

# Digital textures

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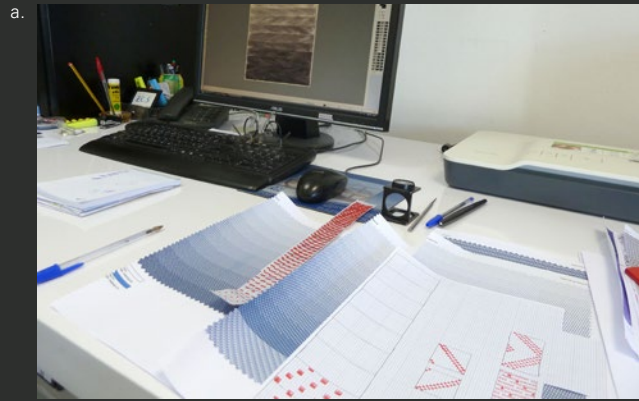
Digital technology has radically changed the manufacturing of decorative fabrics, now known as digital fabrics or woven images. The invention of the computerised Jacquard loom, the digital loom and digital processing programs have opened up a huge field for developing new digital textures.

## Historical development of decorative fabrics

Fabric manufacturing is one of the oldest industries around, but the most significant advances came in the 18<sup>th</sup> century, when textile production was mechanised during the Industrial Revolution.

Along with mechanisation came theory on specific graphic conventions in the textile industry to convey the complex operations required to manufacture fabrics. These codes were invented around 1750 by Jean Revel (1684-1751), a painter with ties to the silk industry in Lyon, and are still used today. In 1771, the same codification appeared in the method developed by Johann Michael Kirschbaum (1725-1782). It is an image that describes the weave of the weft through the warp, giving the fabric a specific texture, elasticity, etc. Weavers know how to interpret these drawings and decode them at the loom, just as a musician decodes sheet music and turns it into a melody. The crossing of the warp and weft is represented graphically as a grid, and called the weave or structure. The weaves represent the evolution of the warp and weft to create a specific texture, a binary system expressed with two colours: white and black (or red). Black (or red) represents that the warp goes over the weft, while white shows that the weft goes over the warp.

In the early 19<sup>th</sup> century, Joseph Marie Jacquard (1752-1834) invented a system to program warp threads. He created a machine for the loom that uses pasteboard cards with punched holes that automatically select the threads for each pass. Each thread can be selected independently, allowing for larger patterns, which can be as wide as the loom. Jacquard revolutionised textile design, and has been recognised as a precursor to the invention of the computer and our digital era. He simplified preparation and sped up production. His innovation made it possible to repeat a design quickly and easily, so that decorative fabric became available to more people in what we can call a democratisation of textiles with colours, patterns and textures.



a.

*Blau* by Francesca Piñol, made at Sampedro, Guimarães, 2012.

- a. Sketch on the computer screen and study of textures for colour spectrum in 13 satin and 18 satin.
- b. Point paper design.
- c. Weaving *Blau* on the digital loom.
- d. Finished piece, woven linen, 580 x 310 cm.



b.



c.



d.

## Digital textures today

Textile designs traditionally made with brushes (watercolours, tempera, acrylic), or collage, today are created using digital cameras, scanners and photo editing software. With its speed in capturing complex figurative images, the computer has opened up new fields. The images we work with can be created or drawn by hand, or photographed, but in either case must be put on a computer. Or they can be created digitally, existing only on the screen and not in the physical world. These are called virtual images, according to the concept that Braddock calls true digital (Braddock 2007).

Before starting the process to weave an image, we have to imagine the type of fabric we want. Based on this, we select the colour palette, materials and best structures to create the textures that fit the image. We decide how many textures we need for a digital weave to respect the highlights and shadows, contrast and definition of the figures and background in the picture. On many occasions, after the type of weave has been chosen, with the number of warp threads and weft threads, and the colours, a test is done with several structures to be able to visualise the different textures and choose the best ones for the best woven representation of the image. Sometimes, this composition created by playing with textures takes on a life of its own, and becomes a piece of art in and of itself.

Once we've chosen the textures for the final piece, we simplify the colours in the image to the number of textures chosen. And each colour gets a texture that reflects the characteristics of the drawing. Meaning that each colour in the digitalised picture is assigned a corresponding structure. By superimposing the weaves on the drawing, we get the point paper, which has the information on which threads cross and how, meaning which threads have to be raised on each pass to create the design. In this process, the image, now called the point paper design, becomes the structure of a fabric that the loom translates into a texture or the woven image.

The steps are the same whether it is handwoven or made on an industrial loom. With manual digital looms, the weaver can choose the weft threads and continue making decisions about the piece as the process progresses, putting their personal mark on the finished piece. Hand weaving allows for all sorts of threads and fibres, such as metallic, paper or silk threads, which boost the quality of digital textures, as well as playing with the fabric's own tactile values. The places where different materials and weaves come together can be surprising, novel, opening up new possibilities in terms of textures, and can't be replaced by a computer screen. A random game takes place while working with the materials and structure. Tactile and sensory knowledge of the materials is conveyed to the fabric during the weaving process.





Close-up of textures made with variations of taffeta, 8 satin and twin-wire weaves, with cotton, paper and copper threads.

Nowadays, contemporary artists and designers are experimenting, looking for new fabrics and textures, in addition to using new fibres, aware of the important role the technology and materials used play in creating new fabrics and bringing texture and colour to textiles. The development of digital controls for manual looms equipped with attachments like the Jacquard machines allows textile designers to become creators and control the whole cycle, from design to weaving. A new generation of looms with innovative technology can be found at textile creators' studios and art and design departments at many universities. Holyoke points out that this new generation of looms is used as a tool for creative expression, a new medium in contemporary art (Holyoke 2010).



