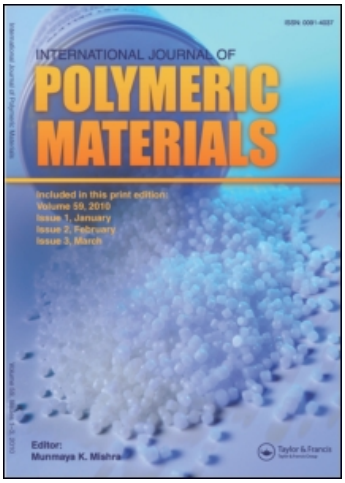

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The Role of Technological Parameters at Woven Fabrics Construction

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A design student frequently poses the question: Why should I study so much technology? This article tries to give the answer to this question by defining the constructional and technological parameters that are important for designing a woven fabric.

A designer like an artist designs a unique product which is the reflection of his ideas. Such product is not intended for massive production. The role of an industrial designer is completely different. Since the aim of an industrial designer is to satisfy the customer's wishes, his artistic expression is more or less limited. A well designed product for massive production is an optimal amalgamation of aesthetic and applicable characteristics with optimal price performance. The aesthetic and applicable properties of final product, in our case of a woven fabric, are greatly influenced by constructional parameters. A designer with solid technological knowledge is capable to achieve special visual effects and better applicable characteristics with only few changes during designing and construction process. Basic knowledge of technology and technological parameters helps a designer to adapt a new product to the available technological capacity as well as to better communicate with technological staff.

Keywords: Construction parameters; woven structure; warp and weft set; crepe fabrics; hounds tooth dobby pattern; hounds tooth jacquard pattern

INTRODUCTION

In some disciplines the development and production process of certain products is usually divided into two parts: the projective – development part and the operative – realisation part. The level of division or

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connection of these two parts varies from discipline to discipline. We can take a typical example from the building sector. The division is so distinctive that two separate disciplines exist: the architecture and the civil engineering. The educational process is also divided due to the extensiveness of these two areas.

Quite opposite situation is specific for art. The artist usually connects the artistic part and the realisation part into one creative unit.

The primary task of an industrial designer is to create products that would be appropriate for massive production. Such products must be an optimal amalgamation of aesthetic and applicable characteristics with optimal price performance. The designer provides optimal appearance and structure within the customer's and manufacturer's requirements. The manufacturer's task is to manufacture a designed product according to standards. Following standards means providing quality and, if possible, with minimal costs. The whole manufacturing process includes knowledge, communication and co-operation between designer and technologist. An industrial designer should be capable to make a complete product development with all necessary details as sketches, technical sketches, materials, *etc.* On that basis the manufacturer should be capable to exactly manufacture a developed product. The planing and designing part in technical branches comprehends more stages, for example basic ideas, construction plans and necessary technical documentation for production.

It is very similar in textile industry. Designers (creator, stylist) make designs and technologists (weaver, knitter, printer, *etc.*) manufacture products. The term "designer" has different meaning and value in different surroundings. In highly developed countries a stylist is most respected and eminent. A stylist issues only guidelines and global ideas about a new style without giving details. A designer should add to the basic ideas all necessary data that enable the production of that product and the connection of functionality and design into a complete unit. Even on this area exists the division of work imposed by market and relationship to designers' work and opposite. An artistically created product is a reflection of designer's ideas and wishes and is not oriented directly to the market. It is a unique product intended to a small group of special buyers. An industrial designers is limited by customers' wishes and requirements and tries to find possibilities for his artistic expression within the order.

This kind of thinking leads to the question: How much technology knowledge should a design student have in order to efficiently create and successfully co-operate with a technologist? The ideal answer would probably be "the same as a technologist". However, it would be quite unrealistic to expect such knowledge because of the educational process and other for designers more important knowledge.

The Role of Technological and Constructional Parameters in Woven Fabric Designing

The aesthetic and functional role of each product, in our case this is a woven fabric, is defined by certain properties which are in close connection or dependence with design, constructional and technological parameters (Fig. 1). Design parameters contain: first of all aesthetic appearance, colour composition, size and shape of a design pattern, combination of woven structures and yarn colours or dyeing and printing and applicable characteristics. Constructional parameters that define the construction of an article are: raw material, yarn structure, fabric structure (warp and weft density, woven structure, *etc.*) and after-treatment (Fig. 2). The determination of fabric constructional parameters belongs to the first stage of fabric production – designing. Without correctly defined and determined constructional param-eters the preparation for production cannot start. The stages and conditions of a woven fabric production hang on constructional parameters. Technological parameters are directly connected with technological procedure and settle the stages of weaving preparation, weaving and finishing (Fig. 3).

