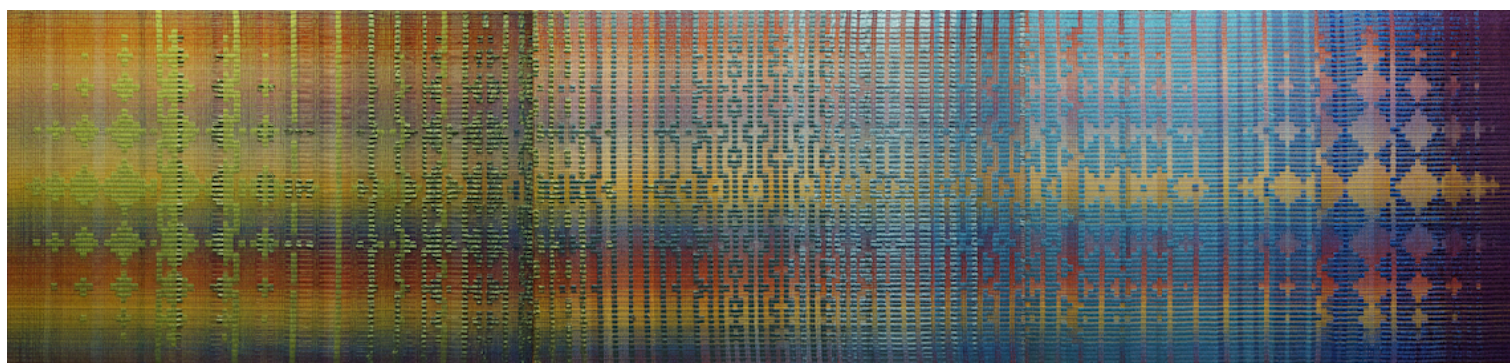
Here the treatment of colors and materials obscures the underlying block graphics.
We can see several aspects : the warp in double gradation visible on the background, the graphics that go into battage from a drawing to its opposite and the gradation of colors, from green to blue, used with thicker materials, shiny or not, for graphics.

The battage has a certain fascination on me, it's like an obsession.

Battage used for tiling my garden

Obsession nourishes the artist and feeds his creation.
By dint of digging into an idea, his knowledge of the subject is enriched and variations are naturally required for new creations. The more a domain is used for creation the easier it is to use it for subsequent creations. In the long run this obsession becomes a feature of the artist, a trademark. He is then inclined to use it in order to be recognized and all the more interested in implementing it often ; which further strengthens his attachment to her.

Another obsession is pixelation, drawing on grid paper.
At the very beginning it came from figurative block drawing : how to represent, with the minimum of dots, a known figure.

I have already explained this in the article : https://oliviermasson.art/en/faq/57-how-was-pointcarre-born-.html

I am fascinated by the ability of the brain to recognize a known figure from a very small number of points.
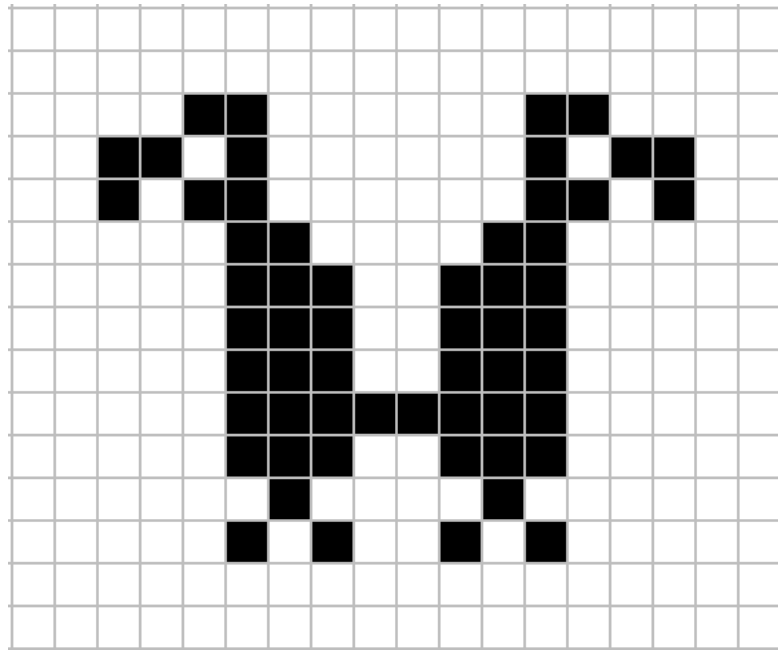

The eye, a white pixel, only exists because it is closed by the beak.
The beak, made up of only 3 pixels, is recognized as a hooked beak because the brain recognized an eye and a bird.

More generally I am interested in drawing on squared paper, made up of few pixels.

