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## Fashion and Ergonomic Design: Aspects that influence the perception of clothing usability

Érica P. das Neves<sup>a\*</sup>, Aline C. Brigatto<sup>a</sup>, Luis C. Paschoarelli<sup>a</sup>

<sup>a</sup>UNESP–Univ. Estadual Paulista, Av. Eng. Luiz Edmundo C. Coube 14-01, Bauru 17033-360, Brazil

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### Abstract

The relevant issues about clothing have been increasing in recent times. The increase number of consumers and users that search for differentiated and appropriate products to their needs and expectations is impacting on the design stages as well as on manufacturing process. Thus the understanding of specified segments of consumers and users emerges as a competitive strategy that is favourable to the development of products that are adequate and satisfactory to different individuals. Regarding the fashion context, the clothing product provides to the emotional level channels of signification and subjective identification. Considering the direct contact between clothing and user, the information about anthropometric biomechanical and ergonomic are of extreme relevance for the development of modelling that are appropriated to different needs of different segments of users.

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### 1. Introduction

The relevant issues about clothing have been increasing in recent times. The increase number of consumers and users that search for differentiated and appropriate products to their needs and expectations is impacting on the design stages as well as on manufacturing process.

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\* Corresponding author. Tel.: +55 14 3234-8340

E-mail address: [ericapneves@yahoo.com.br](mailto:ericapneves@yahoo.com.br)

direct integration of the clothing with the skin and the topography of the body, the garment generates value of judgment inherent to the perception of the aspects of usability, pleasantness, comfort, enjoyment and satisfaction regarding the needs of the subject.

From this principle, ergonomic design provides tools that when applied during the stages of clothing conception, may be able to direct more precisely the characteristics of the product in favor of safety, efficiency and comfort. In order to understand the complexity of the integration of body and clothing, the study of anatomy and body movement are necessary. It is important to understand the balance plans of the entire body as well as the its movements such as flexion, extension and other [1].

In this way, the multi and interdisciplinary interaction between project of clothing and ergonomic design contributes to the progress and to the resolution of the project of clothing projects. The understandings of the concepts of usability, comfort and ergonomics which are specific of certain groups (niches) are necessary in order to obtain fashion patterns that adequately meets to their expectation and requirements.

### 1.1. The metamorphosis of Fashion

Throughout the evolution of societies, fashion contributed to the identification of social and identity role of the subjects by hierarchical use of different clothes and accessories. Its symbolic character is a reflection of subjective and cultural aspirations of a certain period, which, in turn, significantly reflect on the physical and constructive aspects of fashion products, especially clothing.

With respect to the symbolic, physical and materials aspects of clothing, it can be noticed an infinity of transformation that expressed the social, cultural and technological context of a given period. In general, the clothing has gone through a process of simplification, especially from the decade of 1800. This phenomenon is primarily due to new industrial technologies, to higher demands of products and to the adaptation to new manufacturing process.

As an example, the revolution in women's clothing led by French designer Paul Poiret in the early twentieth century can be mentioned. Thanks to the fashion creator, the women's clothes were simplified becoming lighter, thus facilitating the movements of body [2]. The fashion innovation broke with the rigid structure of the corsets that made pressure on woman's abdomen in order to create and define a slim waist, a protuberant bust and a straight posture. The stylist also proposed a lighter silhouette, deeper necklines (mainly the "V" model), apparent shoulder, ample shapes, and other modeling variations.

In general, throughout history, a variety of social, cultural and professional practices have contributed to a more efficient and realistic view about the needs of the individual and of their daily tasks. Due to this trend and the industrial logic of large-scale production between 1950 and 1960, the fashion has become more democratic, and therefore, the user began to be perceived with more relevance by companies in the sector.

The new phase was characterized by what came to be known in France as *prêt-à-porter*, and in the United States as ready to wear. Rigidity, ostentation and exclusivity of the *haute couture* were no longer consistent with the new economic, cultural and demographic realities of the postwar years. There was a need for more agility and quantity of products. Thus a rapid production system began to be practiced under new industrial characteristics that were adapted to the increasing demands of garments product [3,4].

The new industrial system promoted great transformation within the creative and development process of fashion products. The demand for products increased significantly due to new social groups which had higher purchasing power and new forms of consumption established with the advent of mechanization and mass production. Consequently, the system was quickly disseminated through several regions of the world, favoring the strengthening of the textile and apparel industry. The design and planning stages of clothing increasingly improved concerning to new textile and industrial technologies, as well as became more sensitive to social and cultural movements.

