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WHAT IS YOUR SOURCE OF INSPIRATION?

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***Abstract**: On designing and realization of aesthetic appearance of compound woven structures, each of us uses any visual sources that could inspire us. In this paper were generated new woven structures on the principle of communicating vessels as a metaphor, so that one structure helps the other and is complementary to it. For this purpose was used ArahWeave CAD/CAM textile software for dobby and Jacquard fabric design and weaving, which offers such innovative design possibilities and helps to create amazing patterns. ArahWeave has a special function for constructing multiple layer weaves with different densities in warp and weft layers. The maximum weave size is „limited" to 65520 by 65520 threads in ArahWeave Pro and 262080 by 262080 threads in ArahWeave Pro XL. In the Tools menu from Edit weave are advanced weave editing functions, which can be used both on dobby or Jacquard woven fabrics. As sample, in the Edit decomposed window from Tools, the weave area is split into „weave table", where the number of columns is number of warps, and the number of rows is number of wefts. The „limitations" of a decomposed weave means maximum weave systems of 16 warps and 16 wefts. These so-called „limitations" are motivated only by deeper due to technical weaving reasons on dobby and Jacquard looms. By applying weave to fabric tool, the result will be immediately visible on fabric in the main window, in a selected mode of view (Weave, Integer, Shaded integer or Simulation), and appears at the desired zoom level. The hyper realistic woven fabric simulations in ArahWeave, ArahDrape, ArahView3D or Arahne online configurator mean cost and time saving and the best design solutions for a creative work.*

***Keywords:** aesthetic; design; compound weave; ArahWeave; Jacquard tapestry fabric; simulation.*

INTRODUCTION

It is a difference between what is called artistic and decorative embellishment of woven fabrics. For example, the same landscape as painting and as image in Jacquard tapestry; for a painted landscape on canvas, the textile support is neutral and helps to create a realistic impression of perspective, while in Jacquard tapestry, the landscape glorifies the textile surface itself.

Each of the specified techniques has its place in the world of beauty, but „one is the poetry, the other the prose of the art" [1].

The landscapes, portraits or organic motifs as copy after artworks or photographs can be achieved in brocades, Jacquard tapestries and damasks. These types of woven fabrics require more careful planning than other weaves, being a synthesis of the technical, aesthetics and structural aspects of textile design.

The technical aspects refer to process of the loom. The weaves are obtained on a loom having a Jacquard attachment with individually control of raising and lowering for each warp thread. Named after the inventor, Joseph Marie Jacquard, the mechanical Jacquard loom dates back to the early 19th century and is considered the basis for modern programming and precursor of digital Jacquard technology. From perspective of aesthetic aspects, is necessary a complete understanding of the interaction between warp and weft threads, with focus on experimentation with different colors and structures of threads.

The structural aspects of Jacquard tapestry involve multiple layer weaves one on top of the other. The alternate positions of *colored warp and weft threads* in the weave repeat allow the optical mixing of colors and thus, the image control on structure design. This intricate weave is visually powerful, because the colors „are woven" into unique way that cannot be obtained in traditional *painting techniques or digital photography*, like colors of pigments or colors of light. The visual impact is created by using together the chromatic and achromatic colors of *warp and weft threads.*

A professional textile designer can manage all these aspects from the concept development to engineering design and manufacture of fabric, almost effortlessly, by digital practice and modern technological resources.

In this work, has been exploring special functions for constructing single- and multi-layer weaves of ArahWeave software, included in ARAHNE package. ARAHNE is a global leader in CAD/CAM software optimized for dobby and Jacquard fabric design and weaving. ARAHNE is a software company established in 1992 in Slovenia, which provide sustainable solutions for the highly competitive textile business, thanks to „a programmer who understood weaving and a weaver who twisted the weaves until his head was spinning". In ARAHNE package are also included ArahPaint for drawing and image editing, ArahDrape for texture mapping and ArahView3D to show fabric on the 3D model [2].

