

Ergonomics and Fashion: the OIKOS methodology for usability and comfort evaluation in clothing and fashion

Suzana Barreto Martins, PhD.^a

^aUniversidade Estadual de Londrina, suzanabarreto@onda.com.br, Londrina, Paraná, Brazil

Abstract. The purpose of this article is to present a methodological proposition, named OIKOS, to evaluate comfort and usability in clothing and fashion products. The development of the methodology was based on the need to underlay the project of clothing and fashion products with ergonomic and usability principles in all the stages of the product development, since its conception. The theoretical foundation lays on the introduction of ergonomics and usability as fundamental variables while developing clothing and fashion product projects, to obtain comfort. The OIKOS Methodology proposition incorporates ergonomic features, usability principles and comfort criteria for clothing and fashion products. These will be guidelines to fulfill the user different requirements relating to the clothing and fashion products adjustment and quality. Besides reaching the intended comfort, this methodological proposition contributes to extend the product's life cycle, reducing the environment impact caused by its early disposal, and at the same time establishes an emotional connection between the user and the product.

Keywords: Fashion and Clothing; Ergonomics; Usability; Comfort; OIKOS Methodology.

1. Introduction

Fashion as a social factor interacts in collective life. In present days, it not just occupies a strategic place in society, but it is also an everyday esthetic propelling spring (LIPOVETSKY). Despite its temporariness, due to the sequence of constant variations, and despite not having a specific content or purpose fashion is, according to Souza (2001), an “organized, disciplined and sanctioned phenomenon”, related to historical, sociological and artistic aspects which determine a specific taste, and to a social and economic situation, as well.

Being fashion a social phenomenon, present in architecture, interior design, art, behavior and life style, to be in fashion includes “not only clothing, but also housing and office design, life organization, and the adoption of uses and customs.” (DORFLES, 1988).

In this context, clothing fashion has deserved an important reflection, in the academy, and the need to

limit the boundaries between fashion (as a relation system) and clothing (qualification) have been discussed, too.

What we know is that clothing has incorporated fashion and its term as its own field of action, and it is here where fashion gains more visibility and importance. Clothing and fashion products not only fulfill the historical purpose of covering, protecting and embellishing the body; it is now necessary to develop “usable” packages and packaging systems to accommodate it and, at the same time, preserve its health, safety and well-being.

Dressing up is related to the facility the human being has for changing the skin, considering clothing as a second skin, according to the different roles people adopted during their days or lives. Like the skin, which is genetically adapted to the body, accomplishing its basic and fundamental functions; in the same way, clothing should be a second skin covering the body, and as emphasized by Mistura (1999), it has to

be recognized and adapted for the different users in its different definitions.

Many times, being in fashion corresponds not to the functionality of the outfit, whether by the current esthetic standards, or by the excessive thinness, or either by the attempt to minimize the pronounced shape of the body, seeking elegance, which is different from other cultures, in different times. Reiterating Hollander's statement (1996), everyone is controlled by the esthetic ideal of the time, for each time has its own body.

The body, according to Castilho (2004, p.81) represents "a way of presenting oneself to the world, starting in many parts in many different human interactions". This way, clothing "dresses up and plastically joins with the human body, making it an ideal holder."

Regardless the concepts or functions attributed to clothing, it is one of the most consumed items along a person's life.

According to Martins (2005, p.61) clothing, also referred as a Second Skin, can be seen "as a body package or a textile architecture in which every line has a meaning and shows a specific taste, localizing its time and space, defining the relation and delimitation between the garment and the body as a need to be observed." Saltzman (2004) on his turn established the relation between the body and its surroundings, as its *habitat*, where the volume around the body, or the body space, is determined by the proximity or detachment of the body.

This way the space clothing occupies relating to the body can be understood as the measure of comfort it provides for the user, which is so necessary for the development of the activities. However, the consuming goods do not always attend the demand for comfort. Many times, the desire to be in fashion and to wear the latest trends imposed by publicity ends up attacking the body. The absence of functionality can even cause moderate or irreversible physical dysfunction or deformity.