The hedonistic consumption was becoming increasingly present, intensified primarily by aesthetic and symbolic elements of fashion products. Consequently, the industry had to be opened to the perceptions and desires of a society increasingly focused on the present, on the new and on the possibilities of identity expression. The youth groups, for instance, were a segment of consumer which significantly influenced guidelines of development and production of a few fashion products over the course of the decades after the consolidation of the industrial system [3].

With the postmodernism ideas, markets became more complex and were no longer large and homogeneous. The new tendency of consumption led the industry to divide into smaller and smaller segments, which were identified by different needs and expectations of individuals [5].

In this scenario, consumers came to be perceived as determining factor in product development of products. As in previous periods, their actions, desires and expectations induced significantly the correct sizing of the products, considering aesthetic, physical, practical and functional aspects. These factors, in turn, began to determine new constructive methodologies for garment products. The aspects of fashion pattern began to become more prominent, especially due its focus on the assertiveness of the product. The target audience began to be analyzed and considered, especially when industries realized that to increase the production and sales, it was necessary to stimulate the consumption must be effective and continuous. Buying and having were actions that were able to construe the individual subjectivity through non-verbal elements, reflecting on how the subject would be perceived.

In the context of industrialization, some ergonomic knowledge arising from World War II began to be inserted [6]. With the industrial production, clothing patterns of shapes and sizing/measures began to be essential in order to cover the dimensional standards of some individual variations [6]. When we know the user, recognizing their needs, capabilities and limitations, it is possible to identify in advance the occurrence of accidents, health damages and discomfort [6]. Consequently, the individuals are gradually being seen as users and not just as mere consumers.

Allied to this, the market segmentation began to offer variations in functional benefits as well as more attention towards the hedonistic needs [5]. Mainly with the postmodernism advent, the researchers with users and consumers began to extrapolate the aspects of marketing and advertising. The image manipulation realized by media, especially after mid-1950s, were no longer sufficient given the vastness of products that constitute the market. In the post-industrial society the ostentatious aspects of the product were no longer sufficient to the user or consumer, becoming the experience and the emotion both aspects of significant importance to the quality of a product [7].

Regarding the fashion context, the clothing product provides to the emotional level channels of signification and subjective identification. Besides symbolic and aesthetic elements and composition, it gives indistinguishable tools for the promotion of affective states to individual [8].

Thus, the basic functions of clothing extrapolate the function of dressing and covering the body and are associated with the social conditions of subjectivity and construction of identity [8]. Considering its direct contact with the topography of the body and the skin, the fashion product generates judgment of value resulted from the perception of aspects of usability, pleasantness, comfort, enjoyment and satisfaction of individual needs [8].

In this way, the physical and structural characteristics of the clothing that configure this fashion product stimulate the positive evaluation of the user regarding a certain product. In this process, the interdisciplinary characteristic of ergonomics is perceived as a factor that helps in the mediation between the body and the clothing, once this science may offer constructive tools that may be able to provide safety, comfort and health to the user.

### *1.2. Ergonomic Design and Usability aspects: user particularities*

Considering the direct contact between clothing and user, the information about anthropometric biomechanical and ergonomic are of extreme relevance for the development of modeling that are appropriated to different needs of different segments of users. Identified these aspects, it may be possible to develop satisfactory, safe and comfortable products. According to Montemezzo and Santos [9] the clothing, due its contact with the user, acts like an extension of the body such as a “second skin”, which, in turn, is essential to optimize the interface between product and user in order to avoid any discomfort.

The modeling is a process that starts from the observation of the body and its mapping, and ends with the dressing test over a real body [10]. Therefore, to the development of an adequate modeling is necessary to know the human anatomy as well as the functions of the body [1]. At this point, the specific characteristics of the individuals must be observed and exploited in order to obtain consistent data to the development of appropriate products and with quality. It is also necessary to understanding or estimate the preferences and responses of the user regarding the products which will be elaborated.

The use of anthropometric, through the application of scientific methods of body measuring, is appropriate to identify the differences between individual and social groups. The objective of this application aims to obtain

relevant information to help architectural design, urbanism planning, engineering project, and of course, design [11]. In the perspective of fashion, all the articulation of the body that involves or maintains a direct contact with clothing must be analyzed in order to create a product with aesthetic and ergonomics quality.

