PROPOSAL OF TUBULAR TECHNICAL DRAWING FOR CREATION OF SEAMLESS CLOTHING

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Abstract: The present paper suggests an approximation between seamless technology and fashion design by proposing a tool for creating garment, with the final goal of reducing the gap between creative and technical professionals. It is intended to help the optimization of the creative activity together with the technical action, using a technical drawing in form of a circular tube, which will facilitate the communication between the sectors that are involved in the process as well as it will give a bigger possibility for inserting fashion elements on these products.

Keywords: seamless; apparel; fashion design; technical tubular drawing

1. Considerations about Fashion and Seamless Technology

The evolution of seamless technology results from the growth in dialogue between textile engineering and fashion design. As Black (2005) states, knitted fabric is part of the fashion since the time hand knitted silk socks replaced the linen socks usually dressed by Isabel’s nobles and courtiers in Spain and France. The versatility of the techniques, patterns and yarns used offer and extraordinary creative potential when technical staff and designers work together, in particular when the creator posses enough technical background to consider the possibilities at hand.

Arriaga (2008) highlights that “...fashion is innovation; thus, technology constitute an important element in its productive and commercial process”. He stresses that this tendency is valid in all fashion system processes, such as in the production of fibers, yarns, fabrics, apparel and management, among others. He corroborate by stating that “…the technological involvement should respond to the demands of the market in order to convert itself in a determining factor in the entrepreneurial growth, building for this sector a higher level of quality and competitiveness...” (Arriaga, 2008, p.57).

Donofrio-Ferrezza and Hefferen (2008, p. 176) reaffirm and complement that “…the biggest advance in XXI century regarding the production of knitted fabrics was the development of machines with the seamless technology...”. Seamless technology, which is the focus of this study, results from the union between sock production machines and the high diameter knitting machines, which generated a new kind of circular knitting machine with a medium size diameter. This technology designates the concept of clothes with no seams, in which the seams are eliminated (mainly the side seams) or drastically reduced (Catarino e Rocha, 2008).

The principle of knitting with no seams is as old as the knitting itself, as it is proven by fragments of socks found on the Egyptian civilization, dated from V and VI century. Since industrial revolution, when knitting became mechanized, the knitted fabrics industrially produced were made in flat knitting machines or cut from fabrics made in circular knitting machines. However all of them needed an additional step the apparel part. To industrially produce a knitted fabric with no seams, article by article, with little or no intervention
of the apparel sector, is since the beginning one of the main missions for the machine producers (Black, 2005).

Briefly, seamless knitting machines appeared during the 80’s due to a serious crisis involving the stocking industry, endangering both sock producers as well as the machine manufacturers. In an effort to tackle the problem, new solutions were proposed based on new weft knitting machines. In this period, American knitwear producers challenged the Lonati company to create a new kind of knitting machine for underwear fabrics, but based on stocking knitting machines. It should have a bigger diameter and the resulting knitwear should fit close to body. As a result, Lonati presented the first seamless knitting machine in 1988. The Santoni company, which belongs to Lonati’s group, became responsible for the development and production of this kind of machine from 1989 into our days (Catarino e Rocha, 2008; Seamless Consortium Handbook, 2009).

Seamless products go beyond the technological innovation frontier into a reformulation in the symbolic aspect, surpassing the sportwear and underwear segments, which are its most important representatives. The breakthroughs of this technology are already adopted, but based on the technical background, novelty can be centered on incorporating fashion design on these products, usually capable to capture user’s attention. Nevertheless, seamless technology posses attributes (see table 1) capable of promoting its growth, both on industrial as well as consumer point of view, which justifies this study.

<table>
<thead>
<tr>
<th>Tabela 1: Seamless technology attributes</th>
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<td><strong>In favour: industrials</strong></td>
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<tr>
<td><strong>In favour: consumers</strong></td>
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<tr>
<td><strong>To be explored</strong></td>
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One of the positive points of this technology is its high productivity when compared, for instance, to flat knitting machines. Seamless fabrics preferably present a tubular shape due to the nature of the knitting machine but, as Catarino and Rocha state (2008 p. 9) “…it is always possible to produce fabrics with other shapes, but in this case one does not take advantage of the seamless knitting machine, that is its production capability…”.