I. COLOR EFFECTS IN WEAVES

A compound weave or multi-layer weave is made of at least three threads systems. There are also double, triple and quadruple weaves, and multiple layer weaves can be constructed. These weaves have a great structural diversity and allow achieving an advanced degree of concordance between their structural, functional and aesthetic properties requested by users [3].

In multi-layer weaves the color is a variable phenomenon. The color cannot be easily visualized and created with little knowledge of weaving design and techniques. The phenomenon associates with color are even harder to be explained.

When is used in weave, the color is „affected" and „altered" in different ways by all structural parameters, such as raw material, yarn finesses, hairiness of yarn, sense Z- or S-twist yarn, number of twists in yarn, fabric density, fabric thickness, transparency, fabric mass per unit area, and surface design. The distance between observer and textile surface, the viewing angle, natural and artificial light sources, quality and direction of lighting on surface, and finishing technique, also affect the appearance of colors. The ability to choose and combine colors involves an understanding of each structural parameter which influences each color or combination of colors. Therefore the colors should be treated in compound weaves as an artist treats the mixing of paints on a palette.

The analogous color schemes combine colors that are adjacent to one another in the color wheel. These colors give harmonious effects in weaves, but show only subtle color variations from different viewing angles.

The contrasting color schemes are based on opposing hues and include both warm and cool hues. The high *contrast* of complementary colors creates the maximum visual impact. The complementary colors are opposite each other on the color wheel, as red and green, yellow-violet, and blue-orange. For example, mixing equal proportions of red and green threads creates on weave the same illusion of grey brown hue, such as in paints.

The juxtaposition of colors in weave generates a phenomenon known as simultaneous contrast, studied and described by Johannes Itten. The theory of simultaneous contrast of Itten refers to the chameleon quality of a color and affirm that colors, when are viewed together, share some of their complementary color into other colors. In textile surface design simultaneous contrast can be used to obtain the desired color effects. The unwanted effects of simultaneous contrast are important when it is required to combine more colors as in constructing compound weaves. In paints, this problem can be diminished by altering the color quality of one of the colors used.

To conclude, in a weave, similar colors will neutralize each other, and opposite colors will intensify [4].

The ArahWeave software „mixes" the colors and creates the desired color effects. Working with primary colors, and non-colors, white and black, when the threads are „mixed", all sorts of colors are created. All view modes of fabric simulation and great tools of Arahweave were developed for a clear understanding how the colors of the threads can create visual texture and pattern in single- and multi-colored weaves.

II. AN OVERVIEW OF BASIC DESIGN TOOLS IN ARAHWEAVE

ArahWeave is a very powerful software for dobby and Jacquard fabric design and weaving, but with a few „limitations" justified only by deeper due to *technical weaving reasons*.

A few examples are chosen to exemplify some of these „limitations":

- maximum weave repeat size: ArahWeave Pro 65520 by 65520 threads; ArahWeave Pro XL 262080 by 262080 threads;
- maximum size of image for Jacquard conversion: 65520 by 65520;
- maximum number of hooks in Jacquard loom layout: 65520;
- maximum weave systems: 16 warps and 16 wefts; this means that weave area can be split into „weave table" with maximum 256 weaves (16×16); the number of columns correspond to number of warps, and the number of rows to number of wefts;
- number of different yarns in warp or in weft: 25;
- two decimal points Fabric density: minimum 1 thread/cm and maximum 50000 threads/cm;
- zoom level of woven fabric: minimum 5% (twenty times smaller) and maximum 1600% (sixteen times bigger) [5].

These „limitations" raise the question: in which direction the digital Jacquard technology will heading to achieve more textile expression than at present?

ArahWeave software has special functions for constructing single- and multi-layer weaves. They are included in Edit weave and Jacquard conversion windows from Weave menu. For setting the number of weave systems and *size repeat in warp and weft is used* Change weave window (Weave > Edit weave > Edit > Dimension > Change weave).

Edit decomposed is other special function for constructing compound weaves, available in the weave editor (Weave > Edit weave > Tools > Edit decomposed). After specifying of basic weave repeats for each layer and their size in terms of number of warp and weft threads, the ArahWeave automatically constructs the compound weave.