Beyond the basic shapes, crosses, circles, squares, simple pixelated designs have a symbolic charge in our graphic universe.
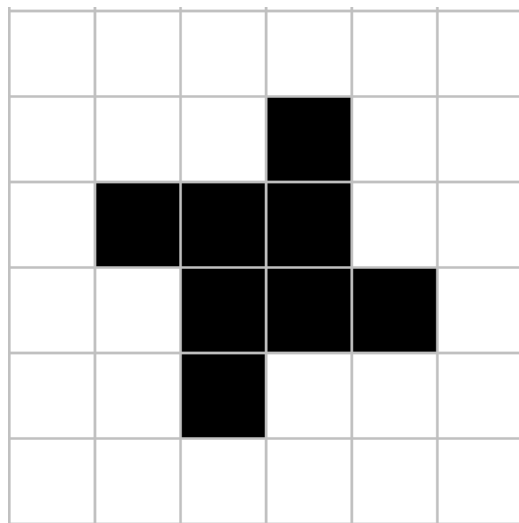

This 8-pixels houndstooth suggests a rotational movement

This ties in with the design of the weave structures that I have already spoken about.
So I want in my tapestries to show the weave structures in big, as seen up close, unlike the classic approach of weavers to use weaves as effects of materials with fine threads.

I agree with the awareness of the 20th century that our world is digital.
The XIXth century saw it as analogue, as continuous. We now know, with quantum physics and computing, that a digital vision is closer to reality at very small scales.
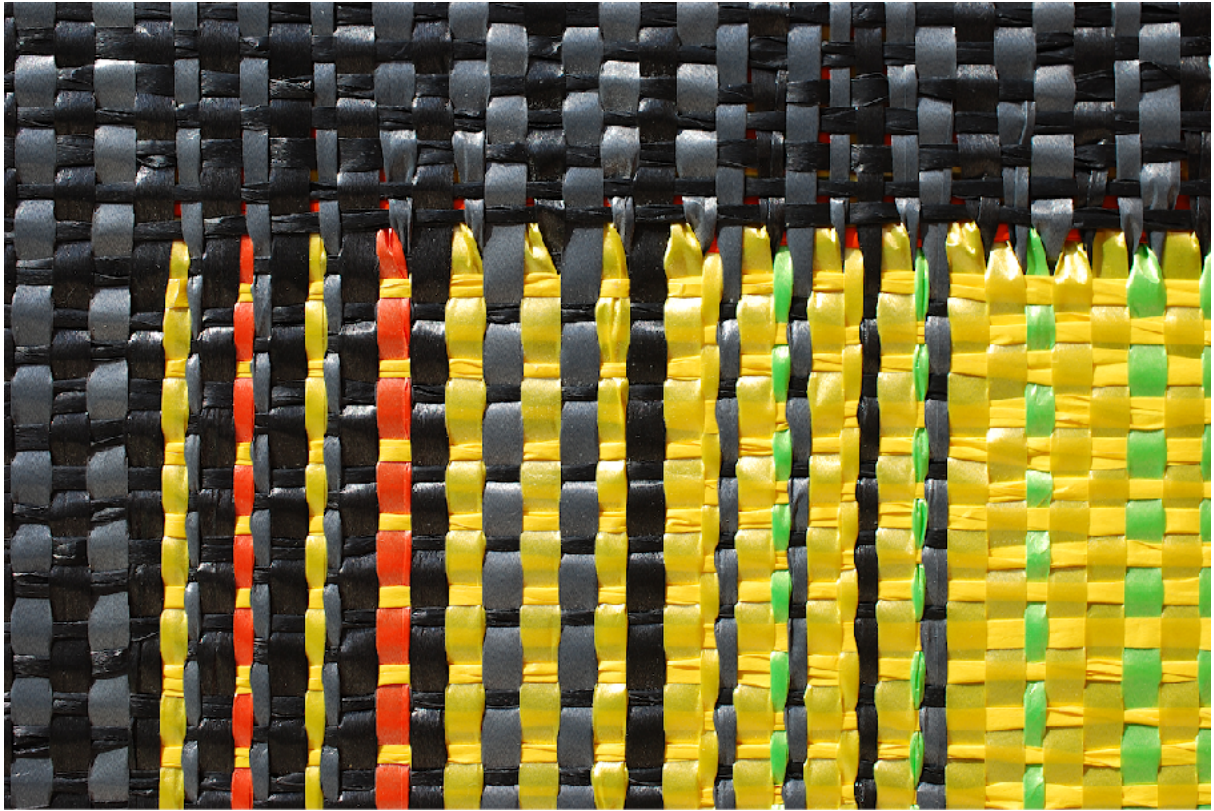

The weaving of gift ribbons allows to visualize the digital aspect of the weave structures

The weaving allows effects of shapes and colors with the indivisible units that are the threads.
A tapestry seen up close reveals how the effects seen up far are made up.

