



Apparels for Comfort. Knitting for People

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Abstract. In garment and fashion design human and technical factors to take into account are multiple, and are reflected in numerous aspects of the product, process and relationship. Comfort of the objects to be projected and produced are an essential element that in many cases is left aside, favoring the aesthetic aspect and social representation. The knitted textile material is a peculiar element which, because of its characteristics, has reserved a prominent place in the field of fashion design and is characterized by the possibility of creating its own textile surface. Knit material, like any other textile surface, includes and promotes a material and immaterial culture representative of the social and communal world. This paper intends to argue and approximate the different characteristics provided by the knitted textile material to the needs of the users and in particular the possibility of co-creating clothing adapted to the needs of the users.

Keywords: Apparel design · Co-design · Textile design · Knit design · Comfort

1 Introduction

The relationship of users with their own clothing is profound. Textile materials have a history of thousands of years and are part of different levels of our experience and way of living. The comfort of clothing, together with the aesthetic issue, is one of the main elements taken into account when choosing a piece that is increasingly representative of our way to be and well-being. Given that, comfort itself should be understood as a comprehensive issue that manifests itself at the material and immaterial level, its approach must be careful, broad and take into account the objective and subjective aspects of the user and the subject of study itself.

In recent years material developments have evolved rapidly and accompanied the new technologies, allowing users to meet the needs of the users in search of materials that better adapt to their daily needs, more agitated and with higher standards in aesthetic and functional terms [1]. The new possibilities and challenges offered by the new technologies, such as the knit material associated with new products and new structures capable of ensuring greater user comfort and high functional performance, are placed in the textile area. The knit material, due to its intrinsic characteristics, presents high levels of elasticity and consequent adaptation to the body, allowing a high increase in thermal comfort, taking into account its better capacity to allow an

easier dissipation of body heat. Since ancient times the knitted textile material has been used to make garments that need to adapt their shape to the body.

To talk about knit is to touch different concepts and variables that, working together and mixing constantly, offer multiple products and structures that are constantly being reinvented [2].

2 The Environment of Knit Material

As an ancient craft, present since 1000BC, knitting was originated from hand knotting or twisting of yarns using hand fingers. The word ‘knit’ originates from the old English term ‘cnyttan’, and from German ‘knütten’, developed to modern term knot. Hand knitting rapidly advanced from fingers, to the use of hand tools – known as pins –, into a skilled and complex craft where, by the fifth century AD, knitted objects such as socks are recorded, combining fashioning, seaming, and circular knitting together with patterning techniques simultaneously [3]. Cross loop knitting (or cross-knit looping) – a single-needle technique – dates back to the 2nd century AD, being found in objects made by civilizations like the Egyptians, Romans and Scandinavians. Pattern knitting, known in Arabia and India from the 9th century, is introduced in the 13th century in Iberia and southern Italy [4]. As said by Schoeser [4] and Steele [5], the development of knitting has been responsible for the most striking and fundamental changes in textiles and clothing since 1600.

This deep connection with the consumer is one of the strong abilities of the knitted textile over the last decades, and the use of knitted textiles has been increased year by year since the seventies, due to the spreading of the practice of sport and the introduction of specific materials for sports activities. According to Sinclair [6], knitwear will have a massive growth in the fashion industry, related to its intrinsic relationship with casual dress, active wear and sportswear, crescent trends in our society. Recent statistics of the European Apparel and Textile Confederation (Euratex) show that in 2015 more than 1/3 of the fashion market was made of knit garments.

Knitting and knitting can probably be considered as one of the most creative options within the entire fashion and apparel production system given the possibility of offering multiple choices and variables placed in the hands of designers. Due to its constructive characteristics, the designer is allowed to create the textile substrate where it can intervene directly and in a much simpler and direct way in the production of the knit itself, without having to intervene vertically in the textile line, as with the production of orthogonal materials. The construction of knitted textile materials exists essentially in two ways: as a warp knit or as a weft knit. If the warp knit is essentially used for the production of more technical and industrial materials, the weft fabrics are the ones that have more application in apparel and fashion, being able to present with different variables within two primordial types of construction and that depend on different Technologies: Circular knit jerseys more thinner and used for interiors and “V” bed knits mainly for external use, being thicker and heavier (Fig. 1).