Figure 1 shows the Edit weave window for a colored multi-layer weave with five warps, three wefts and cross section view in edit weave window. In Edit decomposed weave editor, the compound weave repeat size is split into „weave table" with fifteen different weaves and color combinations possible. For example, the selected weave repeat (red) is a combination of fifth warp and first weft.

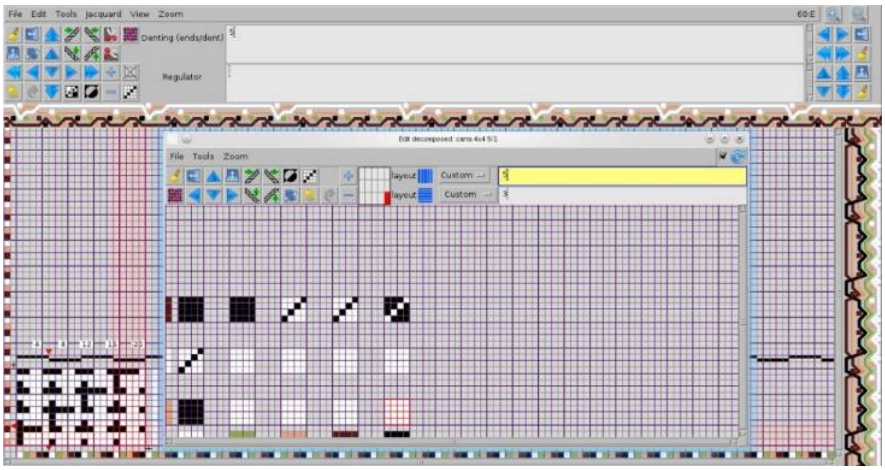

Figure no. 1. Edit decomposed weave editor

When a weft thread is inserted into shed, lies on top of some warp threads and underneath others, producing an interlacement sequence of unders and overs. Conventionally, the weave representation appears as a combination of black and white squares. Warp over weft intersection is represented by a black square and weft over warp intersection by a white square.

The appearance of colors in Jacquard compound weave is given by composition of layers for each color from weave. The result of successive interlacement sequences for each weft thread generates different colors in compound weave. The Decomposed colors view is a great tool for composing multi-layer weaves, especially for placing the stitching points between the fabric layers, together with cross section view. In figure 2 is a detailed representation of decomposed color in a compound weave with five warps and three wefts (figure 2).

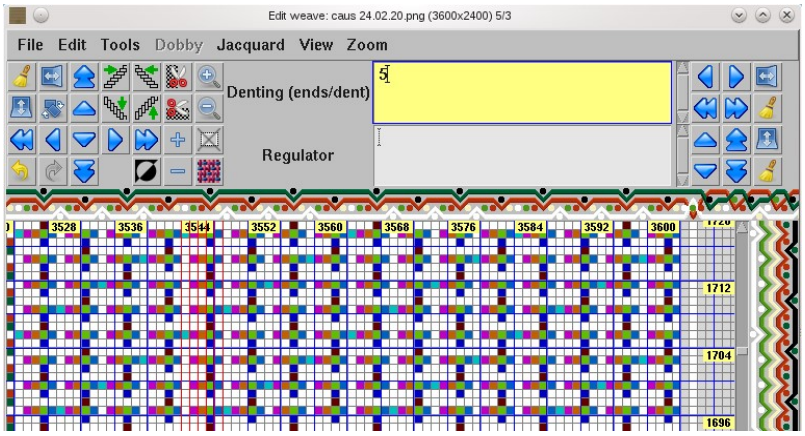

Figure no. 2 Decomposed color view - detail

The ability to compose and decompose weaves operates on the principle of communicating vessels as a metaphor. There color and weave effects with small repeat sizes help the compound weave, and are complementary to it. The ArahWeave's multitasking windowing platform also works on the same principle, since many tools can be used concurrently on the screen. The effect of changing any structural parameters of fabric can be observed in main window in one of the desired view modes (Weave, Integer, Shaded integer or Simulation) and appears at the desired zoom level.

