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RESEARCH ARTICLE

FUSION OF COMPOSITIONAL PRINCIPLES IN DECORATIVE DESIGN AND THE TECHNICAL DEVELOPMENT OF THE FABRICS

*Dr. Ștefana – Roxana Stoica

Postdoctoral Researcher, Asist., Department of Design, Faculty of Visual Arts and Design, National University of Arts Iasi (UNAGE)

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*Corresponding author:
Dr. Ștefana – Roxana Stoica

ABSTRACT

Background: Notions of composition are present in decorative design in order to create a correct ornamentation in terms of compositional principles, but they also represent the parameters that a designer must follow to create the design of the decoration. **Aim of the study:** The aim of the study highlight the importance knowledge of both technical and aesthetic principles in creating a correct and complex design with elements of novelty. **Methods:** Collecting and researching notions, ways and possibilities by which a design product can be created while respecting decorative compositional principles, but also taking into account technical ones. **Results:** The technique of making fabrics is determined by the capacity and limitations of the available machinery. Thus, the aesthetic and technical sides of a project work together to find the optimal solution for designing and implementing the decoration. The rigour of technical design involving calculations based on how to combine ornamental ratios, their dimensions and scaling, and the need to conceive a new or reinterpreted decorative design, make the designer more motivated to find the optimal solution, at the basis of which lies his creativity. The dimensions and ergonomics of the object to be decorated are important to take into account when scaling the decorative design, but also the way of assigning shades to the elements of the composition are imperative to establish before starting the actual weaving. **Discussion and Conclusion:** According to this research, sometimes overlooking the technical limitations of the machines, the designer's ability to mould himself to the concrete things and his ability to think the design correctly from the point of view of the final compositional aspect stands out.

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INTRODUCTION

The design of decorative objects has both aesthetic and technical implications. Ornamentation symbolises a creative side where the designer places emphasis on the visual, but at the same time respecting the standards or limitations of technical design. Compositional and technical principles in fabric design are intertwined. Thus, depending on the technical specifications of the weaving machine, the width of the fabric, for example, is the starting point in sketching the pattern to be woven. Both in the field of product design, interior design, graphic design, clothing design, but also in the area of weaving, the general rules of composition are the same, if we refer to aesthetics. What differentiates them is the practical way in which the objects are conceived. In graphic design we see two-dimensional ornamentation that can be transformed into a tangible, embossed one; in the sphere of product design we can talk about the way in which a piece of textile material constitutes a part of an object; in environmental design - fabric can be found in various objects of furniture or decoration, but it can also be used as an accent on the wall, framed by trimmings; and an unfinished fabric, taken from the weaving machine, can be displayed in an artistic setting, like a work of art in an exhibition.

METHODOLOGY

Documentation of how the product is made technically: research the stages of thinking about a weaving pattern.

Researching the subject matter of decorative design: Decorative design is closely related to compositional principles.

Fusion of technical and aesthetic notions: When aware of the technical limitations of the machines, the designer proposes a composition that fits within the limits of the achievable size of the fabric, but also focuses on the final appearance in terms of ornamentation and shades used in the future finished product.

Designing the composition: The composition is designed in specialised software, calculating the modules that are multiplied to see the pattern as a whole.

Conflict of Interest: There is no conflict of interest.

RESULTS

Decorative design: Ornamentation, embellishment, cooking, adorning, are words that levitate around the word "decorative" which

derives from Latin meaning "decoration" (Radinschi, 1969). The term 'decoration' stands for the work resulting from the action of embellishment. Decoration takes place by using certain techniques, materials and concepts, depending on the various objects or surfaces, and these stages can be classified as 'decorating/decorated' (Radinschi, 1969). A particular portion or shape that is part of a decorative arrangement or composition is called 'ornament' (Radinschi, 1969). Just as product designers talk in their books about the relationship between the functional and the aesthetic part of objects, so do these notions, as argued in the book "General Decorative" by Lect. univ. C. Radinschi, but here another term is introduced - ornament. Thus, the object (as ergonomic - functional form), the object (with the forms seen from the aesthetic, compositional point of view) and the ornament - are designed to correlate harmoniously. (Radinschi, 1969) The "act of design" must have a meaning, it is established by "arrangement" (Papanek, 2018). As Papanek states, arrangement, in design, means planning. The same concept applies in the area of ornamentation or decorativism. The designer has to think systematically, to observe things step by step, logically; he has to connect the information he has in a clear and harmonious way in order to achieve a creative project with an effective possibility of application.