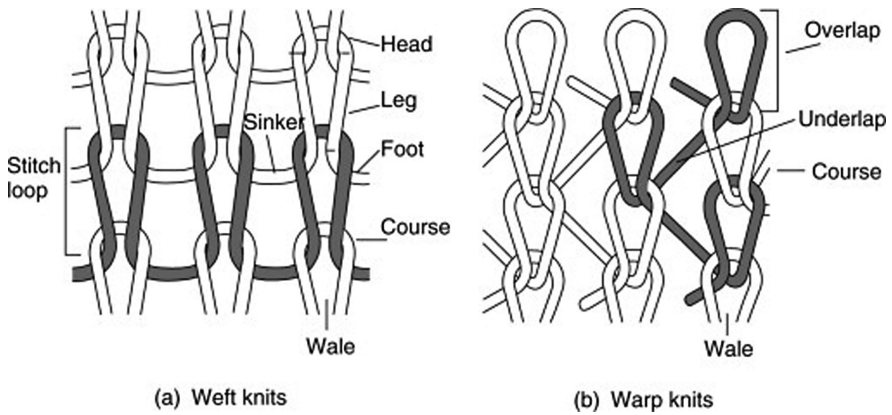


Fig. 1. Weft and Warp knitting structure. <https://www.sciencedirect.com/topics/materials-science/knit-fabrics> [retrived 15/02/2019]

The production of knit substrate for garments technically obeys the rules for the construction of the weft knit which allows the production of the substrate by interpolation of a new loop of knit from the ring formed in the previous row and that is constructed with the use of a single thread. This textile construction which in general terms is considered simple allows a direct intervention of the designer in its production and the choice of the type of yarn and its finish, color, diameter, yarn effect, composition, etc., is a much simpler choice of rather than intervening in an orthogonal textile row (web and weft) where the processes are much more extensive and complex and where the production and availability times of the materials in question are much longer.

As pointed out by Lindsay [7] referring to her Master Thesis, Jack Lenor Larsen in 1961 described machine knitting as the next industrial revolution, with the possibility of overlapping orthogonal textiles (woven textiles) in terms of production speed and economic results.

Still far from this reality, Larsen was able to perceive the great potentiality of the knits that had their greater paradigmatic development with seamless technology. Spencer [8] refers that seamless technology knits on spiral, passing from one needles bed to the other working sequentially selvage needles and thus creating a tube. The process of creating garments for the upper part of the human body, refers Black [9], is to knit one tube for the body and two for sleeves, and join it together starting from under the sleeve. The result of the upper body knit garment will be also an unique tube, using the similar garment conception used by centuries for the Norwegian traditional knitting sweaters, with a traditional circular yoke.

In this sense, taking into account that in the production of this type of material the designer can have total possibility of creation and intervention in the production of its characteristics, the parallelism with *haute couture*, where in many cases the textile material used is a poetic construction of the seasonal inspiration is inevitable. In knitwear, the design becomes a basic step in a long industrial chain that starts from the

development of new fibers, from the recover of the past ones and comes to the innovation on machines that are now allowing new manufactures more and more often [10].

The production of knitted textile substrates allows an infinite and independent creative possibility combined with high productive capacity, greatly enhancing the possibility of personalizing the textile substrate and consequently of the pieces created that may have a high level of communication of brand values. There is a natural interaction between craft/making, design and new technology, refers to Sissons [11]. Knit gives the designer the possibility to work on the textile structure and at the same time to work on the garment form and function. As reported by Quinn [12] textile surfaces are more than just the façade, but are a curious layer of aesthetics and identities, and a contentious site of exploration and resistance.

3 User's Factors

The human factors involved in the design and production of fashion and apparel are multiple and of different origins. The user/object relationship is a relationship that is based on different stages and involves multiple levels of perception and involvement. The relationship of users with the object of clothing is made not only by the contact with the physical object but especially with the aesthetic and social representation that this object represents and to which it may be associated and consequently represent the user himself.