The Jacquard conversion window has its own menu bar, options and tools. The Normal conversion is the default setting of the Jacquard conversion window, where can be loaded a weave for every color from pattern. Besides common conversion (Normal) are five additional type of conversion (Shading, Random shading, Extra wefts, Fil coupé, and Weave blanket).

ArahWeave software offers two great tools, the Shading and Random shading conversions, which makes enable the creation of shading effects on fabrics in different ways.

The source of inspiration is no longer a problem since can be aesthetic and structural harnessed in grayscale and color shading, random shading, combination between grayscale and normal Jacquard conversion, and color shading with tapestry weaves. As a result, you can draw inspiration from anything around you or may find inspiration in something you cannot even see.

III. HOW TO SHADE WITH ARAHWEAVE

The types of shadings were thus selected to obtain the best simulation results of the photographic composition as grayscale shading and color shading with tapestry weaves, both selected from **Weave > Jacquard conversion > Shading.**

3.1. Grayscale shading

Grayscale shading is the more popular conversion, since can transform any seamless repeat patterns, or full width images for weaving portraits or landscapes based on photographic images. This conversion can be used even by non-professionals in the field of digital Jacquard technology.

ArahWeave software can convert a color image to the grayscale mode and then can achieve the best contrast with the Contrast stretch function.

The Jacquard weave shading is constructed on the basis of one weave. Can be loaded any basic satin or twill weaves with warp- or weft faced, depending of grayscale histogram of image and selected colors in warp and weft. The direction of the shading can be chosen horizontal or vertical, by adding points in the basic weave, or random shading conversion can be selected. The chiaroscuro effect in fabric simulation will be even more successful if is used a chromatic differences between the warp and weft threads. Itten's color contrasts or the contrast between colors and non-colors can work compositionally better. The result obtained for Random shading conversion on weft-face satin weave is depicted in figure 3.

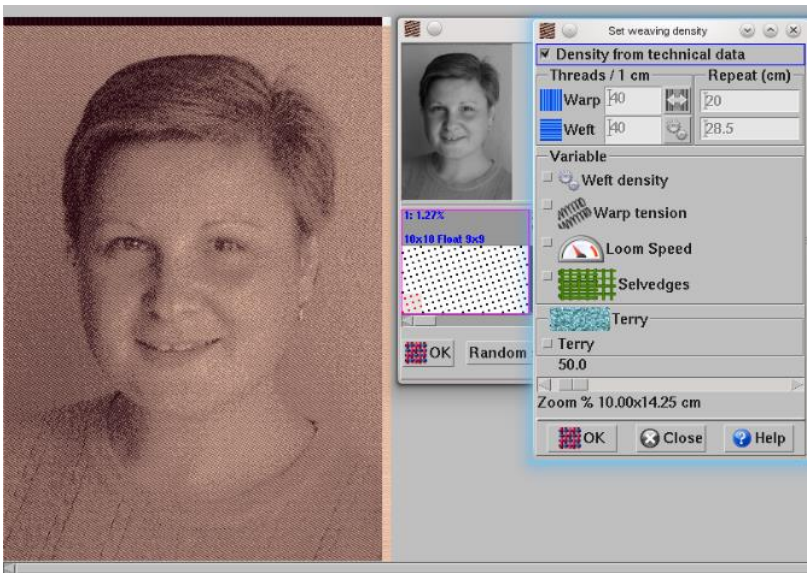

Figure no. 3 Jacquard weave simulation in Random shading

In zoomed image can be observed that are not long float errors and no correction are necessary. Even novice users, less familiar with designing procedure followed for Jacquard weave, consider this as a great advantage in their creative works. The detailed grayscale shading can be viewed directly in Weave mode (View > Weave) at desired zoom level settings (figure 4).

