Jacquard Weaving and the Magnolia Tapestry Project

Two Thousand Years of Tapestry

The history of tapestry encompasses pre-Columbian Inca tunics, Egyptian Coptic medallions, Chinese kesi of woven silk, Navajo blankets, Middle Eastern kilim carpets and wall hangings from Medieval European castles. Egyptian art provides evidence for the existence of looms as long ago as 3000 BC; between the third and seventh centuries, tapestry weaving was introduced by Muslim and Byzantine influences in Western Europe, where it flourished in the medieval period and throughout the Renaissance. Subsequent revivals by the Arts and Crafts movement, the Bauhaus, and independent textile artists brought the medium to a 20th century audience. Le Corbusier called tapestries "nomadic murals" for their portability and considered their warmth of color and texture a well-suited counterpoint to his cool, modern interiors. For more than two thousand years the popularity of the medium has waxed and waned, its status shifting between folk art and fine art, imperial status symbol and industrially produced furnishing, depending on the cultural moment.

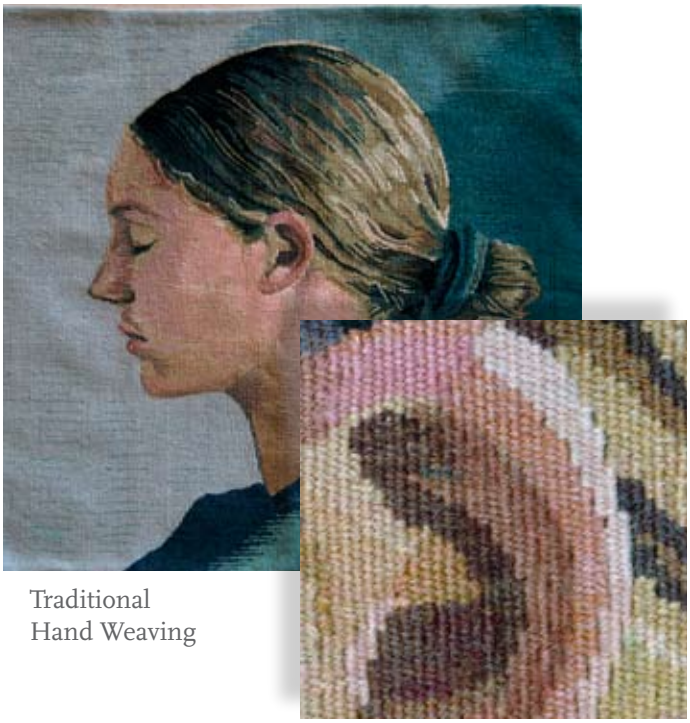
The Basics: Warp and Weft

While the process of tapestry production has evolved over the years, the ingredients remain essentially the same: colored weft threads are woven into fixed warp threads, creating a thick textile fabric. In traditional tapestry weaving, also known as discontinuous weft-faced weaving, the weaver interlaces weft threads or yarns through static warp threads. The warp threads are invisible in the finished product; only the surface weft threads comprise the image. When a color is required in a certain area, a weft thread dyed to the corresponding hue is woven in that area, according to a drawing or "cartoon" placed behind the warp threads. This method of color distribution can be likened to 'paint-by-numbers.'