In a way, this matter can also be related to the fashion product users' health, once specific esthetic patterns associated to inadequate settings and fabrics can compromise mobility and safety. So, each clothing piece needs a pertinent study.

Therefore, ergonomics in clothing and fashion fields, even being a very little known specialization, constitutes an important contribution to the design area, to impel the development of the clothing Sector, as a defining stage of the product project and not only as an accessory activity in the development of a clothing product project.

Clothing as an extension of our body needs requirements that contribute to thermal comfort, mobility, safety, dynamism and hygiene. The adequate product, as well as the correct application of materials, will determine the satisfaction of these requirements to attend the needs of the different kinds of users, and the need to use other areas of knowledge to develop a fashion or clothing product project, as will be discussed hereafter.

2. Method

The method followed used quality and quantity surveys. So, part of it emphasized the evaluation of the users about the clothing comfort, and the other used instruments were enabled to dimension the quantity comfort levels of the clothing products under analysis.

The applied, exploratory research method was adopted, an investigative modality that enables to accompany the observations of the researched object. This way, we made a decision to experiment two different clothing from two different manufacturers, for male and female users, in different situations and conditions. We understood that this option, allied the quality and descriptive analysis would lead to the formulation of a methodological proposition of usability and comfort usability of the clothes – which is the main goal of this study, from the proposed evaluation Methodology.

3. The product project in the clothing scope

The fashion and clothing project have been suffering significant changes. Among them we can list: the abandonment of the techniques which are applied exclusively in production relating to handicraft or artistic contexts; the insertion of factors facing the market needs; the integration between the economic activity maintained by technological innovations, the aggregation of value – through design, the fashion contents and quality; and the cost reduction.

Born under the handicraft conception, clothing production was developed by technical procedures, without the scientific knowledge that could support the technological innovations in the processes developed thus far. This created a certain unawareness relating the possible interfaces as to the continuous improvement in the creation process and the technological innovation in developing a clothing product project, in a perspective to guarantee not only qual-

ity, in standardization patterns, but also to guarantee comfort.

On the other hand, outdated product project techniques and modern production technology may not always incorporate improvements in the field of clothing product project

Nevertheless, by creating, developing and producing clothing products, the designers and the manufacturing industries do not always consider people's mobility needs, relating the different tasks they perform in different day-to-day activities, either they are working or not. The results of the referred products, many times, end up not attending the required adjustment.

Some markets stay out of the standards established for the clothing production, this way generating a great number of users that, because of their physical or physiological peculiarities, are not attended by the clothing market. As an example, we can list the obese, small people or very big adults, children, babies, the elderly, the teenagers, the handicapped (paraplegic, quadriplegic, the visually impaired, those who have mental or intellectual disabilities, motor coordination problems, morbid obesity, and autism, among others). Problems relating usability and comfort tend to increase because there is no pattern to attend the different segments of the market.

4. Ergonomics, usability and comfort in clothing

Briefly, the user is the starting point for the development of any product. However, to satisfy the user, it is necessary to consider, besides their needs, abilities and limitations, the specifications of the materials used and the distinction between the conception of the clothing product project and the production of the developed clothing product. In this process, the relations with the proposed new technologies, such as the physiological aspects, the measurement of comfort, the application of textile materials, and specially the usability and ergonomics should be included.

Ergonomics is a branch of disciplinary knowledge that studies the human being in the concrete conditions of the activities relating the use of objects, machines and equipments under determined working and non-working conditions, privileging the analysis of the accomplished task. It integrates the project of any whereabouts, environment and product, so its function includes the built space, whether it is the working place, the house, the industry, the school, the roads, the urban or the leisure spaces, considering the human being in relation to the use of objects, ma-

chines and equipments under determined working or non-working conditions; it focuses on the analysis of the accomplished task.

Ergonomics aims at evaluating the risk factors that can bring inadequacies to the products and their users. Hence, it is necessary to integrate it to the product project methodology, not only to benefit the product design, in general, but to benefit the clothing design, as well.