The decoration (Radinschi, 1969) must harmoniously complement the function of the object, it must be subordinate to the surface or object, and the most complex form of ornamentation is found when it is necessary to achieve the connection between ornaments arranged on distinct surfaces that are part of the same visual composition, of the same product. There is a misconception that geometric decorations have a formalist (Radinschi, 1969) character, and implicitly so does all popular creation. In all areas and aspects of life there are forms of all kinds, and it is the artist's job to interpret, simplify and stylise them. The folkloric elements or patterns that are made by joining lines and dots are thought out by the artist or designer to please the possible future buyers of the finished product in which the ornamentation is created. In folk ornamentation we find compositions created from the repetition of modules, by alternating geometric shapes, line thicknesses or by alternating colours, they can be designed from overlapping or groupings of elements or by the principle of symmetry and less common is that of asymmetry (in independent ornamentation). Radinschi describes ornamentation as "folk fantasy" (Radinschi, 1969) which is conceived from borders, from squares distributed in the composition in such a way as to create the decorative motif which has symbolic connotations.

Ornaments in the area of traditional objects made more or less by hand, propose modules or geometric shapes that allow their shape to be modified by elongating vertically or horizontally. In graphic design, the elongation of shapes or the distortion of the calculated shape, by modifying it horizontally or vertically, leads to a distortion of the image which results in a wrong design. In the case of fabrics, the geometric shapes made in the program can also be modified there by inserting yarn characteristics (such as thickness) that actually change the pattern of the fabric. A weft yarn thicker than the warp yarn can elongate the pattern along the length of the fabric. The basic elements of visual composition are point, line, shape, texture, value, space and colour. The principles of visual composition are general rules that govern how these elements are organised in an image or design, and they are: proportion and balance, centring, contrast, repetition, alignment, file and connection. Design principles include: balance, contrast, emphasis, movement, pattern, unity and variety. Accent areas and centres of interest are also part of the area of visual composition. In unity versus variety we find compositions that show hierarchy by size (when an element is made on a larger or smaller scale than the group), shape or configuration (when distinct elements are seen among the elements in the group) and location (when an element is further away from the group). In the organisation of the decorative elements of the fabric, the emphasis is on the harmonious combination of the ratios so that each decorative border (with a distinct pattern from the previous one) either creates an effect of discreet continuity of the ornamentation of the original border, or can create a contrast through the choice of shades, or even borders with

motifs that create a contrast of shapes by the way they are placed and scaled. Modules or ratios are outlined by lines forming a geometric shape. The most commonly used geometric shapes to enclose modular ornamentation are: square, rectangle, triangle, hexagon. (Radinschi, 1969). As Professor Radinschi points out, mass or industrial production, during the second half of the 19th century, decorative art began to take on less importance because industrialisation focused on pattern making and this meant a decline in popular art that is handmade. The professor was of the opinion that mass-produced decorative products extirpated the artistic sense of beauty and innovation. (Radinschi, 1969).

