

## REFLECTIONS ON THE FUNCTIONAL APPROACH OF THE ELDERLY AS AN AID TO DEFINING REQUIREMENTS IN PRODUCT DESIGN

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### **SUMMARY**

*The present article aims at raising the main concepts around the research in product design for the elderly, especially in terms of defining project requirements. This study addressed some concepts along with the perspectives of the authors in the field of Biomechanics, Ergonomics and Anthropometry, with special attention to, respectively: Hamill (2010), Gomes (2003), Moraes e Mont'álvão (2003), Iida (2005) and Panero (2002). In this theoretical framework, the following concepts have also been taken into account: Ely and Cavalcanti's population aging (2001); Pupo, Melo and Ferrés social inclusion; Analysis of Daily Living (ADL) by Barros (2009) and Matsudo (2004), as well as some studies directed towards the consumption pattern of the elderly. Besides the theoretical approach, some tools for measuring the physical capability of the elderly in their analysis of daily living have also been proposed, such as: TEMPA (Test d'Evaluation des Membres Supérieurs de Personnes Agées), Hand Grip Strength, Moberg's Test, TUG (Time Up and Go) and the Berg Balance Scale.*

### **KEY WORDS**

*Ergonomics; biomechanics; anthropometry; inclusion; ADL; project requirements.*

### **1. INTRODUCTION**

The matter of population aging has had great influence over the development and functioning of societies, since it carried with it social entailments which require preparation to cater the needs of individuals above 60 years of age.

That phenomenon has been observed worldwide, first in developed countries as a result of the decrease in mortality, great achievements in the field of medical knowledge, appropriate urbanization of cities, nutritional improvement, increase in levels of environmental and personal hygiene in homes as well as at work, and also as a result of technological advancement. All those factors began to occur in the end of the 1940's and beginning of the 1950's.

### **2. POPULATION AGEING**

According to Palácios (2004), the concept of aging is not a unitary process, it does not happen simultaneously to the body as a whole and it is not related with the existence of any diseases. In fact, it involves multiple endogenous and exogenous factors, which must be thought of in an integrated way, overall in diagnostic situations.

When functional abilities begin to deteriorate as the result of an excessive burden imposed on a physiological system unable to bear it and/or because of the existence of pathological processes (disguised or not), the aging process begins to pose its restrictions. That concept is closely related to keeping one's autonomy. In that sense, therefore, the concept of chronological aging diminishes in relevance before the concept of functional aging (KALACHE et al., 2000; CANÇADO, 1994; CARVALHO FILHO E PAPALÉU NETTO, 2000 *apud* CONVERSO E LARTELLI, 2007)

Over the past ten years (2002 – 2011) the elderly population in Brazil (people over the age of 60) has grown 34.7%, while the total population grew by only 10.5%. According to statistical progressions by IBGE (Brazilian Institute of Geography and Statistics), between 2001 and 2050, the population over 60 years old will rise from 10.25% to 29.75% in proportion to the population as a whole, which will be increased by only 10.44% - going from 194 to 215 million inhabitants (IBGE, 2011). The elderly account for the largest proportionally growing age group and will maintain that rate within the next 40 years, representing practically 1/3 of the Brazilian population by 2050 and, amongst those, 22 million will be over 75 years of age, accounting for 10.5% of the total population.

This growth raises consciousness about advanced age as a social issue. Such issue demands special attention because it is directly related to identity crises, change in roles, retirement, several losses and a reduction in social contacts (MENDES, GUSMÃO, FAROS e LEITE, 2005).

### **3. PHYSICAL LIMITATIONS OF THE ELDERLY.**

Considering that aging is a complex process, a single model that categorizes the great variability of people among the elderly population cannot be defined. Therefore, scholars have used criteria that combine functional status with health levels, which correspond to the application of everyday practices (COTTON *apud* MATSUDO, 2004).

It is also known that senior citizens present potential risk regarding the loss of their functional capacities, which can determine partial or total dependence on others to carry out activities of daily living (ADLs).

In that context, the evaluation of such limitations is sought in order to contribute, later, to the proposal of coherent alternatives for the development of more physically adaptable and industrially viable artifacts for the elderly.