The application of its principles can be performed in stages. This way, there is the conception ergonomics, and the correction ergonomics, according to Iida's classification (2005). The ergonomic contribution can occur from the first stage of the product project, the working place or environment, until a real existing situation, to solve problems that reflect on safety, tiredness, and workers' diseases or in the quantity or quality of the production.

In the clothing product project development scope, it is possible to solve the clothing problems in the early stages of conception, by introducing the ergonomic principles. This is done while directing the work to constant review of the risk factors, the product adjustment and quality, without neglecting economic issues. The application of these principles can avoid, for example, the discrepancy between the product development and the "usage" of fashion products and manufactured clothing, relating the inadequacy of the shape and materials used, mobility limitation required for the outfit, which does not attend the intended usability.

Usability is one of the most relevant ergonomic areas while evaluating the relation between the product and the user. It is considered as a group of principles that organized form a step-by-step (algorithm) to make the evaluation of this relation possible. Because it deals with the consumer's features and needs, usability becomes fundamental during the development, the acquisition and the use of products.

Usability represents the interface that enables the efficient use of the products, making them friendly and pleasant during their utilization, specially clothing products. Usability indicators are directly related to the easy management, which, by its turn, determines: the "usage" itself, and the usability of the clothing product, as well as how to dress up, to undress, how to easily access the functional attachments, either opening or closing the apparel.

The morphology of the body, the tasks and activities it performs – either standing or sitting – the kneeling down, the sitting down, the reaching out and the movements required for each piece of clothing must be considered at the moment of the conception

of the products being developed, in order to offer mobility and comfort for the users.

For that purpose, we thought it was necessary to analyze the usability principles by Nielsen (1993), Staton (1998) and Jordan (1998). Jordan's principles such as consistency, user compatibility, clear management, and the lowest possibility of making mistakes were adopted as a requirement to evaluate a piece of clothing's usability according to what is enlisted in the Proposed Methodology chart.

"Comfort", in its turn, can be defined as a "state of physical and mental harmony with the environment, based on the absence of any troublesome feeling (NICOLINI 1995).

The author classifies comfort relating to clothing in three different categories: **physical**: related to the sensations caused by the contact between the fabric and the skin, and the adjustment of the piece to the body and its movements; **physiological**: linked to the interference of the clothing in the body's mechanisms of metabolism, especially the thermal-regulator, and the **psychological**: the purpose of the factors related to esthetic, appearance, situation, social and cultural environment, as showed in the figure below:

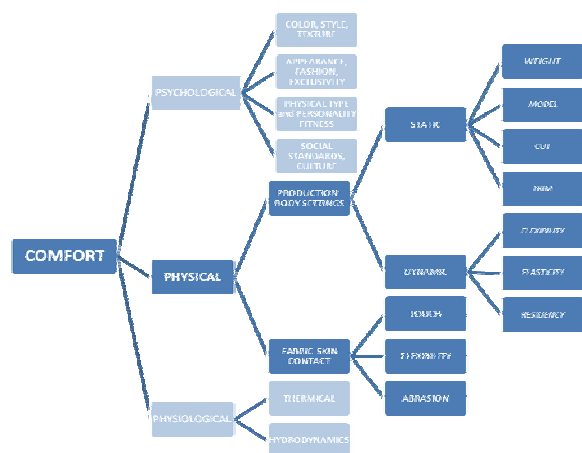


Fig.1 Textile comfort evaluation variables
Source: Nicoline adapted by Martins(2005)

Relating comfort, it is an urgent matter of discussion the need of studies to evaluate it in clothing products, because what has been usually developed

up to the present time in the Brazilian scenery is the measuring of the physical and chemical parameters of textile products, developed by some companies, as Rhodia-Ster S.A., for instance.

Martins (2005) points out that "in clothing's and fashion clothing products design's environment the introduction of ergonomic features, the easy management, the easy learning, the easy maintenance, safety, and the usability principles are very little used as analytical (product conception) as operational (product production) perspectives. He also adds that when the ergonomic features and the usability principles are used in the stage of conception of the product they directly influence comfort and usability of the produced clothing and the adjustment of the pieces. He then concludes that by "establishing the ergonomic features and the usability principles as variables to lead to the clothing product project, one might achieve comfort". (MARTINS 2005, p.19-20).