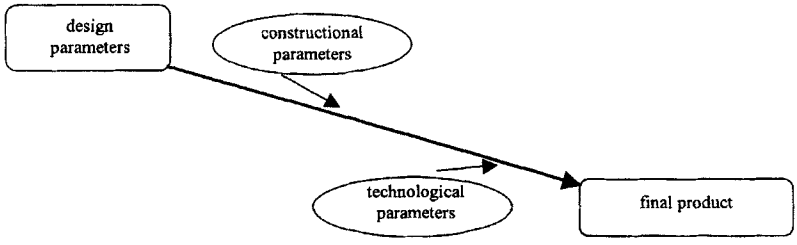

FIGURE 1 The influence of parameters on the final product.

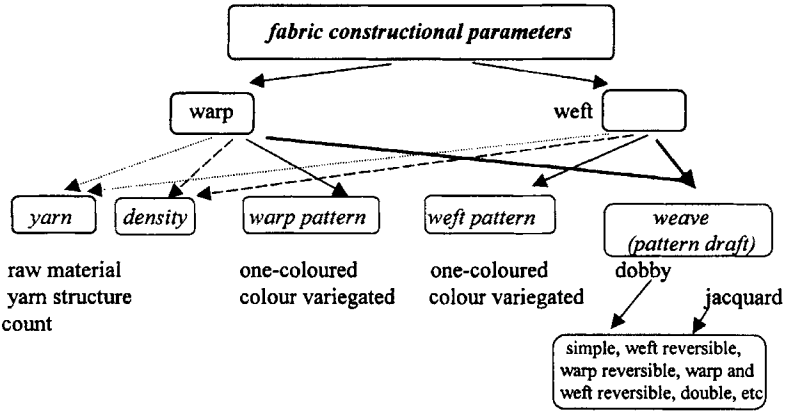

FIGURE 2 The analyse of constructional parameters.

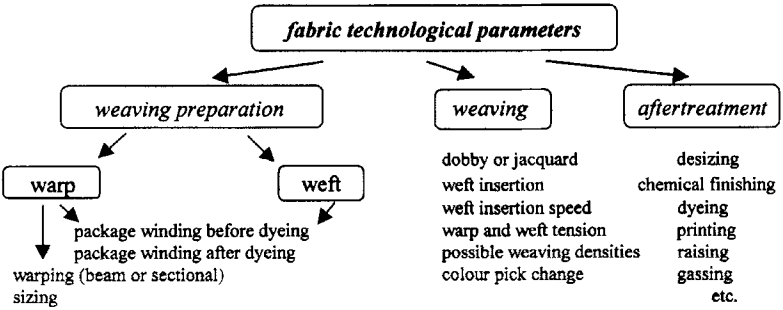

FIGURE 3 The analyse of technological parameters.

The structure and raw material of textiles define the appearance and quality characteristics. Textiles differ from each other but all of them must have some kind of applicable characteristics. A woven fabric can be described as a unit composed of numerous parts and each of them has the influence on final appearance. A yarn with all its characteristics (raw material, geometry, *etc.*) is a constructional base for warp and weft. The warp and the weft are interlaced and the sequence of interlacing is called the woven structure or shorter weave. The weave defines compactness and resistance of the fabric. The frequency of interlacing points influences the dimensional stability, the mechanical and physical properties of the fabric. The weave has also a secondary function. It has a great influence on the fabric thickness and

relief, the domination of warp or weft threads on the face side of the fabric, the arrangement of interlacing points (diagonal, square, *etc.*), the touch and lustre. We can state that the weave has a double role; it is an important element of constructional demands and at the same time it is very important for the integrity of a woven fabric design. Another very important constructional parameter is the warp and the weft density, which is again dependent on yarn, weave, and other constructional and technological parameters.

Typical development steps in designing:

- Designer materialises his ideas in drawings and sketches. Usually he or she defines basic shapes, colours and thickness (also raw material) of fabrics (sketch, computer printouts).
- Drawings must be changed into the forms appropriate for fabric construction (design pattern – repeat) and then the constructional parameters must be determined. This is a very quick and simple part of work when current advance CAD/CAM systems are used. A first contact with technologist is recommended soon. He will warn a designer about demands or restrictions connected with production. A good designer is capable to choose an optimal construction within technological limitation and also to satisfy the artistic wishes. The economic aspect of fabric production is also very important. Chosen constructional parameters render precise all production stages. A successful fabric production on available machines and procedures depends on a designer's technology knowledge. The communication and co-operation between designer and technologist is very important.
- Realisation – fabric production is the task of a technologist, who must take care about the fabric appearance and its properties and reach the best quality in very short time with minimal costs.