*Sveabreen* by Francesca Piñol, 2016. [See detail.](#) ▶

The Digital Jacquard loom TCII. ▼



One of the most interesting manual digital looms is the TCII (Thread Control) digital loom by Digital Weaving. It reads the point paper design digitally, even though the weaving is manual, with some advances that speed up the process. With the TCII, the point paper design can be made with most common design and photo-editing software; it doesn't require anything special. The TCII comes with software that connects the loom to the computer, the TC2 software that reads each pass on the point paper design, and pass by pass weaves the pattern, creating and combining textures that were designed and encoded on the point paper design.



*Portrait, imaged simplified to 6 colours, and point paper design, 2017.*

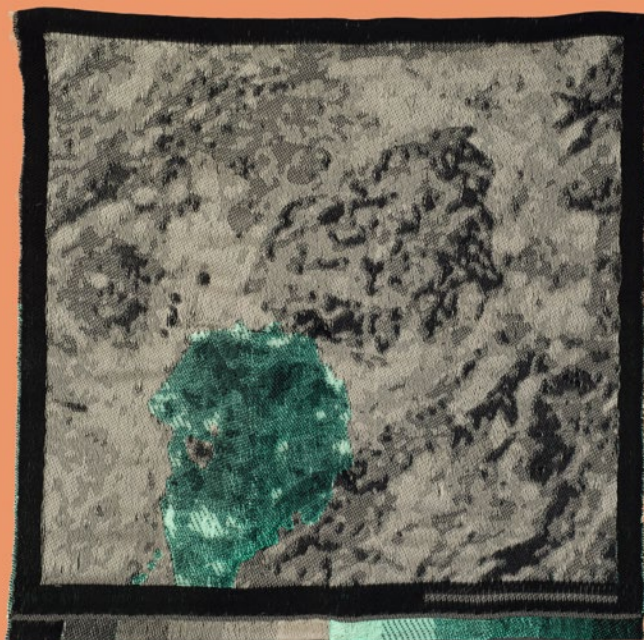
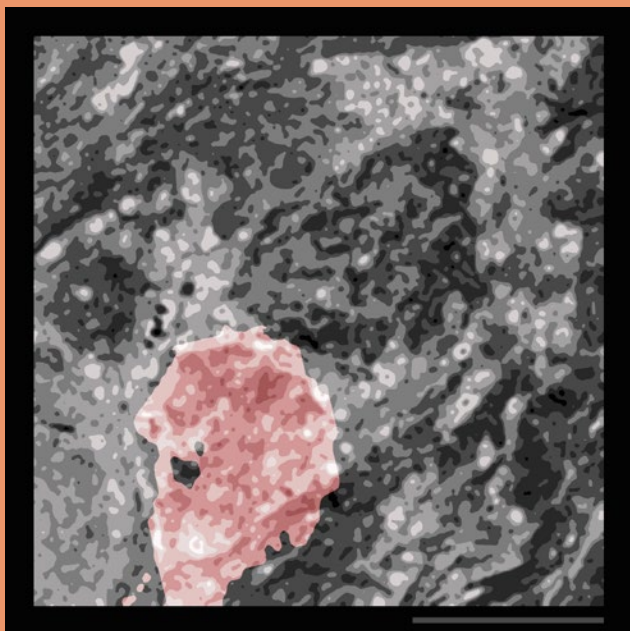
Three versions with different textures for the same portrait, 2017.



### Research into 21<sup>st</sup> century fabric design. An example

In Spain, these digital textures are being developed by Francesca Piñol at Laboratori Tèxtil, her textile laboratory. In late 2018, her research was featured at an exhibition at the Centre de Documentació i Museu Tèxtil de Terrassa in Terrassa (Barcelona), displaying jacquard fabrics made on the latest-generation Digital Weaving TCII loom mentioned previously. Noteworthy pieces include *Paisajes* and *Pasajes de color*, featuring a colour spectrum that goes subtly from heavier to lighter satin. These pieces are design tests as well as works of art. The piece *Plecs* imitates the movement of water on photographs being developed. During an artist's residence at the North Pole, she created her series *Marcas de Agua*, which alludes to the marks left by the movement of sea water along the sand and ice, as well as how light reflects off the ocean surface. To achieve these effects, she used satin and twin-wire weaves. *El Ártico* evokes textures in different states of water, snow and ice, where there is almost an absence of colour. This evocation is transformed into long rectangular fabrics in subtle colours and soft textures of cotton, silk and hemp.

At Laboratori Tèxtil, she is also making woven portraits from photos that bring back memories, in line with the tradition of artistic weaving with the Jacquard technique done in the early 19<sup>th</sup> century.



▲ *The MOR174/9 glomerulus and his unknown neighbour* by Carles Bosch Piñol, 2018.

► Woven version of *The MOR174/9 glomerulus and his unknown neighbour* by Francesca Piñol, 2018.

*The Fabric of Thoughts: Recognising an Odour* is the start of a new collection, a collaboration of art and science through research into the neurons of smell. It was created in collaboration with neuroscientist Carles Bosch Piñol from the Francis Crick Institute in London. It features woven images of neural landscapes from the most recent research done with different sorts of microscopy (optical and electronic), showing how geometric patterns appear on different scales, ranging from microns to millimetres. Some of the elements have been woven in phosphorescent threads, which superimpose some of the previously seen images onto the textures.

In the field of digital textures, although a lot of weaving is still done on an industrial Jacquard machine, part of the process is done manually and that is essential. The new digital software allows us to visualise any image or texture, although they are based on the tactile knowledge of materials and colours. ●

Thanks to Carles Bosch Piñol.

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#### Links

[www.digitalweaving.no](http://www.digitalweaving.no)  
[www.francescapinol.com](http://www.francescapinol.com)