Such confirmation demonstrates the pertinence of the introduction of ergonomic features and the usability principles, as well as their implications, for the conception of any product project, especially for the fashion and clothing products.

From determining the requirements to be considered to the conception of a fashion or clothing product, such as ergonomics, usability and comfort, they will grant satisfaction and pleasure in using them.

Jordan (2000) expresses that besides being useful and easy utilize, products should give satisfaction and pleasure during their use.

As the emotion is related to cognition and to the cultural universe of the users, the emotional factor also interacts in usability, affecting the experience and the pleasure in the use of products, as suggested by Khalid and Helander (2006) that understanding the *emotional design* can contribute to the analysis of the product's life cycle.

In his turn, Savas (2004) states that the current consuming levels are the result of the weakening of the emotional connection between the consumer and the products, confirmed by Iida (2007) when he affirms that from the sustainability point of view, those products with a low emotional connection are disposed more easily, while people tend to keep those with a high emotional connection.

As a consequence, Martins (2008) widens the discussion to the clothing scope, where, once comfort is achieved, the pleasure in using establishes an emotional connection between the user and the fashion product, extending its life cycle, reducing its disposal and easing its environmental impact.

5. The OIKOS Methodology to evaluate comfort and usability in clothing: results and analysis.

The theoretical foundation has defined the main difficulties and the proposed suggestions for the development of a methodology to build up a clothing product project.

To validate the usability tests, men and women between 35 and 50 were subjects of the research, because they were able to present evaluation conditions of the clothing products, and because they are typical elements in the evaluation universe relating the users that consume these clothing pieces. The punctuation given to the evaluated items, provided by the users in the checklist uses a scale that varies from 0 to 100.

Two pieces were selected (bottom and top) for both men and women, from two different companies, a national one and a foreign one. The companies were selected amongst many of the existing having the specific purpose to which they are destined for, that is, some of the comfort variables that are to be analyzed have been considered in the conception of the development of these products. They were also chosen because the clothes they manufacture are focused on the activity sphere in which the comfort concept is implicit, their use and mobility being required to practice certain activities.

As for the usability conditions for the clothing products, the users performed two activities in two different using situations: jogging and an activity involving the use of the computer. The users, who were subject to the research, were required perform a group of activities with each piece of clothing worn by them, according to the next steps: examine the piece of clothing to be tested, to verify the materials and attachments; the process of dressing up; testing the pieces in many using situations (jogging and activities using the computer); fulfilling observations about discomfort and the inadequacy while using it, pointing out the positive aspects and the deficiencies of the clothing product; dressing up, undressing and observing its maintenance and cleaning process.

Each selected user, men as well as women, tested two bottoms and two tops each. One piece from each company, a national and a foreign one, was used, according to the proposition of the OIKOS Methodology. A checklist was given to the users to evaluate the comfort of the described pieces of clothing. The OIKOS Methodology is based on Jordan's usability principles (1998), the product ergonomic features by

Ávila, Cárcamo and Sánchez (1993) apud Martins (2005) and in the comfort variables by Nicolini (1995). After each step, the evaluator took notes of what he or she had observed in the proposed OIKOS Methodology checklist, that were then systematized in order to identify the inadequacy degree relating to the comfort in using the pieces of clothing by the users.

During the fulfillment of the usability tests by the concerning users, photographic records of the using situations were taken individually, so the users could not know the other researched users' evaluation results. In the part of the evaluation related to usability, groups of image entries relating to the fabrics and materials used in the clothing products usability tests were created, according to data obtained by the users.

Once this stage was finalized, the collected data resulting from the usability evaluation, and according the users' profiles relating their daily activities, was organized; the evaluation of the usability criteria, from the proposed OIKOS Methodology, considering the using situations determined for the users; the evaluation of the methodology's validation; as well as the recommendation for the fashion and clothing product project based on the evaluation criteria in the proposed Methodology.