PRACTICAL EXAMPLES

Designing Crepe Fabric

Crepe fabrics are indispensable especially for women garments. This fabric has a dim view with sandy or bladdered tactile properties. Constructional characteristic is the use of overtwisted yarns which causes the yarn creeping and snarling into a weave – in this way the wanted

effect is reached. They are famous because of double face. The most valuable crepe fabrics are known from silk industry. If special yarns are used, the prices of fabric will be higher. Crepe fabrics are produced by different procedures: from crepe yarns, with use of crepe weave, with mechanical and chemical finishing techniques, with effect or textured yarns.

Crepe fabrics made from crepe yarns are most popular and used (crepe georgette, crepe frizon, crepe satin, *etc.*) (Fig. 4). The use of crepe overtwisted yarns does not cause differences only in tactile and appearance characteristics but also in other properties. High twisted crepe threads adsorb less humidity but light fabric structure enable better air circulating. Although crepe threads are placed more loosely into the fabric than regular threads, they do not slip during sewing. The fabric has excellent characteristics: very good crease resistance, breathability, stretch, comfort and resistance. The only question is how to manufacture such fabric with lower costs and to keep the same characteristics.

Crepe fabrics made from crepe weaves also have fine structure but their tactile and appearance characteristics are not so typical (Fig. 4). One solution is to combine regular yarns with crepe yarns and crepe weaves. The speciality of crepe weaves is floating of various warp and weft threads length the result of which is a fine structured fabric

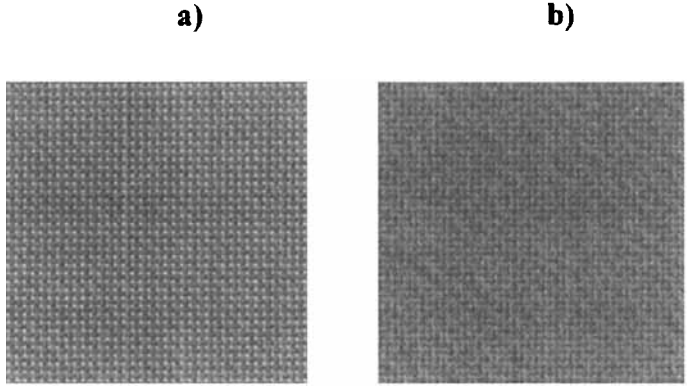

FIGURE 4 a) simulation of crepe cloth made from crepe yarn (CAD Arahne) and b) simulation of crepe cloth made from crepe weave(CAD Arahne); a) woollen crepe georgette (weft and warp pattern: 2 crepe threads Z twist direction, 2 crepe threads S twist direction) and b) silk cloth in crepe weave.

surface. Stripes, diagonal lines and repetitive motives in fabrics are not long for.

Necessary phases for manufacturing crepe fabrics from crepe yarns:

- Crepe twisting or overtwisting.
- Yarn steaming (to fix yarns, to avoid snarling during weaving).
- No sizing (only exceptions).
- Warping (sectional because of warp pattern: 2 threads Z twist direction, 2 threads S twist direction or 4 Z, 4 S).
- Weaving.
- Wet treatment (setting free crepe effect).
- Dyeing (dyeing crepe yarns in package is not recommended).
- After-treatment, cloth inspection.

The technological production process for crepe cloth made exclusively from crepe weaves differs. The regular yarn can be dyed in packages, no steaming, beaming (faster and cheaper than sectional warping), no yarn snarling at weaving, no need for wet treatment. The whole production process is cheaper and faster.

Development of "Pepita" or "Houndstooth" Pattern from Dobby to Jacquard Fabric

In the postgraduate design study Darja Miklaužič made the designs and samples from basic visual unit – pepita pattern. Also in her diploma work she developed similar samples with printing. She implemented designs and samples in shape of two-coloured simple jacquard fabric for the research project (tutor Dimitrovski). She used the textile CAD system Arahne and samples were woven on the TIS electronic jacquard looms. The originality of her work is reflected in new, unknown forms that are developed from popular pepita pattern. For a pepita dobby fabric the pattern arrangement in lines is typical and visual effect is reached with the combination of specific warp and weft pattern and simple dobby weaves.