Compositional principles in decorative design: Compositional principles are found in the stages of the design process. The description or definition of the design process, according to designer Papanek, goes something like this: the design process consists of design and modeling; the design process is a "conscious and intuitive effort to impose a meaningful order" (Papanek, 2018); the design process involves research, analysis; it is a creative process. In the creation of a three-dimensional or relief composition, which is applied or created in the structure of an object, it is necessary to know the ergonomics of the product to be decorated. Depending on the ergonomics of the product to be decorated, the ornamentation is designed, or depending on the ornamentation created, a product is sought that can be adapted in terms of design, shape, textures and shades. Fabrics can be monochrome, two-tone, tricolour, etc., multicoloured, as the artist or designer decides. The decoration of fabrics is achieved by thinking about how to arrange shapes and shades. Thus, colour harmony, harmony of colour tones, proportion, rhythm, grouping or alternation, gradation of shades, are all part of the principles of composition design. The shades of the composition to be woven are determined after weaving a few samples of material. As the weaving of warp threads is a lengthy process, it is advisable to determine the shade or shades that run the length of the fabric. Weft yarns can be replaced quickly, so the designer who wishes to make a weave for his or her decorative object must take account of these aspects and the time spent by the weaver in placing the yarns. Colour matching means matching two or more colours in a composition. The harmony (Radinschi, 1969) between the colours used in a work is rendered by certain compositional laws that deal with how compositional elements interact by accessing compositional principles. Examples of combinations of shades and tones can be found especially in the patterns made by Heidi Arrizabalaga (2007). The decorative borders found in her book can be a source of inspiration in graphic, product or interior design, but also for the compositional design of motifs found in fabrics.

Tones of colours that are joined together and have a common tendency (Radinschi, 1969) towards an intermediate tone create a harmonious composition. For example, warp threads (light beige) and weft threads (cream), when combined, create an effect in which the eye perceives a new shade tone as intermediate between the two. In the opposite sense, dissonant (Radinschi, 1969) harmonising represents a lack of interest in finding the third tone. In other words, a shade of red and a shade of green are not going to look for a meeting tone. A composition cannot be thought of in terms of colours alone. Even if the quantity of each proposed colour is the same, an artist or designer must also consider the other compositional notions of textures, shapes, intensities and of course compositional principles. Theme, technique and style revolve around harmony. Stylistic harmony is the way in which the elements seek a certain constant value, and the tones in the composition can be similar or even opposite. "The 'chromatic law' is rendered in ornamentation according to the style, talent and pleasure of the artist or designer. (Radinschi, 1969). In the image below (Fig. 1.) where the fabric is shown, three shades (cream, red and green) were used. The complementary colours (red and green) are the impact colours, the cream shade being the one that tempers the composition. The red next to the green creates a contrast of colour, "an exaltation" according to Professor Radinschi (1969). 100% cotton yarn was used in the weaving. The cotton (Cioară *et. al.*, 2004) yarns from which a fabric is made can be used to dress a piece of furniture or a decorative object.

Isochromy can be seen in a border of this fabric. Isochrom (Radinschi, 1969) means equally coloured. We find this notion in pattern making using reversal. A module containing two colours placed identically in the dial forms on the reverse side the same image with the same degree of occupancy of both colours, but seen in reverse. The above explanation lends itself to the detailing of a fabric that is intended to be designed face-to-face identically - that is, unless one programs an interleaving of the modules so that one is on the front, the other on the back, in the same ratio or decorative border. If such a module is applied to a transparent substrate (by printing or by making a transparent sticker attached to the crockery as a stand-alone motif, for example), the pattern will be visible as in a mirror. In this case, this independent module functions as a single ornament in which the shades are arranged equally, and in this case, too, it may be isochromy (Radinschi, 1969).



Fig. 1. Fabric made on the weaving machine, designed in the DB-WEAVE program, in the Fabric Design and Display Laboratory of the DIMA Faculty of "GhAsachi" University of Iasi. Observation of fabric face - back (distinct pattern and isochrom pattern)

The similarity between the way of classifying colours in fabrics and classifying (Cristian, 2013) colours in environmental design lies in the division into two parts: plain ones with a single shade and those with colour effects.