Regarding to clothing, the anthropometry provides to the designers two system of body measuring: Static or Structural; and Dynamic or Functional [11]. The first one is related mainly to the variations of the body of the individuals, and the second one to the different biomechanical aspects that are associated to different movements and daily tasks. Convectional modeling mainly uses statistics data of the users such as waist, hip and neck circumference; length of the body or arm; and others.

These data influence the clothing dimensioning. Allied to this, the particular contributions of certain segments of users help to guide the correct drawing or shape of some pieces of clothing that must be adequate to specific and different needs and expectations. Female or male users, elderly and obese are some of the segments that can illustrate this reality.

Each region of the body must be analyzed in order to provide correct information about how a piece of clothing will work in relation to the physical movements. Arms, legs, hips and head, for instance, make several moves that may come into conflict with certain characteristic present in a specific outfit, such as tight sleeves/armholes or collars, loose pants, and others.

For this joint work, some aspects regarding biomechanical and joints articulation must be identified, such as: extension, flexion, adduction and abduction; rotation; and circumduction (Figure 1). Thus, the clothing process must bring together anatomy, moves and the product itself in order to satisfy the physical and anatomical needs of the user, reaching the ideal quality of dressing through functionality and comfort [1].

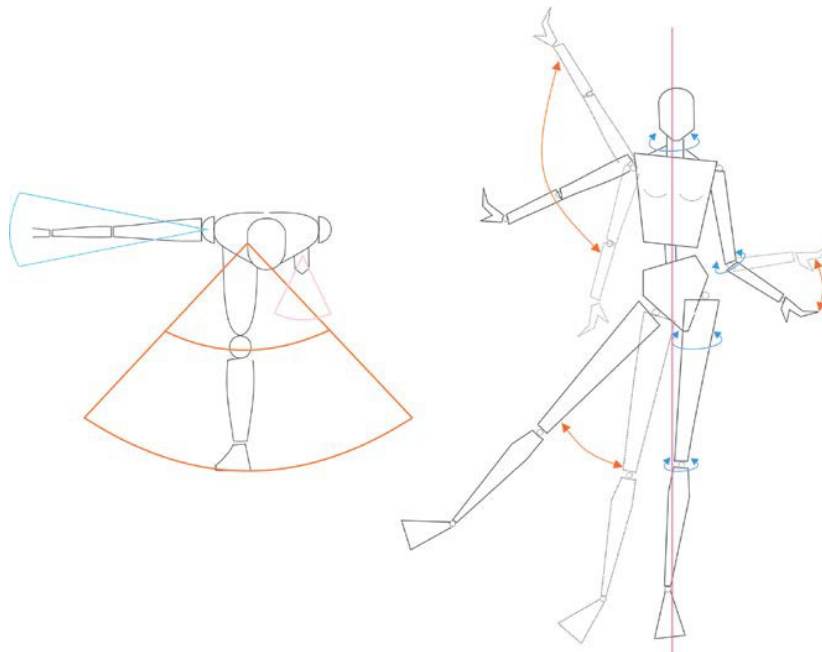


Fig. 1. Some moves to be considered (adapted from Grave [1] and Boueri [11])

As seen, all these knowledge imply a variety of data that are important to understand the relationship between user and clothing. In addition, the understanding of daily activities also helps to identify common moves that may be affected by clothing. These movements can be simple as sit, down, bend the knee and others as well as specific movements of certain activities (Figure 2).