The OIKOS Methodology, mint by a Greek word which means house, cocoon, in this proposition synthesizes, by analogy, the idea of comfort, protection, coziness. It was developed to evaluate fashion and clothing products. It has integrated the usability, ergonomic and comfort principles described above, to base the evaluation, therefore providing a satisfactory result in evaluating the users, according to Chart 1, as follows:

CHART 1. OIKOS METHODOLOGY TO EVALUATE COMFORT AND USABILITY IN FASHION AND CLOTHING PRODUCTS

Source: Martins (2005)

ERGO-NOMIC PROPERTIES, USABILITY AND COMFORT	USABILITY EVALUATION	COM-PANY 1		COM-PANY 2	
		Bot-tom	Top	Bot-tom	Top
1 Easy managem ent	Easy to dress up				
	Easy to undress	100	90	80	100
	Attachment's action	70	90	60	90
	Attachment's grip and handling	70	90	60	90

	Requires little effort to handle	90	100	80	100
	Attachments materials	80	100	80	100
	Adequate material to use	90	100	100	100
	Attachment's finishings	100	90	60	100
	Easy to Pack	100	100	100	100
	Easy to use	100	100	100	100
	Mobility while using	100	100	100	100
2 Easy maintenance	Easy to clean	100	100	100	100
	Quality of the attachments and components	80	100	70	100
	Cleaning efficiency (residue permanency)	100	100	100	100
	Clear instructions in the product	90	70	50	50
3 Easy learning (clear handling)	The shape, attachments and components clearly suggest their function	100	100	100	100
	Does not need using instructions	100	100	100	100
	Maintenance care indicated for the piece is clearly described on the tag	100	70	50	40
4 Safety	Fungus, mite, bacteria and humidity resistance	100	100	90	100
	Protected fastenings	80	100	100	100
	Non-flammable fabric	90	100	100	100
	Waistbands, collars and cuffs do not stop circulation or harm the skin	60	100	100	100
	Modeling allows mobility and wide movements	100	100	100	100
	Fabric allows transpiration	80	100	100	100
5 Usability indicators	Consistency (regarding accomplished tasks)	100	100	100	100

(Jordan)	Compatibility with the user (regarding use)	100	100	100	100	
	Visual clearance (regarding product information)	100	100	100	100	
	Functionality prioritization - hierarchic understanding of functions	100	100	100	100	
	Information prioritization – hierarchic understanding of information	100	100	100	100	
	Technology transference (adequate application)	100	100	100	100	
	6 Comfort	Fabric/skin contact - touch	70	100	100	100
		Fabric/skin contact - abrasion	80	100	100	100
		Fabric/skin contact - softness	80	100	100	100
		Body fitness - static – weight	100	100	100	100
Body fitness - static – trim		100	100	100	100	
Body fitness - static – model		100	100	90	100	
Body fitness - static – CUT		90	100	90	100	
Body fitness - dynamic - flexibility		90	100	100	100	
Body fitness - dynamic - elasticity		90	100	100	100	
Body fitness - dynamic - resiliency	100	100	100	100		
Total attended items	26	34	28	37		
Average punctuation	92, 92	97, 31	91, 70	96, 82		
Approved items percentage	63, 41	82, 92	70, 3	90, 24		

Source: Martins (2005)

From the initial evaluation of the proposed methodology, it is possible to verify in the stage of conception of the products the nonconformity relating to the ergonomic, usability and comfort aspects of the utilized pieces. From this stage it is possible to suggest modifications in the conceptual project, even before

it reaches the manufacturing process, which will contribute to a cost reduction, processes, raw material, components and cleaner manufacturing processes anticipating a more sustainable scenery for the clothing sector.

The methodology to project a fashion and clothing product is now guided by the sustainability principles. This new requirement demands the introduction of new principles, such as ergonomics, comfort and usability in the fashion and clothing product's project. All these changes will motivate the development of new products to attend new markets; the requirement of sustainable criteria to select raw-material and components, as well as the comfort certificate, which is presently in a stage of developing the credit procedures.