(a) Pepita Dobby Cloth (Fig. 5)

The fabric is woven on dobby looms with variegated warp and weft pattern and it has the following constructional parameters (one

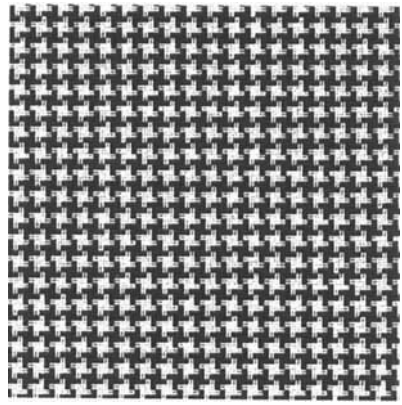

FIGURE 5 Pepita dobby cloth.

sample of pepita):

Raw material : cotton
$T_t = 40$ Tex
Warp density : 20 threads per centimetre
Weft density : 20 threads per centimetre
Weave : hopsack 8/8
Warp pattern : 2 white, 4 black, 2 white
Weft pattern : 2 white, 4 black, 2 white

On the basis of basic design and constructional parameters we can fix necessary preparation phases and weaving procedure. They are:

- Package winding before dyeing.
- Yarn dyeing.
- Package winding after dyeing for warping.
- Package winding for weft insertion.
- Warping (beaming or sectional).
- Drawing in (number of shafts, number of heddles, reed count, warp width in reed, *etc.*).
- Cards punching for dobby.
- Weaving (machine setting).
- Aftertreatment, cloth inspection.

(b) Pepita Jacquard Fabric (Fig. 6)

A pepita jacquard cloth has bigger pattern and is made from two weaves combined with one-colour warp and one-colour weft (contrast colours). In our case the satin 5/5 weave was used, so the cloth gets beside basic design also a slightly three-dimensional shape.

The designing and technological part of work varies from the modification mentioned above. The whole process has been made on CAD/CAM textile system that enables quick work and simple data transfer to the jacquard machine without card punching.

The technological preparation and manufacturing phases differ from warping on. The warp pattern is one coloured so beaming is enough, there is no need for sectional warping. The warp can be simply tied-in and card punching is no more needed because data are transferred to the jacquard machine with floppy disk or *via* on-line.

It is necessary to point out that the whole development and fabric producing process has sense only with current advanced CAD/CAM systems and electronic jacquard otherwise the realisation of jacquard fabric is much more expensive.

(c) Printed Pepita Fabric

For printed pepita cloth only one-colour simple fabric is needed, printing preparation, printing and aftertreatment follow. Mentioning only cloth as a base for printing fall away many phases (no need for sectional warping, dobby weaving of simple, doubleface weave).

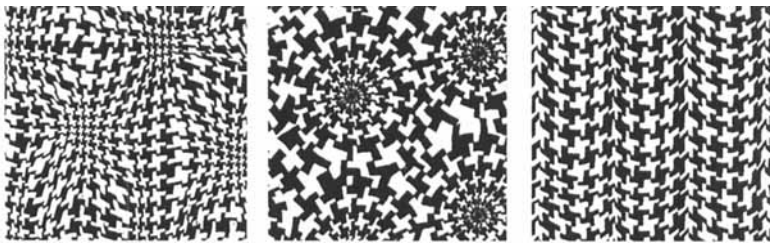

FIGURE 6 Designed forms from pepita pattern (D. Miklaužič).

CONCLUSION

A designer or industrial designer must know very well the artistic components and the constructional parameters, the technological parameters are perhaps less important. Basic knowledge of technological parameters is recommended also for a designer's better communication with a technologist.

The primary task of technological staff is a technological part of work by considering constructional parameters (organisation and connection of machine plants, their setting, organisation of inside transport of semiproducts and final products, inspection of product quality, *etc.*). This is the only way to assure a quality and proper manufacturing organisation.

The common point of a technologist and a designer is the excellent knowledge of constructional parameters, which are a part of the textile technology and no one can avoid it. The advanced fabric designing exceeds in any case a mere use of paper and drawing tools. The latest technological and computer achievements and after all also the market fast changes demand quick response in view of new collections. The time needed for designing, preparation and producing of a new fabric has been shortened from couple of weeks to only few days or even hours. Only a designer who has a solid background of technological and computer knowledge beside artistic skills is capable of designing aesthetic and functional products in such a short time.

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