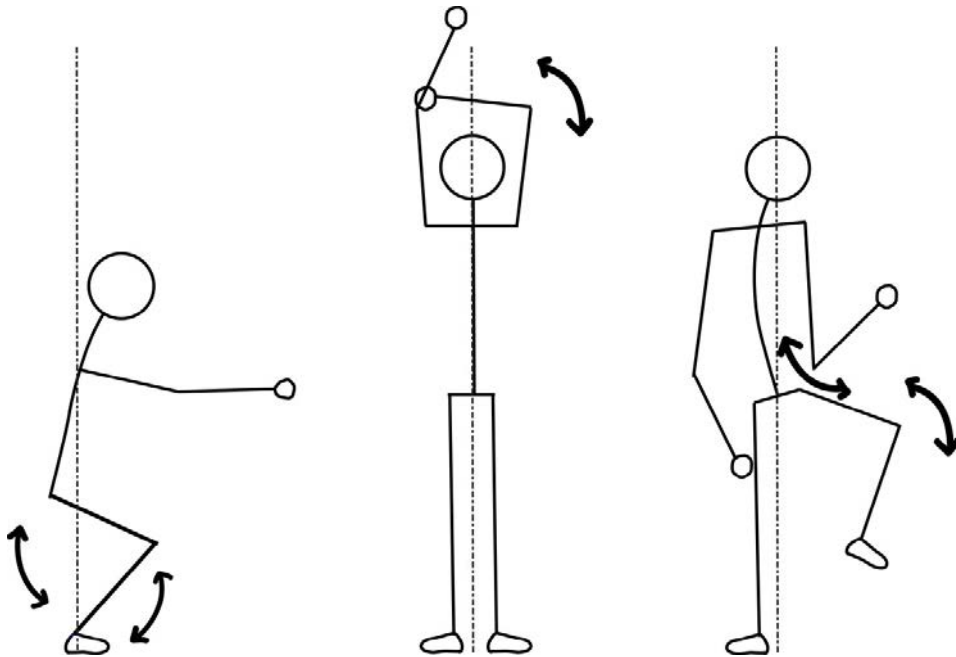


Fig. 2. Some activities to be considered

With these variables is possible to create an anthropometric profile of user once the different standards of usability can be identified. The elderly users, for instance, need some attention regarding the disabilities inherent of the process of aging. With the gradual loss of balance, muscle strength and vision restrictions, some dressing activities may be performed with some difficulty, such as dress the pants, to close the button, to put shoes and socks on, and others. These examples bring some restriction mainly regarding mobility, but it is important to notice that other body peculiarities can influence the usability of clothing. Women of middle age, for instance, that are experiencing the biopsychosocial issues of menopause, are aware of their bodily changes resulting from this stage of life [12]. It seems that most part of these changes is negatively evaluated by mid-age women. It also noted that, due to this reality, the most of them identify themselves uncomfortable. Changes in the measures of the abdomen, waist and hips are some areas that due to the increasing of adiposity may cause discomfort and dissatisfaction. Due to this, the clothing has been seen as a tool to manipulate physical aspects that bother these women. Waist and abdomen for instance, are the areas that most require the interference of clothing due to the capacity of some pieces of garment to hide or disguise some “body imperfections” [12].

In this sense, it can be noticed that there are specific body variations that are important to be considered regarding the clothing characteristics for these segment. The considerations about biomechanical could even be generalized; however, anthropometric and subjective differences significantly influence the assessment of the fashion product, especially with regard to aspects of usability.

Another aspect to be considered in decisions of clothing project is the activities and tasks performed by the users. The particularities of these actions may present differences in the dynamic of the body, mainly if observed professional activities and sportive practice.

Over the past years, the sports have influenced the technological innovations within the textile and clothing field. Focusing on efficiency, comfort, safety as well as on the performance of the athletes, the sport industry has been investing in the development of new technologies. This fact can be observed in the increasing of sports brands and in the growing number of researches that brings issues about this universe.

Regarding to professional clothing, the dynamics of daily activities must direct the design of products. The external environment, the biomechanical performance, the characteristics of the task and the anthropometric aspects

of the user may provide assertive information that is important to the efficiency of the clothing during the professional exercise.

The perspective of social inclusion has also influenced the fashion universe. The purpose is to create clothes with aesthetic elements and adequate shapes which may help the participation of individuals in a given social-cultural environment without compromise their health and well-being [13]. The observation of the body and the activities of the user as well as their physical limitations are essential to identify their needs and expectations.

In general, the understanding about human mechanism, voluntary and involuntary movements as well as the psychological behavior of certain user is relatively important to the clothing project. Therefore, the ergonomics knowledge is important to guide correctly this kind of project, once this science is related to the daily tasks and environment of people. The ergonomics focuses in the human being, identifying all kinds of skills, disabilities, physical and cognitive aspects, cultural and social perspectives, and other aspects regarding the dynamics of the body [6].

Regarding the clothing, as already observed, its function goes beyond the basics of decoration and covering of the body. The clothing involves the sake of mental and physical health [1]once may guarantee comfort and safety to user as well as stimulates the subjective perceived. In this sense, the joint work among ergonomic modeling, body, aesthetic and raw material (textile) is significantly important to the assertiveness of the clothing product.