Fashion and clothing products sustainability must be one of the guidelines to be achieved by the companies, by treating the conception, development or manufacturing of fashion and clothing products, which also involves a revision in the stages of projecting the product. Sustainability will require, in a second moment, the use of the Ecodesign - method for product development processes incorporating environmental principles and tools such as analysis of the product life cycle assessment (LCA); stages foundations to select raw-materials and components for the development of any product. Nevertheless, the proposed Methodology did not take into consideration the evaluation of the life cycle of the product or the Ecodesign stages, but their application passes through these aspects and in last resort delineate some ways towards sustainability for the clothing sector; which is responsible for significant environment impacts.

All the exposed above indicates that the OIKOS Methodology can be applied to any kind of clothing product, with different textile materials, which, by itself, contributes significantly to the clothing sector.

Considering the step-by-step and the analysis items within the OIKOS Methodology, it is possible to conceive clothing pieces adjusted to the using conditions projected to guarantee the users' usability and comfort. However, the OIKOS Methodology is viable when used in the first stage of conceiving a product and checked upon every stage of development of the project, representing the conducting wire for the adjustment of the developed clothing pieces as well as for assuring usability and comfort in clothing.

The OIKOS Methodology represents a methodology of prevention, with which it is possible to detect the problems in the products' conceiving and deve-

lopment stages, and it must permeate the stages of the project until the final result, reviewing after every one of them, if the requirements were fulfilled. It is not a linear process; it also results in reviewing the stages of the project that were performed with the project team to check if the requirements at issue are being contemplated and applied. After the pilot piece is manufactured, it should be analyzed under concrete using conditions to verify its usability and if the intended comfort was achieved. If not, it is necessary to go back to the previous development stages of the project to detect the flaw in the process. Only when finalizing this process one can move to the manufacturing stage.

The use of the OIKOS Methodology as an analysis instrument for the conception of clothing products means economy of time and resources, for, by working the project conception of the clothing products, future inadequacies can be avoided and time and resources can be optimized, though eliminating remaining and expenses with the production of inadequate pieces.

The OIKOS Methodology can also be applied to the manufacturing of clothing products for public of different ages, whether the elderly, babies, children, teenagers; the obese, the extremes in the population (adults or children who are either too short or too tall, too thin or too fat) and people with special needs, such as those in wheelchairs, blind people, amputees, with motor disabilities, with cerebral palsy, confined to bed, as already mentioned. Its application can be widened to other clothing items and accessories, such as shoes, bags, jewelry, caps, socks, underwear, etc. In these terms, we believe it will bring contributions to the manufacturing, fashion and clothing sectors.

6. Final considerations

Some considerations deserve to be highlighted as far as the OIKOS Methodology is concerned: the Methodology requires interdisciplinary work, in the clothing product project as well as in its production, and this will guarantee the unfolding of project development and production of other kinds of products. At the same time, OIKOS suggests that new relations with the academic world, in the design area, should be encouraged, disciplines and ways of projecting and developing products for the clothing sector in teams should be restructured. Yet, the OIKOS Methodology, as one of its branches, promotes the inclusion of ergonomics and its interaction with fashion and clothing products, as a discipline that underlies

the fashion product's project for Fashion Design graduation and specialization courses.

The solution recommendations for the detected inadequacies and the solution proposed, from the evaluations performed in the clothing pieces of the companies that were analyzed, can be used as a starting point to promote their pertinent improvement and correction. The same orientation is worth for the inadequacies detected in other clothing products, that is, to propose advices from the performed evaluations, to change or redesign the existing clothing products.

Usability represents the interaction that enables the efficient use of products, specially clothing. That is why comfort represents a desired goal, in any environment, living, working or just having fun. So, clothing products can become a ludic and pleasant experience for the users, without realizing its presence over its support, which is the body, freeing it from its chains by using ergonomics in its favor; because a piece of clothing without ergonomics is a prison for the body.

With this understanding, a new path is opened for the perception of this new body in space, because there already is an appropriation of this owned space, to finally recover space to imagine, to resize time in searching for the slow life, the coziness, the comfort, and the body's house, its home, its OIKOS.