#### **3.1 Scales for functional capability evaluation**

There are many scales used to evaluate functional capability. However, ADLs have shown more relevance and reliability for the application of this study. The *Independence in Activities of Daily Living Index* (Katz Index) was created by Sidney Katz and published for the first time in 1963. Nevertheless, it is still one of the most widely used instruments in gerontological studies, due to its practicality of application and reliability. The activities object of evaluation are described as Activities of Daily Living (ADLs), where focus is concentrated on those related to self-care, such as: bathing, dressing, commuting and feeding (BARROS, 2010).

Matsudo (2004) states that, according to the American Geriatrics Society, activities of daily living (ADLs) are classified as basic (BADLs) and include self-care activities. IADLs comprise BADLs and include essential tasks for keeping one's independence. AADLs refer to occupational, recreational functions and community services (COTTON, *apud* MATSUDO, 2004).

Based on that classification, Spirduso (*apud* MATSUDO, 2004) classifies that the tests to be included in a set of assessments of individuals over 60 years of age, according to the functional level are:

Category	Types of tests
Physically dependent	BADL tests
Physically fragile	BADL and IADL tests
Physically independent	Physical aptitude tests: VO <sup>2</sup> máx; stamina; reaction and movement time; agility; balance.  AADL tests.
Physically active / able	Physical aptitude tests: VO <sup>2</sup> máx; stamina; reaction and movement time; agility; balance.

**Table 1: Functional level classification table (MATSUDO, 2004, p. 21)**

In order to evaluate the capability and conditioning of elderly individuals, it is necessary to observe their physical muscular endurance. Muscular endurance represents the most suitable measurement of functional capability of a muscle or group of muscles. The improvement in muscular endurance is important because some reductions of functional activities in elderly adults seem to be related to the individual's inability to maintain repetitive strains necessary to perform activities of daily living.

That appears to be partially due to a relative weakness of the lower limbs in elderly adults and the need to perform at almost full strength to do a given activity. The loss of a small amount of strength caused by fatigue will result in a significantly lower muscular endurance according to Adams and Col (*apud* DANTAS, DANTAS E ARAGÃO, 2002)

In order to measure physical muscular endurance incorporated into activities of daily living (ADL), some tools for evaluating that conditioning have been compiled as follows:

- TEMPA (Test d'Evaluation des Membres Supérieurs de Personnes Agées) – Test of evaluation of upper limbs in elderly people. Ideal to evaluate abilities of upper limbs.
  - Hand grip. Evaluates the hand strength, reaction time, response time, strength maintenance.
  - Moberg's test – manual skill.
  - TUG – Time Up and Go: the acts of getting up and going, returning and sitting down.
  - Berg Balance Scale – balance test in the act of sitting down and getting up.
  - IPAQ – International Physical Activity Questionnaire, the view of the elderly over their capability in activities of daily living.
  - Semmes-Weinstein - plantar tactile sensitivity test: evaluates the level of loss of sensitivity in the hands.

Those tools have been considered pertinent to this study due to their verified laboratory use in the field of physical therapy and physical education, focusing on measuring the physical limitations and incapability of

the elderly aiming to propose improvements in their physical conditioning. In the case of design, it aims at raising awareness of those physical limitations in order to meet and/or suggest project requirements.

#### **4. Ergonomical analysis: HUMAN FACTORS**

In order to understand the term “human factors” it is necessary to define it as the work of human activity in terms of effort, thought, relationship and dedication to the environment into which they are integrated. Provided that the goal of Ergonomics is to achieve the best integration possible between the product and its users, in the context of task (job) to be performed, it is concluded that the purpose of Ergonomics and human factors is to adapt the job to the worker and the product to the user. To that effect, scientific theoretical bases have been used, such as the Ergonomics of Gomes (2003) and Moraes (2003), as a more comprehensive theory segmented by Hamill’s Biomechanics (2008), which will discuss Panero’s anthropometry (2002) as part of the main tool in the process of ergonomical analysis.

Ergonomics has a multidisciplinary role and makes use of several areas of knowledge, for example, the Organization of Work, Visual Perception; Sociology; Anthropology and Anthropometry, Information Theory, Medicine, Physiology and Occupational Psychology, Cognitive Psychology, (Production, Industrial, Safety, System and others) Engineering; Architecture and Urban Studies, (Product, Graphic, Fashion, Environmental, Light, Sound and others) Design, Social Communication, diverse technologies such as Computing, Cybernetics, Telematics, Robotics and others, as well as national and international standards ABNT, ISSO, SAE, DIN etc. (*apud* GOMES, 2003).