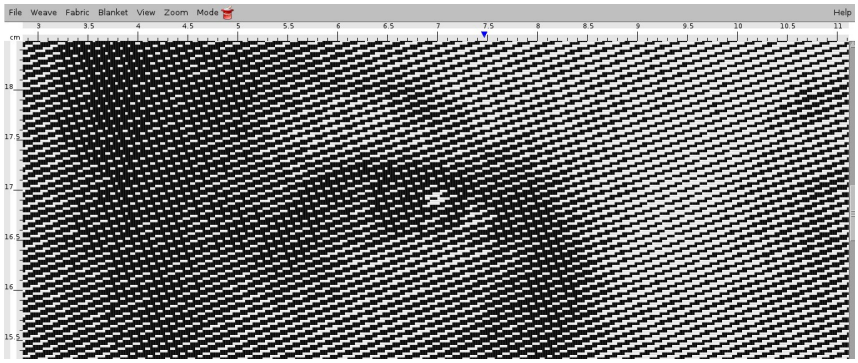

Figure no. 4. Detail of grayscale shading at 400% zoom level

3.2. Color shading

In Arahweave's color shading, the number of colors from image is equal to the number of weaves. Color shading can express any color image into a Jacquard fabric with roughly the same colors and without any color reduction. The chromatic attributes depend on not only the threads colors

in fabric and colors ordering in patterns, but also the arrangement of threads floats in the fabric face-layer. During gradual transition from one color shading to another, ArahWeave examines the loaded image in Jacquard conversion window, calculates all possible weave combinations, and replace color pixels with most appropriate weaves, based on color similarity.

The figure 5 presents *comparative two Jacquard* fabric simulations of the same image. The simulation on the left was designed as single-layer weave in grayscale shading and on the right as multi-layer weave in color shading.

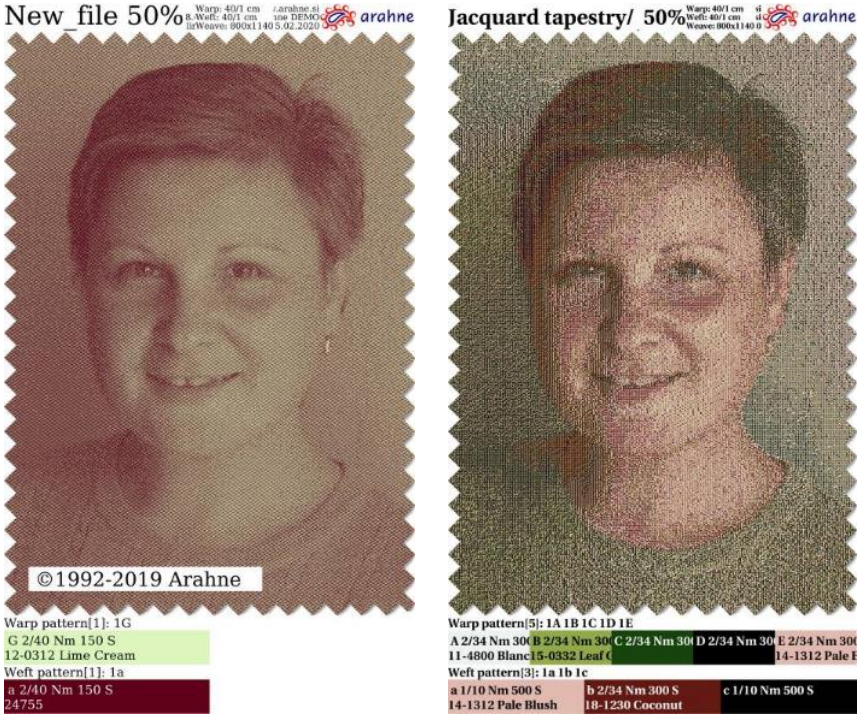

Figure no. 5. Grayscale shading (left) and color shading (right)

The weave size in warp depends on the numbers of hooks of Jacquard loom [6]. This number is typed in the warp field. The weave size in weft is calculated from the fabric density, which has to be set in the Set weaving density window (Fabric > Density and control). In this example, both Jacquard fabrics use only 800 hooks, but more hooks will be able to render the image with much more details

The electronic Jacquard heads use multiples of 512 hooks which provide widths of 1536 (3×), 3072 (6×) etc. The largest head is Stäubli electronic Jacquard machine LXXL with 23040 hooks wide (45×512). Formats up to 51200 hooks can be achieved by combining 2 machines, with spectacular results in Jacquard woven fabrics.