Seamless knitting machines can satisfy the demands in a aesthetical and functional point of view. This is true because the former has the ability to produce different structures and use different raw materials in the same fabric and in pre-established areas. It is possible to produce pre-shapes, such as pockets, collars, caps, beyond other drawings, made from previously conceived images. One can also insert elastomeric filaments in specific areas in order to obtain compression or support. The seamless fabrics arrive to the seaming and finishing stages in few minutes and presenting the possibility of eliminating operations related with cut and seam, depending on the produced model. Considering seams, the former when not eliminated, they can be drastically reduced. Cut operations can be optimized in time by using already made signs and marks in the knitted fabric which orient the technician about where to cut, or even by using special yarns that dissolve when the fabric is washed (Catarino e Rocha, 2008).

Starting with this favorable view, a tool is proposed for creating outfits in seamless technology, with a special emphasis on outwear. It is important to note that this tool can be used in any sort of seamless
garment and it is not intended to propose an ideal model to be used by professionals, instead is intended to share a proposal of practice for creating fashion apparel with seamless technology.

2. Tubular technical drawing proposal

The proposal rise as a logical consequence from several inquiries, in a first stage trying to understand the lack of proposals of outfits more related with fashion trends. At first, the question was if the machines were able to respond to the demands that an outfit may require. From the answers one can say that there exists a considerable variety of seamless knitting machines, even for production of outwear. It was observed that there is a lack of investment by the knitwear producers concerning the replacement of old machines by new ones, more versatile. Other observation made was that there is also a lack of education more related with creative fashion design and specifically oriented to seamless technology. From this and the study of methods used for developing fashion products one considered the proposal of a language that may bring more close the technical staff to the creative staff. The adequate mean to achieve this was identified as being the technical drawing.

To create a seamless knitted fabric demands for caution and knowledge, not only to the technical part as well as for the design. An important factor stands for the information exchange that is mandatory between fashion designer and knitting machine programmer, in the pursuit as a team for solutions. The technical drawing or specification is a fundamental tool, used by the fashion designer to communicate his idea. After producing and approving the artistic drawings (croquis), it is necessary to draw a more detailed drawing, involving lengths, seams, among other aspects. “The professional will need to remember that his orientations will serve as the base for producing the fabric and the latter, undressed, is basically a flat surface, but which will gain volume when dressed, thus becoming three dimensional” (Neiva, 2011).

![Figure 1: Examples of tubular technical drawings](image_url)
In Figure 1 is possible to observe the finishing proposal, combinations of stitches and loop length, idealized by the designer while conceiving the product. The absence of such information would result in a loss of time by the technician to understand the intended aesthetical effect, as well as an increased number of tests.

Complementing this drawing, a legend was made (table 2), using color symbols and patterns in order to understand the drawing when it concerns to the structures to be used in the knitted fabric. It was not intended to cover all the possible combinations of stitches, patterns and finishing, but to think of a language that could be developed in each company in common agreement between the knitting machines’s programming professionals and the fashion staff.

**Table 2**: Coding for pattern structures used in seamless technology

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
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<tr>
<td>Rib(^1)</td>
<td>False rib structure. In knitting machines with only one needle’s bed it is not possible to reproduce rib, this structure resembles the rib structure.</td>
</tr>
<tr>
<td>Jaquard</td>
<td>Surface design decorative elements made with jacquard.</td>
</tr>
<tr>
<td>Disposable</td>
<td>Areas the will be cut and eliminated.</td>
</tr>
<tr>
<td>Border(^2)</td>
<td>Borders of the outfit that are made during the production of the knitted fabric.</td>
</tr>
<tr>
<td>Compression levels</td>
<td>The different compression levels required in specific areas of the model are signed using a grey scale: 1 – low compression level (light grey) 2 – medium compression level (medium grey) 3 – high compression level (dark grey)</td>
</tr>
</tbody>
</table>

It is intended, with this tool, to make the programming technician to easily understand the drawing made by the designer, and at the same time promote a more profound reflection at the designer view, while conceiving the models by means of building a common communication language between technician and designer. The proposed tubular technical drawing should be complemented with the prototype sheet, since it is not possible to include all the information in a objective and clear way just using symbols.