In an evaluative ergonomic process, physical abilities can be more easily acknowledged, for they are the first to be taken into account when projecting areas for the elderly or the physically challenged. They are related to physical health, safety and comfort of the users of such space. Therefore, an environment designed to cater the needs of the elderly must be free of obstacles, and of easy maintenance to avoid accidents and respect the biomechanical and anthropometric characteristics of the user population, according to Bins Ely and Cavalcanti (*apud* ELY and DORNELES, 2006)

Thus, quoting Hamill’s biomechanics and kinesiology (2008), it is understood that it entails the science which assesses human motions anatomically, physiologically, psychologically or mechanically, as well as the effect of forces falling upon an object. To complement a biomechanical analysis, according to Panero (2002), anthropometry discusses specifically the measurements of the human body to determine the differences among individuals and groups. By means of an anthropometric study with a sample of people, it is possible to obtain relevant data for the development of a proper product project. Factors such as human body measurements and their components, motion limitations and force measurement are extremely necessary to establish the relation between men and space and/or object, and other design requirements.

#### **5. PROJECT REQUIREMENTS FOR THE ELDERLY PUBLIC**

##### **5.1 Inclusion**

In order to outline a more inclusive society which acknowledges and values the differences among people it is increasingly important that proposals for accessibility with specific characteristics be articulated to promote quality of life to all. In that sense, people with different skills, interests and needs, due to aging and/or disabilities or not, can be benefited by environmental, product and service proposals that do not segregate them.

That perception about accessibility, related to the various aspects that interact with life and participation in society, combined with Design, may contribute to the configuration of a society for all (PUPO, MELO and FERRÉS, 2006). Accordingly, considering that the concept of Design translates multifactoriality, planning and strategy where applied, whether in virtual, sensory or physical artifacts, its main purpose is to meet human needs as a whole, whether they are segmenting or inclusive. For such, the study of design must be absolutely directed at each human feature so that effective products can be developed.

## **5.2 The elderly as consumers**

The percentage of the population over 65 years of age, according to the United Nations, will be 18% in 2050, as opposed to approximately 3% in 1970. In the 2000s, social security benefits and other income transfers to the elderly represented approximately 12% of the GDP, and figures show that percentage tends to increase rapidly within the next few years (FÍGOLI and QUEIROZ, 2008).

An IPEADATA research suggests an increasing relevance of the Brazilian elderly in their families' provision. As a result of the increased unemployment of their children and grandchildren, grandparents have become more and more responsible for providing for the rest of the family. There are fewer aged people living below the poverty line than in any other age group. They live as dependents at only 4% of the country's homes. At 22%, they are the household heads, often supporting their offspring. The presence of offspring has been observed at 70% of aged people's homes. A research conducted by Paulo Saad, from the United Nations Population Division Ageing Program, has shown that, in Fortaleza, 52% of the elderly who have been interviewed supported their children financially (*Estatuto do Idoso*, 2010).

The World Health Organization suggests that it is only possible to bear the costs of aging if countries, regions, and enterprises develop products and policies aimed at the elderly aiming at keeping the population affected by the aging process more active and productive. To that end, knowing the preferences and the behavior of old age consumers favors businesses in terms of strategies, having a positive effect on their purchase decisions. Thus, it is understood that conforming to the attributes of the products or services most valued by elderly consumers might influence groups in their purchase decisions, given the fact that the elderly are considered a new group of consumers. Partially responsible for the income, they are potential consumers with their own needs, expectations and demands. In marketing as well as in administration, fashion design and tourism, tailoring products to meet the needs of that public is evident.

## **6. FINAL CONSIDERATIONS**

Facing the fact of population aging and the statistical increase of the elderly population, the scientific world has recognized that phenomenon and is responding to its demands. In order to foster a more inclusive society that acknowledges and values the differences among people, it is of utmost importance that accessibility proposals with specific purposes be created to promote quality of life to all. That understanding of accessibility, related to several aspects which interact with life and participation in society, combined with Design, may contribute to the configuration of a society for all.

Connecting population aging with the statistical survey about the increase in that population, the inclusion and accessibility intended, as well as the ergonomical point of view (human factors), this article has the purpose of aiding research regarding that emerging public, so as to generate scientific studies and also project requirements for the development of products towards that group as an inclusive factor.

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