From these final considerations, it is possible to point out the following recommendations:

Verify the implications of ergonomics and usability for the clothing product's project in every stage of the product's life cycle, from conception to disposal, considering that the sustainability principles to develop and manufacture these products open a relevant and wide field of action for the sector.

Underlie the working process of the clothing product's project, to enable the different knowledge to take part in the creation and development process of a product's project, not only clothing ones.

Evaluate the implications of the OIKOS Methodology in the whole clothing products and fashion chain of production. Present the creation of qualifying courses for professionals in the fashion and clothing sector, considering the ergonomic and usability implications as a comfort and satisfaction guarantee for the users.

Test the application of the OIKOS Methodology to evaluate the psychological and physiological comfort variables and their relation with clothing. This will open a wide research field in the clothing product comfort area that has just begun with the development of this research, which has released the OI-

KOS Methodology, directed to the evaluation of clothing products usability and comfort.

6. References

and clothing products, as a discipline that underlies the fashion product's project for Fashion Design graduation and specialization courses.

- [1] CASTILHO, Káthia. *Moda e Linguagem*. São Paulo: Editora Anhembi Morumbi, 2004
- [2] DORFLES, Gillo. *A moda da moda*. São Paulo: Edições 70, 1988. (Arte e comunicação)
- [3] HOLLANDER, Anne. *O sexo e as roupas: a evolução do traje moderno*. Rio de Janeiro: Rocco, 1996.
- [4] LIPOVETSKY, Gilles. *O império do efêmero*. A moda e seu destino nas sociedades modernas. São Paulo, Companhia das Letras, 1989
- [5] IIDA, I. *Ergonomia projeto e produção*. São Paulo: Blücher, 2005.
- [6] JORDAN, P. W. N. *A Introduction to Usability*. Londres: Taylor & Francis, 1998.
- [7] _____. *Designing Pleasurable Products*. Londres: Taylor & Francis, 2000
- [8] KHALID, H.M; HELANDER, MG. *Customer emotionall needs in product design*, vol.14, num.5, setembro 2006, downloaded from <http://cer.sagepub.com> at CAPES on January 19, 2007
- [9] MARTINS, Suzana Barreto. *O conforto no vestuário: uma interpretação da ergonomia. Metodologia para avaliação de usabilidade e conforto no vestuário*. Florianópolis, 2005.140p. Tese (Doutorado em Engenharia de Produção) – Programa de Doutorado em Engenharia de Produção. Universidade Federal de Santa Catarina – UFSC
- [10] _____. *Ergonomia e usabilidade: princípios para o projeto de produtos de moda e vestuário*. CONGRESSO BRASILEIRO DE ERGONOMIA, ABERGO, 14, 2006 Curitiba, Anais... Curitiba, 2006. 1CD-ROM.
- [11] Suzana Barreto. *Ergonomia e moda: repensando a Segunda Pele*. In. PIRES, Dorotéia.(Org.). *Design de Moda: olhares diversos*. Barueri, Estação das Letras e Cores Editora, 2008
- [12] MISTURA, G. *L'abito Mutante: le base di un nuovo stile*. Milano: Modo, 1999. [13]NICOLINI, Rubens. *Medida de conforto em Têxteis*. In: I CONFERÊNCIA INTERNACIONAL TÊXTIL/CONFECÇÃO. Rio de Janeiro: Senai/Cetiq, 1995.

- [14] NIELSEN, Jacob. *Usability engineering*. In: _____. *Usability Assessment Methods beyond testing*. San Francisco: Morgan Kaufmann, 1993.
- [15] SALTZMAN, Andrea. *El cuerpo diseñado: sobre la forma en el proyecto de la vestimenta*. Buenos Aires: Paidós, 2004.
- [16] STANTON, N. A.; YOUNG, M. *Ergonomics methods in consumer product design and evaluation*. In: STANTON, N. A. *Human factors in consumer products*. London: Taylor & Francis, 1998. SAVAS, Özlem. In: McDONAGH, D. et al. *Designing and Emotion*. Londres: Taylor & Francis, 2004.
- [17] SOUZA, Gilda de Mello e. *O espírito das roupas: a moda no século dezenove*. São Paulo: Cia das letras, 2001.