The design of the houndstooth is obtained in weaving by an even simpler design, the plain weave,
One thread above, one thread below. Simply we use a particular coloring, 2 threads of one color followed by two threads of another.
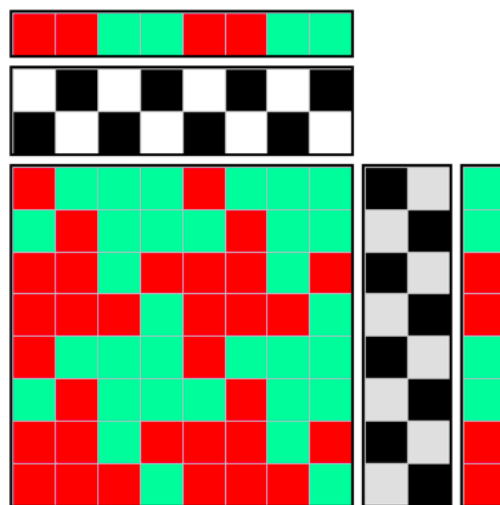
So the houndstooth is obtained by a combination of vertical (warp) and horizontal (weft) red threads and there is indeed an alternation, one thread above (apparent warp), one below (visible weft).
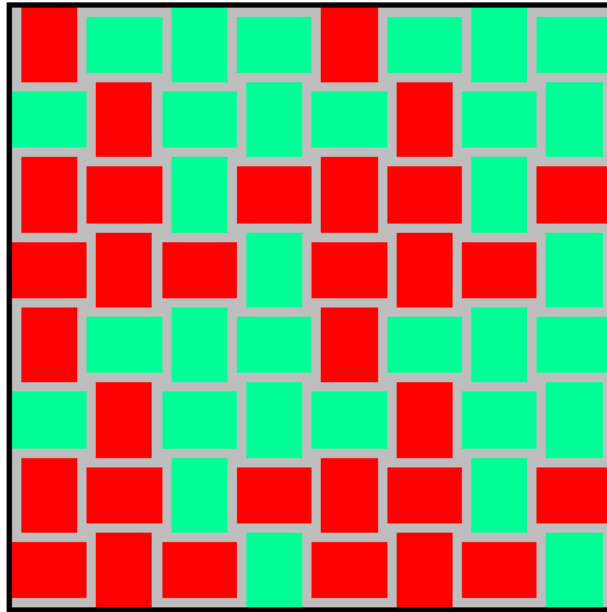
The red houndstooth pattern induces another green houndstooth pattern, as a background. Unless we consider the drawing as a green houndstooth on a red background. We have a double tiling, or rather a single tiling colored with two colors.
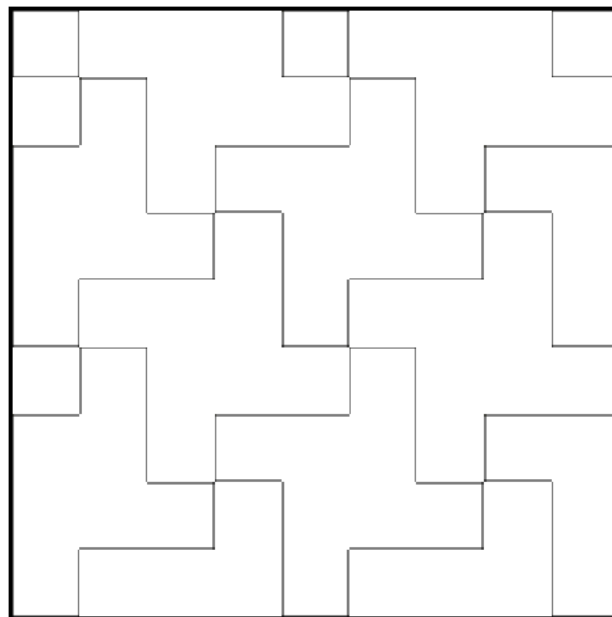
Houndstooth tiling

Repetition and more generally tilings are another fundamental aspect of weaving.
This, simply because the repetition is very easy to implement.
It suffices to repeat the threading and the pegplan to obtain a repetition in the fabric.
The repetition of a pattern has thus become a characteristic of the textile ; the art of textiles having become for some "the art of what is repeated".

This explains the affinity of weaving with the art of tiling which is also one of my areas of interest.

Khudayar Khan Palace, Kokand, Ouzbékistan
Here we find classic weaving structures in tiling

I have the impression of participating in research and issues that developed very early in the history of humanity.

Roman mosaic, Risan, Monténégro

We have seen that the creation with the shaft weaving is carried out by series ; each warping gives rise to a series of tapestries.

These tapestries are a series of choices which "comes on the top", of successive decisions which concern first the warp then later the weft.

For each tapestry, this stacking will be successful or not. The creation is addressed to the group, not directly to an individual work.

The artist then expresses himself by his choice of the best elements of the series.

We must not lose sight of the fact that the primary goal of the artistic process is to transmit an emotion.

It is because such and such tapestry will be judged by the artist as the bearer of a greater or lesser charge of emotion that it will be put forward.

It is inevitable that not all creations are of equal quality.
It takes a long time to work, in different directions, so that works that satisfy you emerge.
It is not necessarily those that have been the most planned that will be the most interesting ; the choice can be made on works where chance comes in part, in a strongly constrained frame.
The creation is in the definition of the frame, in the successive use of different constraints.

It is in this sense that I say that weaving is to tapestry what poetry is to prose. If tapestry allows great graphic freedom, weaving is the art of using constraints. Paradoxically, this frame allows multiple reading of the works ; between the lines.

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