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STUDIES AND RESEARCH ON HUMAN BEHAVIORAL CHANGES INDUCED BY THE ENVIRONMENT

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Abstract: *Factors that define the environment affect the behavior of human subjects but also the social and economic actions of the population lead to changes, sometimes substantial, of the surrounding environment. Different international organizations in the health, social, economic or cultural spheres are involved in preserving the environment, eliminating the causes and disastrous effects of structural changes, as well as education and training of human subjects. From the point of view of the behavior of human subjects in professional activities, the environment has a determining effect for achieving high performance, comfort and comfortable lifestyle. In this paper there are presented some considerations regarding the modifications that can occur in the human subjects' behavior and due to the parameters of the environment (temperature, humidity, atmospheric pressure, light radiation, noises and vibrations). In the second part of the paper is presented the general scheme of analysis of the behavior of the human subject and also the proposal of the structure for analysis and monitoring of the visual function in different situations. In the final part of the paper are presented the conclusions of this synthetic analysis.*
Keywords: *behavior, environment, comfort, visual function monitoring, adaptation*

1. INTRODUCTION

In the field of occupational therapy, it has been proven over the years that a significant number of health problems can be attributed to environmental factors ranging from chemicals and food to housing, traffic, production areas, trade, and so on. For example, a WHO study in 2004 reported that one-third of the age-related children, adolescents, in the European region, comes from just **five environmental risk factors**. [1]
High-quality and depth research is therefore needed to support policies that have a positive impact on the environmental factors that affect our health as well as the population and the environment or ecosystems. These reporting elements, on some of the latest research that show the way for sound health and environmental policies help to assess their impact on human development.
For example, the impact of climate change is far more profound, and scientific information on possible health effects is under development and understanding by key decision makers.
The link between climate change and human factor health can be an active call to develop more research to highlight the human factor's sensitivity to the environment, while managing pathologies due to climate change involves procedures to protect the health of the whole Europe on a changing planet.
For example, research into the effects of air pollution on health is still low, sometimes even critical, and often the effects of air pollution inside living quarters or workplaces on health are overlooked or insufficiently studied.
Generally, it is assumed that human beings perceive and understand the world through the senses, and that these epistemic ties to the world take place by transmitting information from the surrounding world through these senses to the central human-brain unit.
The convergent perspective, based on the same hypothesis, is that the environment influences individuals, both micro-genetically and in development, and by the information that is generated in that environment and transmitted to the minds of those human subjects by the action of the senses.
Thus, a purely philosophical problem with purely philosophical, but also physiological and social consequences is born - a problem of skepticism (Ana & Barnes, 1985, Burnyeat 1983, Popkin, 1979, Rescher, 1980, Stroud, 1984, Wittgenstein, 1969). results from the question: How can we know that the representations of the surrounding world, perceived by human senses, are correct? The only answer seems to imply verification of these implications, by different methods and procedures, and their correlation with the physiological and psychological perceptions of human [2]
The conditions in which the human subject carries out its activity is a particular category of factors that can influence its performance and attitudes. The most important factors (other than psychosocial and / or motivational-wage factors) are the physical, chemical and biological factors (Tab.1.).

Factors of the work or living environment are structural, functional and functional elements of the workplace and life and are interdependent with the other components of the human-machine-environment system, being of great diversity.

Tab.1. Environment factors [5]

Factori fizici	Microclimate (temperature, humidity, air currents, calorific radiation); hyper / hypobarism - atmospheric pressure; the noise; lighting; functional colors; functional music; vibration; infrasound; ultrasound; infrared, bright, ultraviolet radiation.
Physical and chemical factors	Organic, inorganic, synthetic, particulate materials;
Chemical agents	Toxic substances in gaseous, liquid or solid state;
Biological Factors	Microorganisms, bacteria, fungi;
Psycho-social factors	Interpersonal relationships; temperamental particularities; aspirations; driving style, motivation, etc.

