

From ‘human being’ to ‘social subject’: “unfreezing” ergonomics and the implications for understanding and intervening health-disease process

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Abstract. Ergonomics has been successful in increasing productivity and comfort in the work arena. It has also contributed to reducing occupational accidents. Despite this, ergonomics is frequently limited to understanding the health-disease process related to human-technology interactions, as this process is more complex than what can be understood from an ergonomic evaluation. Recognising this limit, this work ontologically and epistemologically contrasts the notions of ‘human being’ and ‘social subject’, and concludes that the study object of ergonomics, or human-technology interaction, greatly depends on social aspects that nowadays are not tackled explicitly: route (history), project, structure, agency, motivations and power. It also analyses how participatory ergonomics tacitly includes many of these aspects, including some implications that the change of notion, from ‘human being’ to ‘social subject’, brings to the understanding of the health-disease process and the reduction of associated risks during human activities.

Keywords: Ergonomics, Occupational health, Health-disease process, Social subject, Participatory ergonomics

1. Introduction

Although more reliable and accurate instruments have been developed for understanding physical, cognitive and organisational interactions between human beings and technology, some aspects were left out during the ergonomic analysis, and were therefore not included either as part of the problem or as part of the solution. Consequently, and despite ergonomic evaluations and interventions, the oft-expected improvement in health and safety conditions is not achieved. What are we leaving out in the analysis of human - technology interaction? To answer this question, we recognise that if we are to understand the

complexity of human being - technology interactions and the health-disease process, we need a different approach in order to understand the relationships between society and technology.

As part of this change of focus, we reflect on the notion of ‘human being’, based on ergonomics theory and practice. We begin by locating the origins of ergonomics historically, and go on to analyse the current definition as a scientific discipline and as a profession. The basic questions are (i) what circumstances were associated with the development of ergonomics?; and (ii) how have these conditions determined the concept of ‘human being’, as established in ergonomics? Besides mainstream ergonomics, we

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consider the contributions made by Activity Theory and Participatory Ergonomics. As the concept of human being found in ergonomics is limited, we put forward the notion of 'social subject', after dialoguing with social sciences and philosophy authors like Giddens [1], Butler [2], Foucault [3], Bourdieu [4] and Krippendorff [5]. As a conclusion to this dialogue, we reflect on some implications regarding this change of concept from 'human being' to 'social subject' for understanding and intervening the health-disease process.

2. Some reflections on the health-disease process and ways of intervening it through ergonomics

It is common, especially in an occupational health scenario, to focus on risks and the prevention or reduction of risks. We prefer to talk of the health-disease process and how this process takes place during the performance of human activities. The concept of risk is associated with probability and severity [6], which are useful from an economic, legal and management viewpoint. However, health and disease can be viewed as a blend, as a grading of colours, instead of as plain opposites (i.e. white/black). When is someone ill? When is someone healthy? Certainly when dealing with accidents the white/black concept functions perfectly, but when tackling diseases and disabilities a grading may work better. This way, talking of the health-disease process allows professional diseases and disabilities to be understood from a broader perspective, without reducing them to a linear cause-effect relationship or a probability of occurrence or associated damage.

To talk of the health-disease process is to talk of a continuum in many senses. On the one hand, it refers to the idea that each person has at least something of both. What defines when a person is healthy or when a person is ill depends on externally (socially) established parameters. On the other hand, an understanding of what is health and what is disease depends on the specific historical development of a society, and is strongly related to values, beliefs, power, technology, and daily life. Hence, health and disease are not just scientific but also political categories, and scientific knowledge about health and disease is greatly influenced by the surrounding social and political context [7].

A further argument for talking of a health-disease process is that ergonomics has broadened its sphere of action beyond the work arena [7], not just in terms

of target population or collectives but also in terms of fields of action. Considering this in ergonomics practice makes it possible to study the human being - technology interaction beyond the work scenario. Education, health services and entertainment are but some of the scenarios where ergonomics is already contributing. Ergonomics is thus getting closer to public health, which concerns itself with understanding and intervening the health-disease process. And this process, whether it be in its genesis, development or solution, always involves human activities. Therefore, if we talk of the health-disease process we bring ergonomics closer to the problematic field of public health.

Talking of the health-disease process means increasing the complexity of the interactions that are analysed, since interaction becomes dynamic: the time factor is added to a cycle or working day, typical lapses in analyses from an ergonomic angle. Interactions become complex, especially if we assume that interactions between human beings and the other elements in a system not only occur in but also form a social world - that is, they are not limited "simply" to the direct interaction between a hand and a tool but rather have a historical background and, in turn, shape and modify the social world in which they occur.

3. The concept of ergonomics, yesterday and today

The first document to theoretically conceptualise the discipline was the treaty entitled "The Outline of Ergonomics, i.e. Science of Work, Based on the Truths Taken from the Natural Science" by Wojciech B. Jastrzebowski [9]. This was published between the first and the second Industrial Revolution, but was unfortunately not available in English until 2000.

3.1. Industrial Revolution

At this decisive turning point in history, changes occurred which profoundly altered people's lives and the conception of the subject in society. In our opinion, Coriat [10] clearly showed how the subject, typified in the form of a master-artisan, was transformed into a workman employed by industry to perform a repetitive activity, resulting in him losing his power to make decisions and being stripped of his status as a person to such an extent that he became part of the production machinery and simply followed the speed, accuracy and rhythm in the move-

ments of the machines. Specialisation reinforced the idea of a fragmented subject who was limited to regulating a technological part, thereby restricting his ability to create and decide. The subject went from having technological autonomy (artisan-creator) to being dependent on technology (workman-reproducer), with the concepts of 'productivity' and efficiency' as a thread running right through production dynamics [11]. But these concepts that were achieved in economic terms had to be set against an increase in the accident and sickness at work index, which subsequently and paradoxically led to a new problem of non-productivity and inefficiency. This tension between productivity and efficiency on the one hand and the health-disease process on the other became unsustainable as the Industrial Revolution matured in the early 20th century, because these conditions were conflicting and irreconcilable.