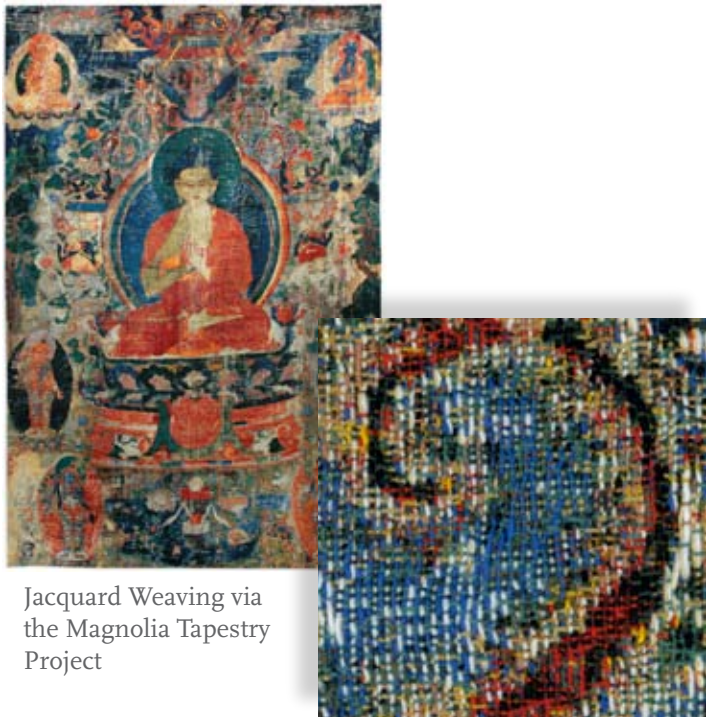
Jacquard Technology

In 1801, Joseph-Marie Jacquard developed an apparatus that revolutionized weaving. In Jacquard's process, a cartoon of the design to be woven is divided into a grid, which is used to encode a series of perforated cards. A device (now known as a Jacquard) suspended over the loom lifts each individual warp thread by reading these cards. Each perforation corresponds to a single warp thread, such that each weft thread is interlaced either over or under the warp threads depending on the presence or absence of a hole. Unlike traditional hand weaving, the weft threads span the entire width of the tapestry, and the image is composed of a matrix of warp and weft. Jacquard's innovations were met with resistance and fear by the weavers of his native Lyons; legend has it that a throng of angry weavers attempted to destroy his device when it was first exhibited in Paris. Nevertheless, the Jacquard punch-card system prevailed, providing the basis for the development of computer technology in the early 20th century. The binary "memory" of the perforated cards was the progenitor of other machines with programmed functions: the player piano, the adding machine, and eventually, the computer.

Bronco-X by Ed Moses being woven on an electronic Jacquard loom.



Traditional
Hand Weaving



Jacquard Weaving via
the Magnolia Tapestry
Project

At left: an early test for John Nava's Cathedral project, hand-woven in China based on a cartoon of a painting by Nava. A detail view shows the 'paint-by-numbers' nature of the surface, which is entirely comprised of weft threads. At right: *Thangka I*, a 2004 Jacquard tapestry by Donald and Era Farnsworth. A detail view illustrates the surface matrix of interwoven warp and weft threads. At a distance, the eye perceives these thread combinations as distinct colors.

Tapestries, Color and the Human Eye

Typically, tapestries are translated from the original design via a process resembling paint-by-numbers: the cartoon is divided into regions, each of which is assigned a solid color based on a standard palette. In Jacquard weaving, the repeating series of multicolored warp and weft threads can be used to create colors that are optically blended – i.e., the human eye apprehends the threads' combination of values as a single color. This method can be likened to pointillism, a style of painting in which tiny dots or points placed in close proximity are optically blended as described above. In fact, pointillism originated from discoveries made in the tapestry medium: the style's emergence in the 19th century can be traced to the influence of Eugène Chevreul, a French chemist responsible for developing the color wheel of primary and intermediary hues. Chevreul worked as the director of the dye works at Les Gobelins tapestry works in Paris, where he noticed that the perceived color of a particular thread was influenced by its surrounding threads, a phenomenon he called "simultaneous contrast." Chevreul's work was a continuation of theories of color elaborated by Leonardo da Vinci and Goethe; in turn, his work influenced painters including Eugène Delacroix and Georges Seurat. The principles articulated by Chevreul also apply to contemporary television and computer displays, which use tiny dots of red, green and blue to render color.

Origin of The Magnolia Tapestry Project

The Magnolia Tapestry Project emerged from artist John Nava's 1999 commission to decorate the vast interior walls of the Cathedral of Our Lady of the Angels in Los Angeles. Originally planned as a series of sandblasted relief sculptures, Nava's commission was almost cancelled when engineers realized that the acoustics of the sandblasted walls would be untenable. Textiles were deemed an appropriate solution, being a decorative element which would also absorb sound, reducing unwanted reverberation. Nava and Magnolia Editions co-director Donald Farnsworth quickly created a new proposal, using digital imaging software to give Nava's painted imagery the appearance of having been woven. The project heads called the artists' bluff: their proposal was approved, and the pair began investigating the best means to actually realize the images as tapestries.

An exhibition of Jacquard tapestries by John Nava at the town hall in Bruges; the tapestries are now permanently installed in the Cathedral of Our Lady of the Angels in Los Angeles.