Besides these environmental factors, of the work environment that have a direct influence on the physiological performances of the human body and on the active and passive behavior, there are also a number of external, independent factors that exert influence on the different stages of posture or movement such as: soil resistance and elasticity, or gravitational acceleration.

Analysis of human behavior at work is at all times an area of great importance in achieving performance and ensuring occupational comfort.

Behavioral analyzes are thus always directed towards determinations of bipodal posture, normal behavior, with or without weights borne by the human subject, and last but not least, human body movements for performing various maneuvers or actions in work activities (high / low, drawn / pushed, moved over short horizontal distances, etc.).

In these behavioral analyzes, the concept of human-machine-environment system was adopted to be used in a unitary manner and to take into account all aspects of the sources of influence, the modes of interaction and the acquisition of sensory and decisional responses.

At the same time it is emphasized that there are three subsystems (fig. 1) between which interactions are established, their result influencing the quality and amount of human work. [5]

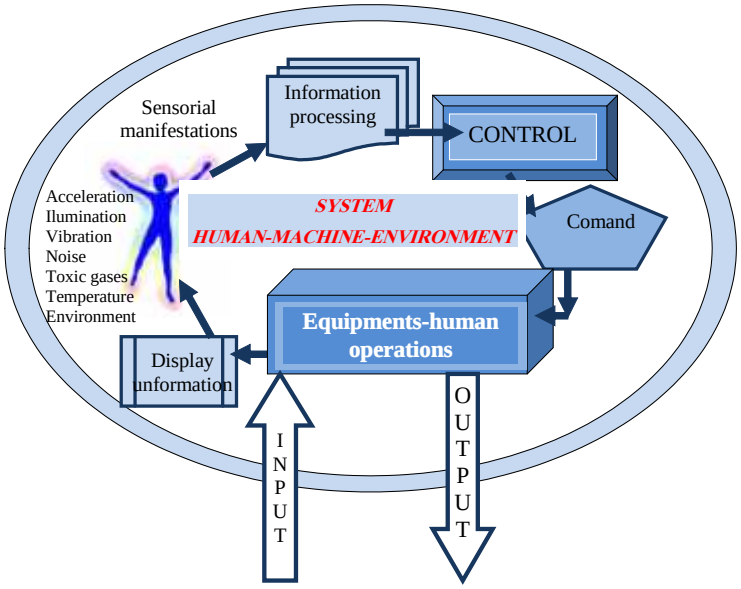

Figure 1: Structural block diagram of human-machine-environment system [4]

The human subsystem is described by the reception, information processing and decision making functions and the action function that acts directly on the machine.

The machine subsystem consists of the following elements: display and signaling devices, control devices; Between these two, the car performs a series of operations.

The environment subsystem influences the system's operation through its components, such as: noise, temperature, humidity, toxic noxes, lighting, etc.

To reduce design effort and time, it has been adopted that the work environment is designed and used in virtual environments, while taking into account economic aspects, eliminating the costs associated with physical prototyping, but the safety and quality of workers' work remaining still on the forefront. [5]
For example, in 2006, the Bureau of Labor Statistics (Bureau of Labor Statistics, BLS) reported that the highest number of non-fatal occupational illnesses occurred during production, averaging about 6 incidents per 100 workers per year, this is why there has been a need to use virtual modeling, simulations in operation of equipment, especially where the human factor is involved (which is in turn modeled virtually).
The human digital models (DHMs) that can be used in such analyzes are virtual representations of the human body and allow the products and processes that interact with man to be virtually "brought" to the human being, forming with it and work-piece geometry, a computer-aided system, analyzed and optimized through software tools. [4]
A wide array of models using a database (CAESER) or image acquisition through Microsoft Kinect has been developed, and the general feature of these models is that human subjects involved in work activities will be able to choose the positions in which the human body's joints can execute and develop the greatest moments and forces in an optimal way of self-regulation of the motion and stability mechanisms.