## 2. Considerations

The consumers are searching increasingly for fashion products that present unique physical qualities such as usability. In this perspective, innovation and differentiation strategies are substantial to support the relationship between the product and the user, as well as to the brand positioning ahead the competitors. For this, the understanding of specific segments of consumer and users emerges as a competitive strategy favorable to the of fashion products which are adequate and satisfactory to specific needs and desires.

Therefore, the comprehension about the factors that may influence the acquisition and the use of some piece of garment become essential to guide the design process of fashion products. Due this logic, biophysical, anthropometrics and social characteristics which are specific to each segment of interest must be always considered within the creative process. These variables, when properly worked and applied add value to the product through the complicity and integrity in the interrelation user-action/task-clothing. Besides that, given the close relationship between clothing and body, the fashion product generates value of judgment inherent to the perception of some aspects such as usability, pleasantness, comfort, pleasure and the satisfaction of individual and subjective needs.

In this context, structural and physical qualities (such as tactile and thermal comfort) that support the clothing directly influence the positive evaluation of this product. In this process, anthropometry and ergonomics (and its interdisciplinary characteristics) are knowledge that help the assertive work regarding the relation of body and clothing, once these understandings offer some tools that when properly used, may promote safety, health and comfort to users. In parallel, the aesthetic and symbolic elements of the fashion product stimulate the emotion perception of the users through its plastic composition by the promotion of aesthetic pleasure and, consequently, generate positive value of judgment in front of a product.

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## References

- [1] M.F. Grave. A modelagem sob a ótica da ergonomia. São Paulo: Zennex, 2004.
- [2] D.B. Pezzolo. Pordentro a moda: definições e experiências. São Paulo: EditoraSenac, 2009.
- [3] F. Baudot. A moda do século. São Paulo: Cosac Naify, 2002.
- [4] E. Palomino. A moda. São Paulo: Publifolha, 2003.

- [5] J.F. Engel; R.D. Blackwell; P. W. Miniard. *Comportamento do Consumidor*. 8° ed. Rio de Janeiro: Livros Técnicos e Científicos Editora S.A., 2000.
- [6] S. B. Martins. *Ergonomia e moda: repensando a segunda pele*. In: D.B. Pires. *Design de moda e olhares diversos - Ergonomia e moda*. Barueri: Estação das letras, 2008.
- [7] L.O.R. Colombo, T.B. Favoto, S.N. Carmo. A evolução da sociedade de consumo. *Akrópolis - Revistas de ciências humanas da Unipar, Umuarama*, v.16. n.3 (2008) p.143-149. <http://revistas.unipar.br/akropolis/issue/view/264>.
- [8] E.P. Neves, L.C. Paschoarelli, M.S. Menezes. *Moda e Ergonomia: Contribuição Emocional à percepção do vestuário*. *Proceedings 14° Congresso Internacional de Ergonomia e Usabilidade de Interfaces Humano-Tecnologia: Produto, Informações, Ambiente Construído e Transporte (ERGODESIGN)*, 2014, Joinville.
- [9] M.C.F.S. Montemezzo, J.E.G. Santos. *O papel do vestuário na interação homem-ambiente*. *Proceedings 5° P&D Design Congress*, Brasília, Rio de Janeiro – AEND-BR (2002).
- [10] F. Sabrá, A. Cipiniuk, M.A.S. Machado. *Design, moda e consume: por que compramos um produto têxtil novo?* In K. Castilho, S. Demetresco (Orgs). *Consumo – Práticas e Narrativas*. São Paulo: estação das Letras e Cores, 2011. 147-156.
- [11] J.J. Boueri. *A Contribuição da Ergonomia na Formação do Arquiteto: O Dimensionamento dos Espaços da Habitação*. Tese de Livre Docência. São Paulo, FAU USP. 2004
- [12] E.P. Neves, L.C. Paschoarelli. *Bio-psychosocial aspects of the climateric / menopause and its importance in fashion for women and elderly women*. *Proceedings CIMODE - I International Fashion and Design Conference*, 2012, Guimarães, Universidade do Minho, 2012. p. 1166-1173
- [13] M.F. Grave. *A moda-vestuário e a ergonomia do hemiplégico*. São Paulo: Escrituras Editora, 2010.