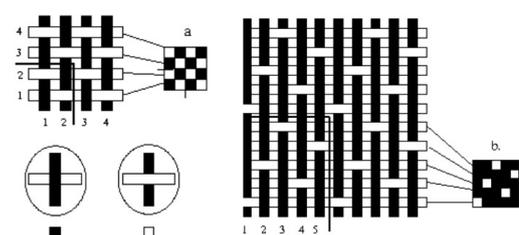
The difference between the way of thinking about colours in fabrics and the way of placing colours in the environmental space, lies in other elements that the designer has to take into account, namely: the matching of textures, the choice of scaling of the ornamentation or pattern in the fabrics and of course the harmonious blending of shades of all elements in that space. In weaving, ideas are also applied that take as their starting point the notions of a visual composition, in which rhythm is the most important element because we are talking here about a ratio, or mode, that is repeated 'n' times, forming the pattern. An idea of composition concerning the object itself to be decorated, but also the whole visual composition concerning its placement in a certain environmental space, can be observed in detail by Professor Radinschi, as follows: the proportion or scaling of the ornament must be adapted according to the space, the destination, the distance and the ensemble in which the ornamented object is to be inserted. Therefore, the simplicity or complexity of the ornamentation is conceived with the above in mind. (Radinschi, 1969). Ornamental compositions are thought according to rhythm (Radinschi, 1969) - in terms of meter, cadence, alternation, balance, contrast, dynamics. In ornamentation, the highest degree of contrast is alternation (or reversal of mode) - more plastic - 'contradiction' is achieved. There are two types of ornamentation: free or independent and rhythmic or repetitive. In rhythmic ornamentation we see the repetition of the decorative module by moving on the same or another border, we see various ways of inverting modules or motifs, or we can even introduce secondary decorative elements that can link the main ones. These are based on symmetry, contrast, balance and scaling of

elements. In ornamentation, alternation of colour or size can mean an interleaving of differently arranged shapes or colours. Alternating several distinct but similar ornamental borders creates variation that removes aesthetic monotony. Alternation can also be found in the way elements are grouped in ratios.

The concept of progression, regression and gradation in ornamentation is seen when slowly moving from smaller to larger or vice versa, or when gradually intensifying or de-emphasising a colour. Within the realm of interpretation are the shades to be inserted into decorative trim compositions with application in product, environmental or architectural design. These interpretations of colours focus on the sensations they convey to people, and in practice these ornamentations, depending on the textures and colours that are part of the composition, can also create certain moods, for example, a medium shade of green is a cool shade, shades of red are warm, and ochre or shades of beige are also part of the warm range. Combining these, warm and cool shades, gives a sense of calm. In a report, the way in which lines are grouped (by repeating one line of a certain thickness or by repeating groups of lines of the same thickness) is called "conjugation" of identical elements. The ratio may contain a repetition of lines of distinct thicknesses and orientations (vertical, horizontal, oblique) or they may be arranged symmetrically. The way in which these ratios/modules are created from lines and points, or the way in which they are repeated and arranged in ornamental borders or patterns, is related to the principles of visual composition that deal with subjects such as variation, alternation, progression/regression, symmetry or controlled asymmetry. Compositional principles and the calculated construction of the elements inserted into the pattern are the main concepts a designer uses to start a project.

Technical design of fabrics: The interlacing of longitudinally arranged yarns (warp yarns) with transversally placed yarns (weft yarns) is called weaving. The observation of the longitudinal and transverse directions of the yarns is identified in the design as the intersection of vertical and horizontal yarns respectively, if we refer to the two-dimensional design in the DB-WEAVE program. The connection of the wires formed by the warp and weft wires gives their width, thickness, mass and degree of crimp. Mixing the different types of yarns changes the characteristics of the whole fabric structure. Fabrics are classified into two categories: general purpose and technical fabrics. Technical fabrics include decorative items of furniture, cushion covers, tablecloths, bedspreads, etc., while technical fabrics are found in areas such as the food industry, clothing accessories, construction, architecture, agriculture, etc. Fabric with a width of 20-70 cm is often used to make handkerchiefs and shawls, but the 35 cm width of fabric made in the laboratory, due to the yarns used, can be used for an interior area to decorate an object. An important structural characteristic in fabrics is the width of the warp and weft yarns. Yarn warp, yarn width and fineness give the degree of crimp, mass and thickness, thus also the degree of compactness.