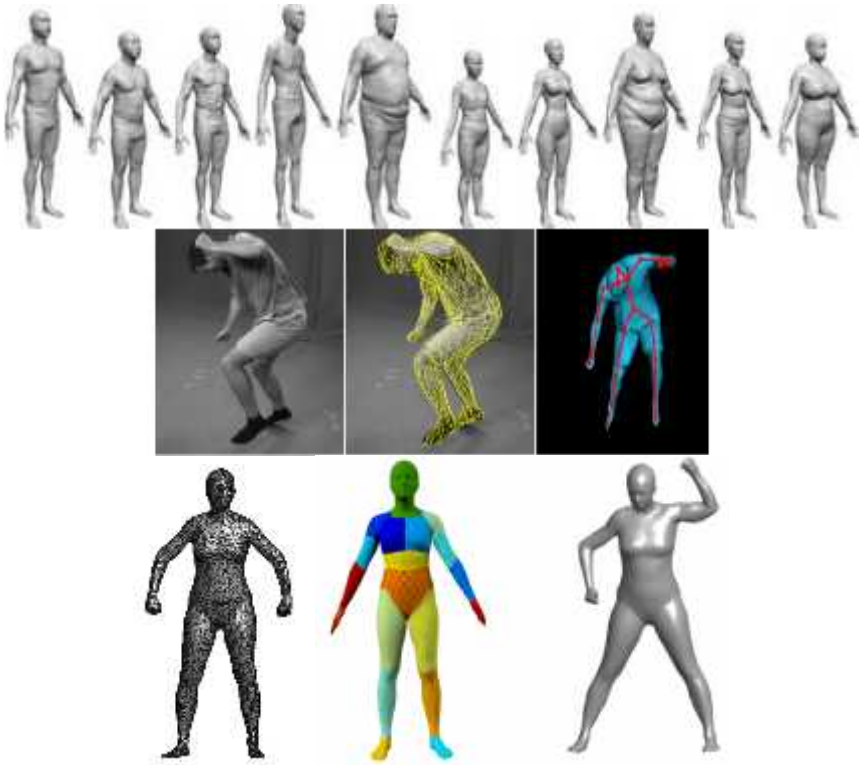

Figure 1: General model for study human body interaction with environment [9]

In the 2000s a number of researchers developed a model based on predictive posture optimization, which in turn is based on human posture and information on tensions and forces developed in human body segments.
Tensions have been used in these models as constraints approaching the "more natural" aspects of human biomechanics to improve the visual realism of posture prediction. [4]
As shown by specialists' research, "more natural" aspects, viewed as subjective criteria, are necessary but not sufficient for validating ergonomic analyzes and for resolving biomechanical optimization and efficiency analyzes.
In a similar way, the same approach is found in the work of other researchers who develop models capable of predicting the "natural" form as a situation opposite the predictive posture, but finds that the natural aspect is not sufficient for a quantitative measurement.
Many other researchers have proposed that workstations be predictive by optimizing factors such as potential energy, deviation from the point of motion of the joints, discomfort and tension. [4]
From the point of view of the bio-human behavior study in different activity situations there is a wide range of techniques, methods and equipment that analyze behavioral characteristics especially in the state of comfort.
Controlled techniques, protocols analysis, direct observation method, or individualized analysis methods are some of the techniques of investigation, screening, correction and training for this interdisciplinary field that seeks to ensure the optimal working conditions and life of human subjects.

2. EXPERIMENTAL SETUP

The experimental system, designed to develop the complex analysis of human bio-behavior, consists of several modules corresponding to the stages of activity and types of stimuli concentrated on different modules of the human body.
The analysis modules are marked in the general scheme of the development process of these studies of FIG.
For a complete analysis, these modules can work independently or in conjunction with stimulus groups, thus allowing validation of the effects of stimuli on the human body through several pathways, as well as identifying connections between sensory responses.
In this general block diagram was taken into consideration the totality of the human body's visual, auditory, loco-motor system responses to different external stimuli and their recording modalities (thermovision, video recordings, sensorial boards, etc.) for information regarding the level of comfort that the subject has at different moments of activity can be quantified and measured.