The simulation of Jacquard tapestry in color shading conversion has five different threads in warp and three different threads in weft. Thus fifteen different weaves and color combinations are possible (warp1-weft1, warp1-weft2, warp1-weft3 … warp5-weft2, warp5-weft4).

The composition of the weavings is highly sensitive in terms of such image conversion. The dithering or non-dithering technique and the noise option should be used in this transformation. There is no rule to use the noise and dithering options, the choice depends on the gradual transition of colors between shades and on the final color effects desired.

Other digital tapestries constructions were developed in color shading conversion, inspired by two photographic compositions, author Violeta Radu, a Romanian visual artist. The pattern seen as projection on palms together and handshake represents the double spiral, for the first time appeared on the painted ceramics of the Cucuteni culture.

The double spiral is a sign capable of fully representing its symbolic significance in many variants and combinations. It constitutes a symbol of inversion and of the intercommunication between two opposite principles.

This ancient civilization is an invaluable source of inspiration for modern material culture.

It was chosen the same compound structure, five warps and three wefts, but for more accurate color rendering were changed the warp and weft colors. Color of threads was changed in **Edit colors** window (**Fabric > Colors)**. Figure 6 illustrates how is working Jacquard conversion window, together with decomposed weave and color editor. In background the effects of these changes can be seen immediately on fabric simulation in bottom left.

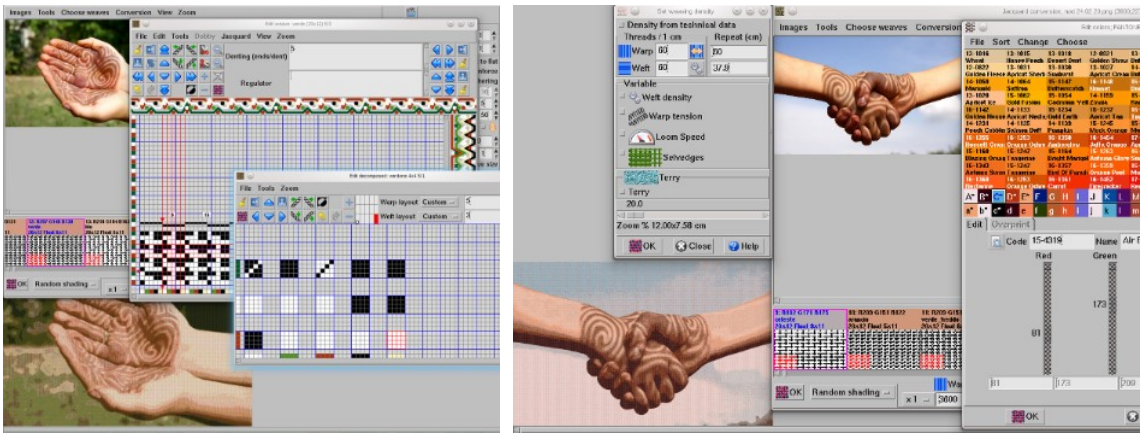

Figure no. 6. Color random shading in Jacquard weaves editor

Usually appear considerable number of long floats after color shading conversion. Therefore it is necessary that before preparing the file for weaving to correct all float errors (Edit weave > Change > Float). In figures 7 and 8 are presented simulations of Jacquard tapestry fabrics at 33,3% zoom level.