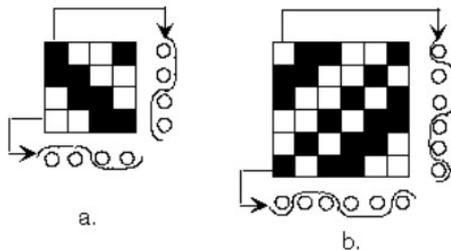
"All links are plotted on the fabric on the front" In the design quadrant, warp threads are numbered from left to right and weft threads are numbered from bottom to top. The binding element is represented by pressing a square which turns black. This small element means constructing from an "elementary length of warp thread and an elementary length of weft thread, in a certain position relative to each other". When the weft thread passes over the warp thread it is called being "picked" and appears coloured black (Fig. 2).



Source: Cioară et al., 2004, p. 55-59

Fig. 2. Links - graphical representation

The word "mode" that we use in identifying the repeating unit in a pattern is called "ratio" in the fabric area. Although, a ratio could mean a sequence of modules. In the weaving area, the number of threads with a given distribution of system effects arranged in a given sequence is called a ratio and represents warp and weft threads. Floats are link segments that are made up of successive weave elements. The length of the thread observed on the face or back of the fabric is called the weft segment. In order to make the weave, a thread must connect the threads on the front with those on the back. In the longitudinal and cross-sections (Fig. 3.) successive link segments can be seen forming a pair of link segments. In order to weave a correct weave it is necessary for one thread to pass over and under the threads of the opposite system, which makes the linking segments form the junction of warp and weft threads.



Source: Cioară et al., 2004, p. 55-59

Fig. 3. Longitudinal and cross sections

In a ratio, the size of the link ratio and the number of passes of the wire determine the size of the link segment. The bond firmness is given by the average bond float and represents how the fabric behaves under physical and mechanical stress.

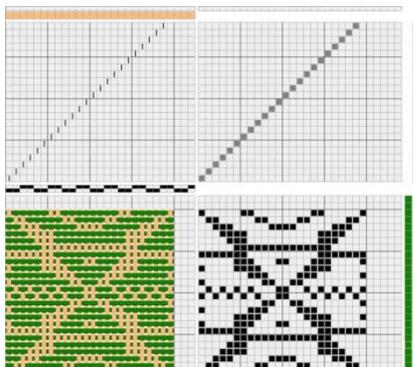


Fig. 4. Report creation in DB-WEAVE program

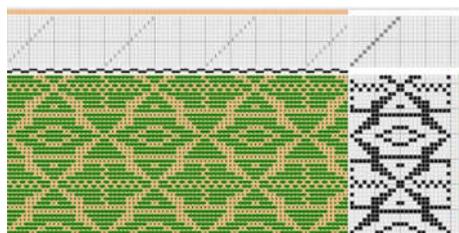


Fig. 5. The pattern for making the fabric, designed from the multiplication of ratios/modules, in the DB-WEAVE program

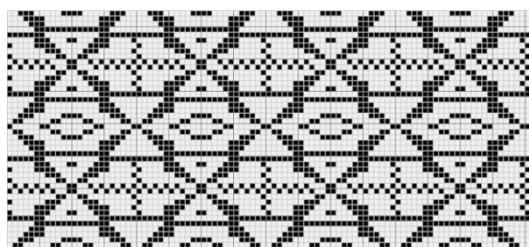


Fig. 6. Fabric pattern observed as "draft" in DB-WEAVE program

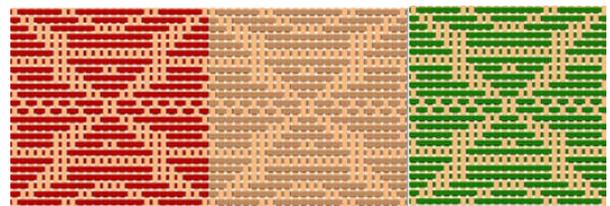


Fig. 7. Variants of weft yarn colouring in the DB-WEAVE program



Fig. 8. Actual observation of the fabric (front - back) shown in the above images

