



Keeping up with Aging: An Ergonomics Perspective

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The Rationale

Aging is ubiquitous but uneven. Regarded in perspective, aging perception has evolved as the lifestyle, the hygiene and the implementation of the medical advancements came across. Based on the past and present figures, there is solid evidence that the number of population over 70 years of age will increase in 2050 about three times vs. 2015 and about 5 times to 2100 when the counting will reach about 2 million people. There has been also observed a trend in extending the active life which became more visible by 1980's when the retirement age was extended in many countries. This implies that more and more old age people are involved in the economic and social activities receive or provide services as the adult population. Previous studies indicate that less than 1/3 of active people plan to take retirement at the legal retirement age [1]. It is somehow clear that ergonomics of aging will play a significant role in providing the suitable tools to the older people to the extent that they will be able to continue their active life for longer and in a healthy and comfortable way. Research in ergonomics is a moving science which continuously changes as noticed in 1990's when the concept of Gerontechnology was crystallized [2,3]. It has been again proved that the Ergonomics is not just a self-standing science but it has extremely tight links with other sciences such as medicine, exercise science, engineering and metrology to name only the most important of those. The technology plays a major role in the driving the active life of older population. Development of effective exercise equipment as a result of the joint efforts of the exercise science and engineering were first thought as physical rehabilitation systems. The research significantly evolved over past three decade through the extension of the objectives as well as through the employed knowledge – which keeps the pace with the technology progress. Despite the progress, it is obvious that we have to learn much more than what it is known at this time [4]. Hence, the research on old age ergonomics needs more answers at this time as the aging as well as the requirements necessary to perform tasks are in a steady dynamic. Research in this field will bring more understanding in the way the work that cannot be automated at the present time need to be organized to provide the operator with the capability to completely perform the tasks. Any condition assigned to aging may be considered in this research: reduced mobility, reduced sensorial acuity (visual, hearing, accuracy in motion and equilibrium, correct understanding, etc. To follow the present trend in technology, all phenomena need to have a model. Ergonomics would not be an exception from this basic rule. However, the complex physics and physiology involved in modeling of handling tools or un-harming

kinetics or the effect of stress on human activities makes modeling challenging. It is expected that a great deal of research in ergonomics will be covering the complex area of modeling. Ergonomics would be also in charge with making the new technological advancements available to the elderly. Adaptive fonts or variable sound volume are just two examples of how the research could be used to enhance the perceptibility of written messages or speech. However, the technology that will be implemented and which is not yet known will require features that would make it easily available to all groups of age.

The Future Directions

In the above paragraph few of the issues related to aging and social activities were pointed out. There are many other issues that have not even been mentioned. However, the problems either enounced or not need some solutions. The research in ergonomics has lately extended and it does not refer mainly to the protective means to avoid incidents and accidents during the day to day activities but to measures which mitigate the risks of activities to zero. This would be possible through the implementation of Artificial Intelligence in the devices and the systems which will play an important role in detection and mitigation of the risks of injuries and of the long term exposure which could cause disabilities in the long run. Previous work involving fuzzy sets with applications to physical neuroergonomics [5,6] did state the capability of AI approach to solving problems related to the human factors. Other types of models include humanoid models which have been developed for various purposes. Their utility could be extended to the ergonomics. There is a large number of models of the human body created on platforms that could be also used in human factors applications. Thus, Life Modeler or MSC Software application on human-vehicle interaction, human body models have been used for optimal design of sporting equipment, analysis of knee or hip implants or vibrations on the human body or analysis of vehicles accidents on the occupants [7]. The models could be enriched with elements of AI and perform under limit conditions to assess the capability of specific type of activities under physical constraints. A significant number of contributions are expected to rise from this emerging area. Solutions finding may be facilitated by novel approaches in problem solving such as Design Research Methodology [8]. Adaptability and versatility are among the design variables that are most desired in an ergonomics product but also most difficult to achieve. The research design concept seeks the information that is instrumental in providing clear answers to the primary questions that are posed at the beginning of the design when the rationale is established. Another expected research direction in ergonomics is the certification of a new design of a system or device before the device is built, through software simulations by employing the principles of design research methodology. Such research will establish the most suitable design stream for a class of products, which is essential in a field that it is and it will be at a great demand. This attempt has been seen in flight pre-certification of software or in maintenance simulation [9]. The certifications programs should be capable to identify the point of concern and perform fast a parametric study for various dimensional ranges of the product that should fit the entire range of human size percentile. Significant research will be carried out in environment and environment control as here there are numerous knowledge gaps in knowledge. There is evidence that somehow unrelated technologies will start being implemented at

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large scale in ergonomics such as the augmented and virtual reality. Such technologies have been used in training [10] and along with the reduction in cost and enhanced capabilities, they will become of interest to the ergonomics. A great deal of research is required here along with the probably necessary paradigm shift in practicing engineering using software development tools that incorporate prior knowledge and the best design practice. Such software tools need to be versatile, handy to use and easy to adapt or modify. Besides what is known and predicted at the present time, there is a large dose of unknown that will be shaped along with the launching of the new technologies that have not been predicted yet.

The Expected Results

Human activities are the ones that have brought the today advancements and wealth of the humankind. Evolution is associated with progress but it is also linked with aging. This is one of the things that makes a society diverse. Aging and life span increase are usually related with disabilities. Given the present trend, few years ago the World Health Organization redefined the disability as diversity in abilities of a population. There is a threshold at which specific tasks cannot be anymore performed but along the ability lines, there are many conditions that may not be optimal but still operational. It is expected that the implementation of the AI, Virtual Reality through modeling and design research methodology approach will yield equipment and tools that will be able to help the user to optimally perform a task regardless the respective level of ability. The new design produced through the research in ergonomics will yield higher flexibility in use, will be able to use by anyone regardless the respective level of ability, they will simple to use and intuitive to learn

the operation be collecting the proper perceptive information, they will be tolerant to errors and accessible to people. As a matter of fact, the aspirations of individuals converge towards the same values: safe and comfortable living where the daily tasks can be performed without pain or severe efforts. The ergonomics will transform as medicine did - such that it will help people to easier cope with daily tasks while they grow older.

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