Despite the great importance and involvement of the aesthetic and social mechanisms of clothing, which gratify and participate in the construction of the psychological well-being of the user, the issue of physical well-being becomes more and more important and contributes to the psychological well-being and the increase of self-esteem, and the garment can be defined as a multisensory interface that communicates constantly with the outside world.

The comfort of the clothing we use on different occasions is increasingly taken into consideration and is one of the determining factors for the end user. In reality comfort is usually measured by its opposite, that is by the level of discomfort that any object or situation may cause the individual. In this sense, Chappells and Shove (2004) [13], says that comfort can be defined as “a feeling of contentment, a sense of cosiness, or a state of physical and mental well-being.” In this sense, Sontag [14], Oğlakçioğlu and Marmaralı [1] and Kamalha [15] add that the main areas of comfort can be summarized as follows: psychological comfort, sensorial comfort and thermo-physical comfort. Psychological comfort can influence the user in their relationship with others and in the way their interpersonal social network can perceive the values that the user wants to communicate. In this sense, it is a matter that, linked to the object of study, is projected to the outside and will help in the construction of greater security of the individual with its social structure. An example of this can be considered the typical motifs of the “fair isle” knits that soon identifies a group of individuals with the small Scottish island. There are small geometric motifs that are repeated throughout the surface of the textile and are often worked in stripes of different and contrasting colors. As stated by Steed [3] knitting has always been the method for expressing oral history, facilitating community engagement

and expressing deep personal attachments. In a society where the individual seeks to be heard, knitting emerges as a powerful social and political tool.

With regard to sensory and thermophysical comfort, these two areas of comfort are related more to the individual and less to his social network. The sensorial and thermophysical comfort will eventually be more connected to the user's senses, being more related to the textile material and the garment. The possibility of wearing a comfortable piece, which does not create great thermal oscillations in the entrance and exit of specific environments and that are comfortable in the movement of the user in its interior may be priorities for this area of comfort, being, more and more, today are a necessity to be taken into account by the multifaceted uses of the garments we find on the market. Sportswear, which had a great development of materials from the 70's of last century, with its more comfortable garments, is influencing more and more our everyday clothing, which we require to be practical, due to our overactive life. Knitting, because of its adaptive and comfortable capabilities, has always been used in active wear and sportswear. In the future, refers to Sinclair [6] we will see a growing migration of high-performance knit textile surfaces - used in both of these areas - to everyday life.

4 Design for People

The adaptation of the product of fashion and clothing to the users is often an empirical task that, through advances and retreats, adapts to the market and the needs of the possible customers who, season after season, wait for continuous innovations and proposals of renewed communication codes with its ecosystem. The elements that form part of this equation are multiple and of different levels, ranging from styles and materials, colors and structures, details and volumes, references and significances, hierarchies and recognitions, honors and approaches, among others. The continuous mixing, remixing, alteration, adaptation, forecasting, etc., of these and other slopes and variables are the center of the fashion product that has the capacity to reinvent itself constantly, even if it is found in terrains that are not stable and constantly in balance between the objective and subjective, between material and immaterial, between concrete and abstract, between fashion and tradition, between the individual and society.

Despite all the possibilities presented by the direct actors in the process, we must take into account indirect and subsidiary actors who carry out the activities necessary for the implementation of the product on the market, have specific and specific needs that must be taken into account. It is a multifactorial, interdisciplinary and complex process where the objective needs of the different actors are associated with the subjective ones, in a continuous change of positions and commitments with the aim of presenting a product that satisfies a high number of consumer needs to whom the product or service is directed.

No doubt that design is the discipline that more naturally predisposes as an intermediary of these issues, presenting methods that can help reduce distances between different positions and especially between user and fashion product/textile. Design, subject to different areas of knowledge, combines quantitative and qualitative work

methods, subjective and objective, active and observational, etc., which allow the exploration and application of methods and methodologies that provide collaborative work among the different areas disciplinary measures that contribute to the production of the textile object.

Co-design and customization are two typical examples of end-user collaboration in the production processes of the textile products themselves, which for some time have been equated by design teams and companies in order to reduce the distance between those who use and those who make product to its source of revenue.