The tissue sample helps to observe and determine the bond. From bottom to top, the warp threads (observed in the vertical plane) are read and interlaced with the weft threads (in the horizontal plane). The width of a weave is given by the number of threads, which may not be less than two. The warp threads run through the selvages and the backing and are mounted on the fabric reel. The weft thread passes between the warp threads which are raised and lowered (that space is called the selvage). The maximum width of the fabric depends on the number of threads of the weaving machine. In a pattern, longitudinal colour stripes are formed when we intervene with shades in the warp ratio, and when we insert coloured yarns in the weft ratio, transverse colour stripes are formed. When we insert coloured yarns on both warp and weft, the diamond pattern is formed. Fabrics have a wide range of uses.



Fig. 9. Fabric made on the weaving machine, designed in the DB-WEAVE program, in the Fabric Design and Display Laboratory of the DIMA Faculty of "GhAsa chi" University of Iasi. Observation of the fabric without standing under tension



Fig. 10. Fabric photo Interleaving of borders with various pattern designs

They can be used in clothing design, in environmental design (such as in the creation of bedspreads, curtains, furniture fabrics, carpets, tablecloths, etc.) and in the design of technical articles (such as filters, tyre cord nets).



Fig. 11. Fabric photo. Interleaving of borders with various pattern designs

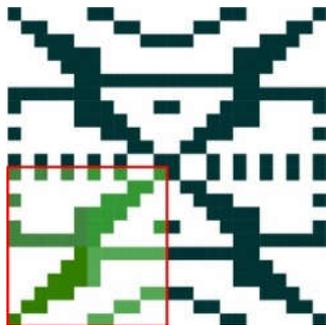


Fig. 12. Vectorization of the repetitive motif in the fabric. Observation of the area that repeats four times in the large module. Vectorization done in Corel Draw



Fig. 13. Observation of model styling. Vectorization done in Corel Draw

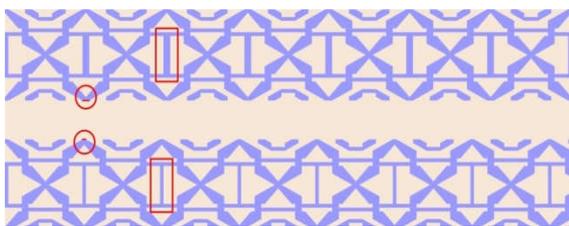


Fig. 14. Making decorative vector borders. Observation of how the modules are joined. The first decorative border shows a doubling of the dial line, while the second border has finer joints, allowing the pattern to "breathe"