A New Approach to Jacquard Weaving

Farnsworth and Nava traveled to mills worldwide, stopping in China, Belgium and North Carolina, where both Jacquard and hand weavers showed them the methods currently in use. Watching weavers choose thread colors for their palettes simply by 'eyeballing,' the artists were struck by the potential for this medium to be fine-tuned. While totally unfamiliar with the terminology and mechanics of weaving, Farnsworth and Nava have spent years manipulating pigment and pixels to achieve specific effects of color. Nava is an internationally renowned figure painter, grounded in classical techniques and color theory. Farnsworth has been enthusiastic about the creative potential of digital technology since his first Apple IIe computer in 1980. His decades of experience with computers and printmaking, which often involves subtle translations between media – creating lithographs from drawings, inkjet prints from paintings, etc – served as a knowledge base from which to explore weaving.

The pair's relative ignorance of the textile field allowed them to ask the impossible: to strive for conditions whereby warp and weft threads could possess variable dynamics comparable to other fine art media, from the gentlest stroke of charcoal to the thickest, oiliest blast of paint. Armed with a spectrometer and 25 years of applied color theory, the two sought to pinpoint exactly which combinations of colored threads the eye perceives and differentiates as particular colors. They understood that without an extremely precise control over the color and tonal quality of a tapestry, an artist would ultimately be unsatisfied. Rather than weaving solid areas of color, as in traditional hand weaving, the Magnolia Tapestry Project's method makes the most of Jacquard technology's potential to weave a complex, mosaic-like network of color combinations.

Farnsworth and Nava were put in touch with a Belgian mill where weavers had begun experimenting with a customized electronic Jacquard loom. By combining three warp systems and a double-headed Jacquard with 20.000 lifting hooks, the mill hit upon an arrangement described as "one of the most complex weaving machines in the world." The Magnolia Tapestry Project is a direct result of Farnsworth and Nava's unorthodox application of this innovative technology. The hundreds of tests done for the Cathedral project and the subsequent tapestries woven over the past five years are part of an ongoing effort to meet new challenges and push the limits of the electronic Jacquard loom.

A woven palette from 2004.

Color Palettes and Weave Files

The tapestries are woven based on a set of continually revised and improved color palettes. Creating a palette is a lengthy process: first, a set of either 8 or 10 weft threads are selected, based on color, composition and weight. These threads are woven in all accessible combinations to create over 3,000 possible color swatches. The selection of swatches is edited down to a range between 250 and 510 colors; an electronic lookup table based on the weave structure and color of the swatches is then created. Next, a preliminary file is produced and woven to

test the accuracy of a projected set of colors. Once an accurate woven color table has been achieved, work can begin on the weave file for a particular image.

Working with the artist, either Farnsworth or Nava creates an electronic weave file by translating an image into the colors available to a specific palette and modifying the resulting file for maximum weavability. Each pixel in a file structure is a request for a specific weave pattern. A pixelated weave file will call different colors to the surface of the tapestry, sending others to the back; the tension created by excessive pixelization can cause warp threads to break. If one of the 17,800 warp threads breaks, the loom comes to an immediate halt and the broken thread must be found and repaired. Many artists choose to use the weave file as a blank canvas of sorts upon which a completely new and unique composition can be generated. The completed weave files are sent to Belgium where the customized, computer-driven looms 'read' the files and combine warp and weft threads accordingly.

A Medium for Contemporary Artists

In the same way that Tamarind and Gemini put the commercial lithographic technology of the 19th century into the hands of fine artists in the fifties and sixties, the Magnolia Tapestry Project is putting the electronic Jacquard loom to work in unexpected ways for contemporary artists. The project includes tapestries representative of several generations and numerous art movements: the Abstract Expressionist wizardry of Ed Moses; Chuck Close's rigorous, process-based portraiture; the Pop princesses of Mel Ramos; the monumental, Expressionistic figures of Leon Golub; the playful poetics of William Wiley and the post-Surrealist visions of Bruce Conner are all re-envisioned in striking new editions. The Magnolia Tapestry Project has also produced tapestries by Hung Liu, Squeak Carnwath, John Nava, Doug Hall, Guy Diehl, Nancy Spero, Lewis deSoto, D.J. Hall, Donald and Era Farnsworth, George Miyasaki, Rupert Garcia, Diane Andrews Hall, Gus Heinze, Katherine Westerhout, Alan Magee, Robert Kushner, Lia Cook and others. ■

Installation view of a 2006 Magnolia Tapestry Project show at Sullivan Goss gallery in Santa Barbara, CA. From left: *DOUBLE ANGEL* by Bruce Conner; *Forum Pine* by Donald & Era Farnsworth; *Still Life with Charles Demuth* by Guy Diehl; *Little Fugue* by Alan Magee (beyond doorway); *La Xochitl IV* by Rupert Garcia; *Profile II* by Hung Liu, and *Crema de La* by Ed Moses.