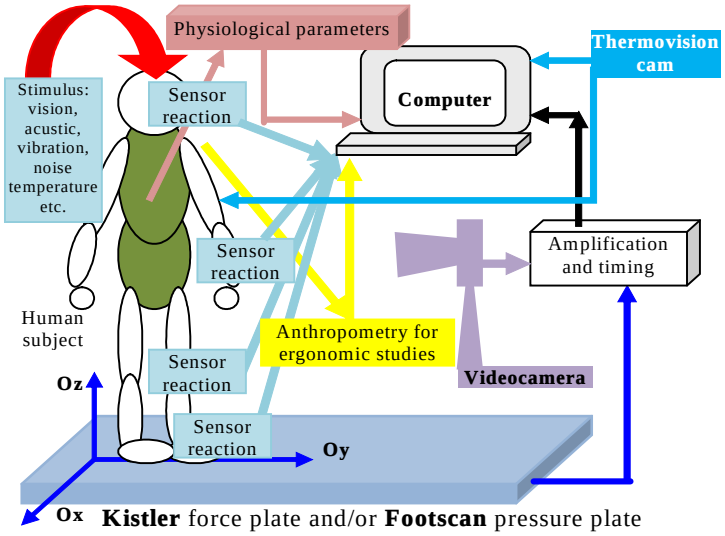

Figure 2: General block diagram to study human bio-behavior in environment and different activities

From this general block diagram, several structures can be identified to measure and measure sensory responses at the level of the human subject, including the visual function monitoring function.

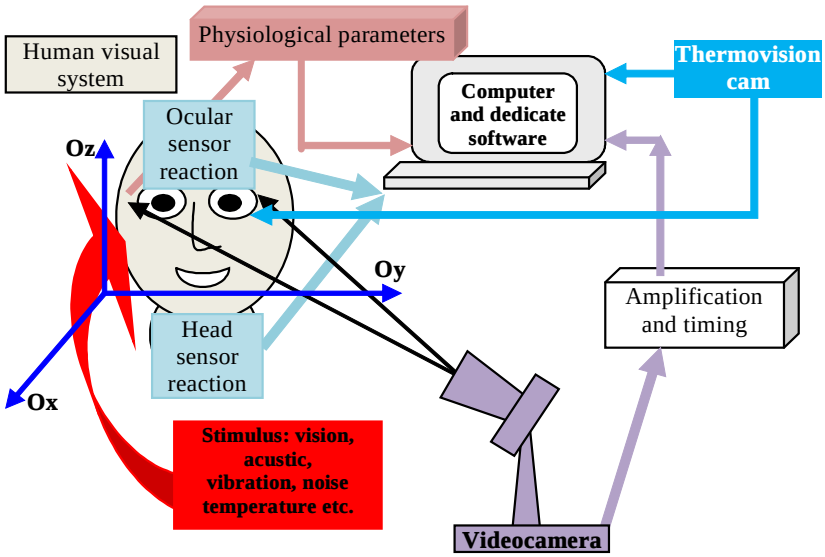

Figure 3: General block diagram to study and monitoring visual system in different situations

This analysis module can include video recording and visualization of eye positions and movements, visual acuity, visual field, chromatic vision, contrast sensitivity, and last but not least systems analysis of human body

responses in response to different external visual stimuli or ocular pathologies (ocular movements, nistagmus, strabismus, fixation, convergence, accommodation, light / dark adaptation process, etc.) (fig.3).
In addition, in facial analysis, it is considered necessary to assess the temperature distribution of epidermis and ocular structures as a reaction to the forms of positive / negative emotions that can be manifested in different professional, personal and working environments.
Thermo-vision method is one way to analyze zonal-eye or extended-all head / neck system, the patterns of temperature distribution, high / low temperature (maximum / minimum) and its evolution over time.
The video motion recording system may be a fixed system, external to the human subject, placed at a constant distance from the subject, or may be positioned and attached with a gripping system on a pair of spectacles or a dedicated structure.
These systems, either fixed or portable, allow the eye movement to be analyzed in the normal convergence / fixation process, in various visual control exercises, or in behavioral analyzes of different visual stimuli (computer display, website from internet, picture, etc.) [8]
In order for the investigations on the human subject not to be altered by the working of the devices, then a series of working conditions have been identified and considered to be imperatively complied with, as follows: All equipment used in the study and monitoring of the visual function must:

- ensure real-time acquisition of sensory responses,
- not to interact or modify the behavioral response of the subjects,
- allow the resumption and restoration of recordings,
- can be calibrated according to necessity.