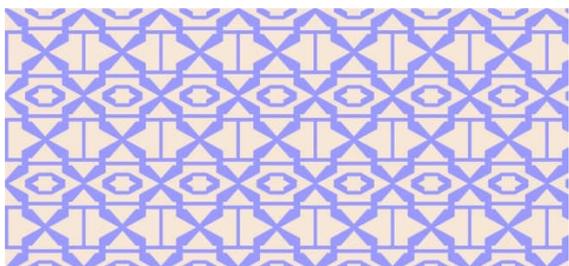


Fig. 15. Second variant of joining modules in the pattern

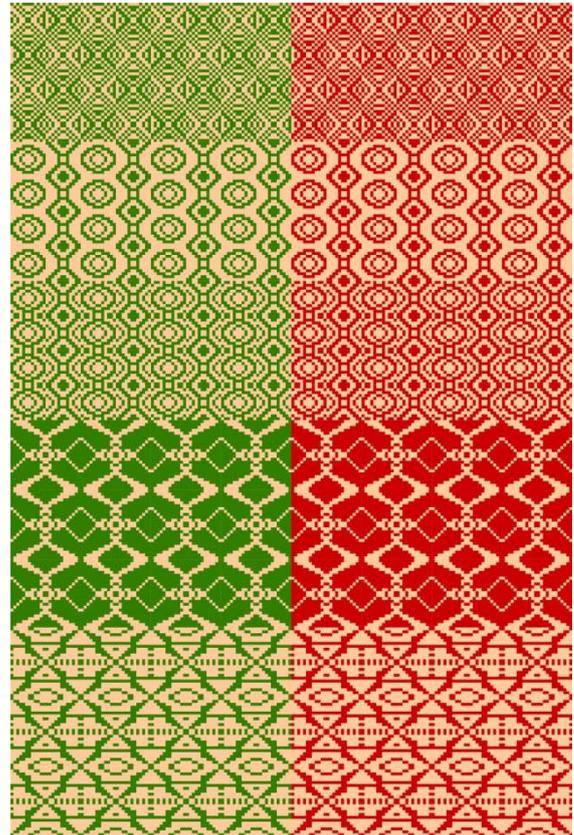


Fig. 16. Combining the five models. Vector realization. This vector representation serves a more concrete visualization of how these patterns merge. Shade selection variants. A more harmonious blending of patterns 1-3 and 4-5 can be seen; but switching from pattern 3 to 4 only works if we view it as a fabric

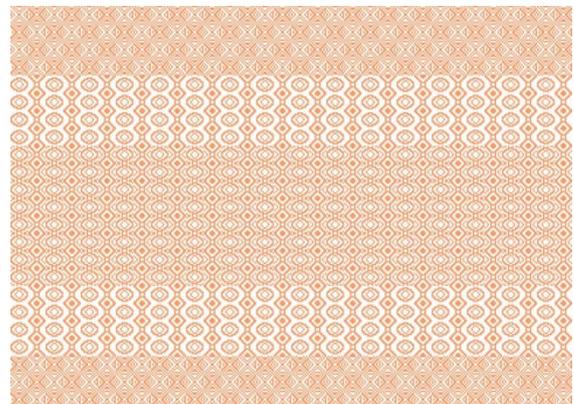


Fig. 17. Making the pattern that can be printed on any support material. The vector elements are inspired by the fabrics shown in this article

The finishing processes applied to a fabric, such as printing, dyeing, etc., and the countless ways of combining colours, make fabrics an accumulation of influences based on various types of internal structure. The process (Briggs-Goodie *et al.*, 2011) of designing fabrics made by commercial textile designers is one that requires careful attention to cost, productivity requirements and creation deadlines. The industrial or product designer needs to consider current trends or design a reinterpretation of classic designs to create a collection of high interest to the industry and to attract interior designers to use their products.

DISCUSSION

Designers can take inspiration from woven product designs or create designs to be woven.

The image below shows the vectorisation of a pattern found in fabric specifically for use in the decoration of an upholstered hallway bench or as a decorative cushion cover. Products that meet the ecological and sustainable criteria of the products are topical because the core customers are those who are concerned about the environment and are therefore selective in their product purchases. They appreciate the quality and tradition that is identified in textile products. For this reason, the environmental accreditation of the yarns used is important, and those products that result from the use of fabrics can be considered quality products. Luxury textiles include natural yarns such as wool, silk and cotton. Weaving and tailoring find their common denominator in the design of a product, where ornamentation is a must.

CONCLUSION

The versatility of ornamentation can be seen in the various ways in which an ornamentation can modify certain elements of its composition to create a new variant, but the versatility of ornamentation can also mean the multitude of ways in which it can be printed, decorated or made on different material bases (such as paper, canvas, plastic objects, wood, etc.). All these artists start from a vector composition which is then designed to match the technology or software used to create the object. For example, the ornamentation created vectorially in the two-dimensional Corel Draw program was then designed and created similarly in the DB-WEAVE program to design the interlacing of warp and weft threads. Thus, the connection between CAD technology and CAM technology is observed. "Stylization implies interpretation, simplification, generalization, extraction, intervention, discarding details, bringing out expressive features". "To stylize means to invent other motifs... interpreting what we have stylized, taking out or highlighting certain particularities with the help of geometrizations of straight or curved lines".

The methods for selecting the design plan for vector ornamentation are diverse and start first from the creativity of the designer, who must have a solid base of knowledge of decorative motifs and how to create them for use in both 2D and 3D versions.

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