Although there are different definitions of these concepts, we can broadly agree with those presented here. The co-design process can be defined as a process where user needs and preferences are the basis for the development of the entire design process, improvements and innovation [16, 17]. To Zamenopoulos and Alexiou [18], co-design means that people come together to conceptually develop and create things that respond to certain matters of concern and create a (better) future reality.

This need, already identified by Toffler in his 1980 book *The Third Wave* when a consumer participates in co-design and at the same time becomes a co-producer of the product he consumes, can be defined as “prosumer” [19, 20]. By customization we can understand the adaptation of a product made available to consumers for a possible adaptation in the technical design phase and the physical production of the service article [21]. Different definitions can be adopted for the development of actions and methods that in general terms differ little from each other, as in the case of tailored product, consumer driven design, made to measure, made to consumption, among many others.

The knit material is a textile structure that has specific characteristics due to its majority of the technology used in its production. While it is true that for the production of any material the technology used in its production has a major influence, for the knitting sector this symbiosis has always been essential and in many cases the new products implemented in the market as fashion products were the result of great advances technological developments. We can state here many, but taking into account the knit/comfort aspect that is the focus of this article, the possibility of seamless knit production has allowed the implementation of a new paradigm for the sector that is still far from exhausting its possibilities. As referred by Spencer 2001 apud Peterson (2016) [22] complete garment technology, also known as the seamless garment technology, was introduced on “V-bed” flat knitting machines in 1995, having evolved from developments in the 1980s. V-bed machines have two needles beds, on a position of an inverted V and equipped with needles. This methodology, initially based on existing technology, allowed the development of garments with different shapes but without seams, which in some cases may represent a problem because of the friction and thickness that may increase the levels of discomfort and in severe could provoke scares on the user’s skin surface. The whole garment is made directly in the flat knitting machine without post cutting and sewing processes (Legner 2003 apud Peterson 2016) [22]. At the beginning of the 21st century, another innovative technology for knitting became a reality and a productive one. “Seamless” or “no seam garments” knitting technology allows the production of knit garments that fit the body and use a limited number of seams, usually reserved for hem finishes or hemming applications. This technology was developed in the 80’s of the XX century, when a lot of leather shoes

were used directly in contact with the skin of the lower limbs, minimizing the use of socks. For this reason, the Seamless technology has been adapted to clothing so as to minimize the ever-increasing decline in stocking markets and to apply the techniques and logics of tubular and three-dimensional fabrics, adapting itself to the production of interior and exterior knit which could be used as any other type of knitted garment, with remarkable increasing levels of comfort for the end user.

The technological possibilities make this type of clothing an example of customization and adaptation to the different needs of use, since it presents infinite possibilities of technical development of the product used different textile structures in the same piece, being able to adopt different levels of compression by zones, application of different intensities of the substrate also by zones/areas at the surface level and in particular, being able to produce finishes that very little interfere in the interaction with the user. This technology is prepared to be able to produce individual pieces adapted to the users producing knitted garments in a mass customization optics. The disadvantage of the high prices of these equipment continues to be a factor that still prevents the large diffusion of these technologies for small shops and small businesses where, despite everything, the competition is also still in the price competition base.

5 Conclusions

If the fashion and clothing product remains one of the central elements of the individual's relationship with the social and professional environment, design processes need better vertical and horizontal integration to help design products to be more representative of consumer needs and its media. The possibility of user participation in the design process can be done in different ways, all of which allow a better efficiency in the interpretation of user needs, increasing the market penetration capacity of brands and designers, decrease in production of garments that, season after season, fill stores of not sold or rejected clothing by consumers for not responding to their needs. The poor sustainability of the garment industry needs to apply co-design strategies in order to produce better and more sustainably, sparing resources that are still wasted today because they do not have a close relationship with their final users.

Participation in the production of the knit garments by the authors themselves may represent the most complete and real scenario of co-design, and may include and extend to the adjacent methodologies of "design by user", "inclusive design", among others, knitted fabric provides this kind of joint production, adapted, customized while providing high levels of comfort and adaptability of the material produced.

With the integration of technological systems, processes, methods, etc., the act of creating products is no longer to be fragmented to become integrated and thought as a joint problem, promoting the interconnection between producer and user and meeting the real material and immaterial needs that make the fashion product a true product of communication and individual expression.

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