The important aspects that this research aims to develop in relation to the human visual system consist in identifying ocular globe's behavior when the human subject is involved in the complex process of perception of the environment in assessing interactions with other human sensory systems in affective participation and effective in unfolding events to which the human subject is an integral part, or in adapting to the impact of new information technology and technologies.
The sensory response measured in the eyeballs, monitored and analyzed, modeled and simulated according to optimized and schematized analysis variants, is the essential element of the research process that highlights the superior level of the visual function, namely the visual mechanism to neural perceptions.
As a concrete response of these studies, the complex process of adaptation of the human subject to environmental stimuli is sought.
As mentioned in the synthesis of the research presented in the paper [4], the process of adaptation to environmental factors is concretized by the complex mechanisms of defense of the organism to the demands determined by external stimuli, to the environmental or even social changes, various conditions of existence. This whole process is in fact the result of the long-term evolution and ontogenesis of the human organism.
From the multitude of examples of adaptation to the environment, one can mention the following:

- Sensory adaptation - the simplest reflective manifestations, consisting of attenuation of the sensitivity to a stimulus and the total lack of excitation response, which previously produced a prompt reaction from an organ or complex of organs (the disappearance after a few minutes of the smell of a substance, the habit of the tic-tactic of the clock, the adaptation of the dark / light vision, etc.);
- Temporal adaptation (bio-rhythmics) - Human subjects, according to time, space and matter, carry out their vital processes with integrated biorhythmic succession and biorhythmic periodicity dependent on day, week, month, season;
- then adaptation to the thermal environment oscillations; adaptation to hypoxia and hypopressia (at altitudes or spaces closed with diminishing the proportion of oxygen, etc.); adaptation to chemical factors; adaptation to biological agents; the cultural and behavioral adaptation, which requires not only human adaptation to the environment but also the human environment, according to its needs (reproduction, nutrition, communication, exploration of reality, relations with other groups, etc.).

Also, when considering the adaptation process, the two forms can be highlighted: *autoplastic* adaptation (modification of the organism in relation to the capacities of the environment) and *aloplastic* adaptation (modification of the environment in relation to the needs of the organism).
The forms of manifestation of the adaptation process vary widely, from changes in external physical features (development of muscle mass in the upper and / or lower limbs) or sensory traits (visual acuity, increased audibility, etc.), metabolic, endocrine changes, neurological and immunological (organic and functional).
Through the adaptation process, the attributes of the organism are harmonized with the characteristics of the external factors; consequently the body becomes more independent of the negative influences of the environment.
In the same context, it must be mentioned that adaptation to the environment is a positive result, which is manifested by the strengthening of physiological functions and the proper development of organs, while the lack of adaptation is followed by illness, stress, discomfort or even death.

This adaptation also takes place through psycho-social manifestations, the manifestations of adaptation consisting in increasing the work capacity, the performance, the control of the environment, the technologies, the working machines, etc. "

3. CONCLUSION

All mechanisms for adapting, accommodating the human subject with the environment are, as shown in [4] processes, "which require systemic and complex approaches. The parallel existence of the influence of several factors on the human body in interaction with all the components of the physical and social space in which human subjects carry out their activity involves the study approach through the management mechanisms of the interactions of these factors both through their static and dynamic connections.
The dynamics of the evolution of technology and the evolution of the human species, their processes of adaptability, growth and balance are inherently connected and lead to the phenomenon of progress as long as the limits of functioning of the environment and / or social- human."

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