Figure no. 7 „Cucutenian dipper" – Jacquard tapestry fabric simulated at 33,3% zoom level

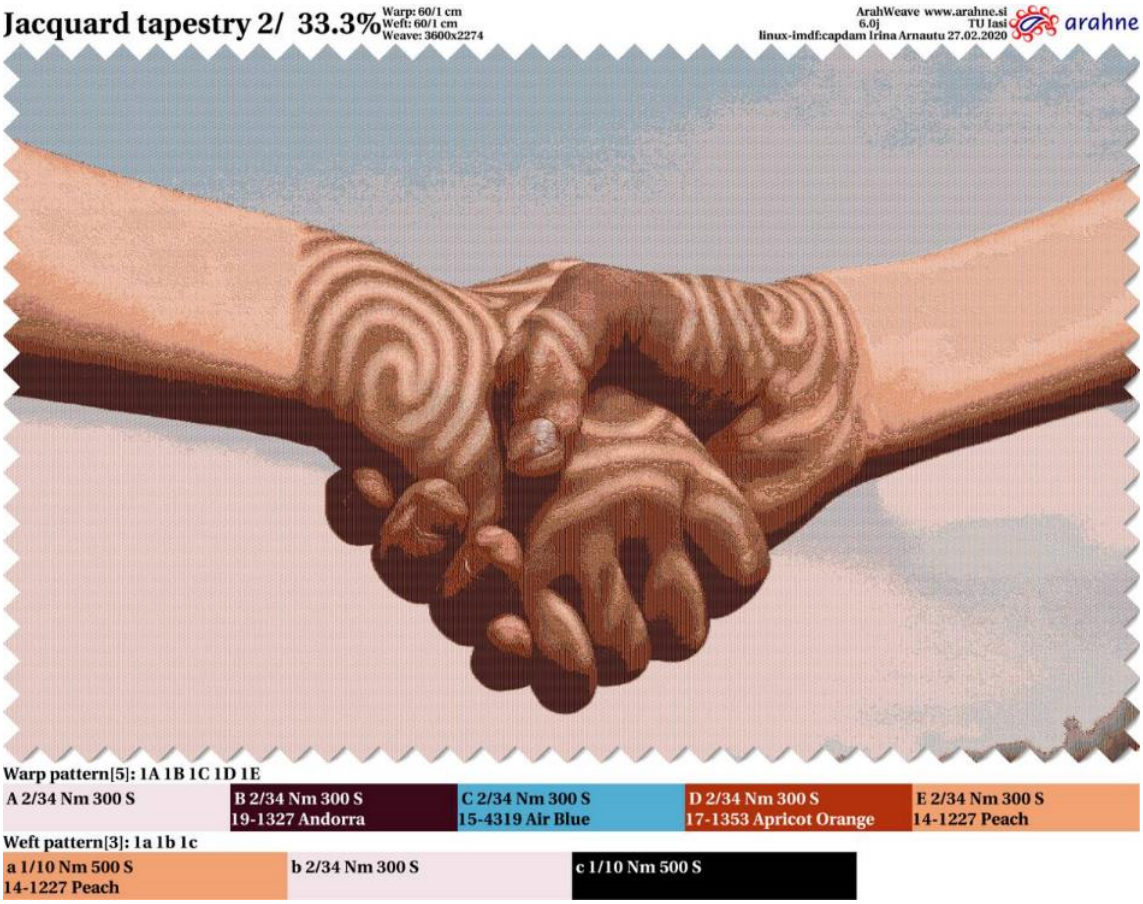

Figure no. 8 „Cucutenian node" – Jacquard tapestry simulated at 33,3% zoom level

IV. CONCLUSION

When copy-and-paste is the current modus operandi in textile design, the photographic image is an alternative way to connect with any inspiration source for a further development on Jacquard tapestry fabric.

In this paper, the Cucutenian source found its way back to me through an emotive relationship with the double spiral as pattern, a sign that simultaneously connects and separates, and through exploring the spectrum of digital technology, embedded within artistic context.

The powerful tools of simulation of ArahWeave software helped me to transpose photographic image into the language of Jacquard tapestry in the most appropriate manner.

A professional textile designer can achieve more expressions for textile surfaces (almost) effortless with the help of digital Jacquard technology.

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