\(^1\) It characterizes by presenting vertical stripes with different widths, resembling rib structures.

\(^2\) It is a specific part of the fabric, usually at the end, like collars, wristband, purl. It can be made with any kind of structure.
The prototyping sheet is the first version of the technical sheet. It is made by the designer and it considers all the necessary information for the model under development. It includes aesthetical details, just as description, shapes and color combinations, together with information regarding finishing details and raw materials. For this case of seamless, it should also include the structure patterns to be used. It will be the main communication tool between the designer and the programming technician, for that reason it must contain all the pertinent information in a very clear language. The main component of the prototyping sheet is the technical drawing. All the modifications made, aesthetical or by technical reasons, should be annotated in the prototyping sheet, under the agreement of both professionals.

The prototyping sheet should contain at least:

- Headers: Collection name or theme, client, season, technician and designer responsible, date;
- Model: reference, technical drawing, description, color combination, size;
- Raw material: yarns reference, composition, linear density, number of cables, colors;
- Accessories/embroideries/stamping: description, reference, size and quantity;
- Free field for observations.

Additional information can be inserted by using arrows with details in the drawing, as well as inserting reference images, since the visual language is usually more enlightening to the samples gathering sector.

It is important for this proposal to be applied as part of the new product conception process, instead of being used as an isolated process. One suggests that makes part of the fashion design collection development process, with predefined and sequential stages and involving the technical and aesthetical part in the decision step. Fashion products adopt a logic of a collection and the relationship between these products is usually centered on the inspiring theme that was chosen, emphasizing the consumer style linked to the brand’s image. Thus, the insertion of fashion is not limited to incorporating fashion or other kind of tool, it is simply bigger.

The final notion of collection should not be forgotten at any time by the designer, when developing new products. It facilitates and optimizes his work; it also makes the consumer understand more easily the message, since the pieces of garments are thought as a whole, being complimentary, instead of an isolated. This approach also allows increasing the sails.

3. Remarks

It is important to ally the knitting textile industry tradition to the inherent renovation process present in fashion design, in order to merge competences for the consumer benefit, which always looks for novelty. It is necessary to join efforts between all parts that comprehend the textile and clothing sector, in a pursuit of consolidation of the market of seamless technology with fashion products. The worked presented in this paper is a contribute for this, due to the belief of the intrinsic potential that the seamless concept has.

The academic community needs to graduate professionals with the ability for working in the seamless segment, and stimulate scientific studies in this subject, joining textile engineering and fashion. The lack of bibliographic references, mainly on the fashion part, acts as a limiting factor for designer and entrepreneurs that are willing to invest in this segment. The existence of only one course, in Italy, that is associated with the biggest seamless producer is not enough to satisfy the demand for professionals in this area. One suggestion is the creation of a specialization in the seamless area, which could improve the graduation in design already available at some universities.

Among the future perspectives for this research, which is part of a master thesis “Fashion Design applied to seamless technology”, the authors suggest that the tool should be implemented and tested in companies with this kind of knitting machines, with the final purpose of contributing for the inclusion of fashion design, as well as the proposed coding.
The suggestion of this tool for creating a seamless outfit succeeded in the linking of the creative, technical and marketing approaches. From the study performed, it is intended to propose a reflection and a feasible path by suggesting an alternative that can be encouraging. It is important to note though that there is not a perfect an irrevocable practice, since each project is unique and each professional has his own working rationale, based on his own experience.

4. References