Health and safety were no longer viewed as conflicting with productivity and efficiency. This change of perspective, from conflicting forces to interdependent forces, enabled the health-disease process to be understood in a different way and paved the way for ergonomics to be established as a scientific discipline at the end of World War II.

In the post-war production scenario, and due to technological and systemic efficiency and reliability problems, the British version of ergonomics appeared [12], based on what was for many years to be considered the fundamental concept of the approach to ergonomics: adapting machines to suit the capabilities and limitations of human beings, from the system theory perspective, based on the results of experiments and by establishing notions that were consistent with a positivist approach, such as physical burden and mental burden, for example.

3.2. Current Concept of Ergonomics

IEA defines ergonomics as "the scientific discipline that concerns itself with understanding interactions between human beings and other elements of a system, and the profession which applies theory, principles, data and methods for designing in an attempt to optimise human wellbeing and system performance in general" [13].

Guba & Lincoln [14] propose five research paradigms. We are of the opinion that ergonomics, especially its praxis, has developed under three paradigms: positivist - post-positivist [15], followed by a growing participatory paradigm [16] and an emerging but potential and integrating constructivist paradigm

[5] [17]. However, as a scientific discipline, the current ergonomics hegemony has a positivist-empiricist approach where the social world is treated like a given object which provides an instrumental form of knowledge about the social institutions and forces that control the environment in which economics works, namely the state and private companies [15].

Reflecting on the methodological and instrumental aspects of ergonomics, its growth and extent are consistent with the positivist and post-positivist paradigm hegemony. The vast majority of published studies and research works of a scientific nature are backed by quantitative and qualitative measurements that have been obtained by manipulating experimental variables or falsifying hypotheses. The statistical treatment of the data obtained in these studies is one of the cornerstones of their credibility and scientific validity. In this context where ergonomics is a scientific discipline, the human being and his behaviour are seen as "objectivised" parts of, and separate from, what it means to be a "subject", to be understood from physical, physiological and cognitive viewpoints.

4. The Concepts of 'Human Being' and 'Social Subject' in Ergonomics

4.1. Traditional Understanding of 'Human Being' in ergonomics mainstream

A historical review and understanding of the ontological and epistemological principles of ergonomics [11] [5] [15] allows us to explain, on the one hand, that the goals of ergonomics and the threads that run through it are productivity, efficiency, safety and health, and on the other hand that the way of approaching it is by studying the interaction between the human being and technology [19]. But can any conceptual and practical approach be recognised to a dimension which transforms the view of the human being into a social subject? Ergonomic praxis and theory do not reveal any explicit allusion to the social subject. As it does not appear, the subject in ergonomics can be said to be an abstract ideal of "human being" [18] which only takes on a concrete form in elements of the subject that can be physically or cognitively identified in the interaction, such as its anthropometric dimensions, its biomechanical capabilities and its ability to give answers in the cognitive plain.

In systems ergonomics and Human Factors, the human being is not recognised as a subject, and is understood to be nothing more than just one more

element in the system. Now, currents exist which approach the social subject concept either explicitly, as with the Activity Theory, or implicitly, such as Participatory Ergonomics. Authors linked to movements towards social and cultural ergonomics have also turned their attention to the social and cultural dimensions of the interaction between the human being and technology [19] [20] but without talking explicitly of the human being as a social subject.

4.2. *The Contribution of Activity Theory*

The most notable trends in Activity Theory (Russian, French and Nordic) are permeated by Vigotsky's theory. Vigotsky concentrates his attention on the fact that individuals develop on the basis of a socio-cultural learning process. For Vigotsky, it is social interaction in a context and the collective ability to apprehend and imitate that stimulate the natural or base line for development in individuals. In line with this approach, these trends champion the idea that the human being should be considered as a subject rather than as a simple element in the system. This becomes particularly clear from a reading of the theoretical proposals in the Russian [21] and French [22] [23] approaches, where the term 'human being' is almost always replaced by the word 'subject'.

Taking into account the aspects that Daniellou and Rabardel [17] state are common to all activity-orientated perspectives, we will now discuss some of the ones that we believe contribute to building the social subject concept. On the one hand, it is suggested that activity is a social, cultural and historical construction. If we accept these dimensions of activity, they can be recognised implicitly in those who engage in such activity, namely the subjects. On the other hand, recognising that activity is unique enables us to identify whoever engages in action as individuals with diversity and variability, thereby distancing them from an abstract and generalised ideal and bringing them closer to the concept of subject. A third aspect points to the importance of the subject's life experience, which affects and redefines the activity. Finally, by recognising that activity is an integrating factor where subjects' motivations and goals come up against other decisive ones, reference is made to subjective and tacit dimensions of the human being, once again removing it from an abstract ideal and bringing it closer to a socially-situated dimension. In conclusion, this trend offers a concept of the human being that is much closer to what a social subject would be.

4.3. *The Change of Paradigm in Participatory Ergonomics*

Participatory ergonomics [16] is recognised by some authors as being part of macro-ergonomics, since it is used in approaching the organisational structure from the bottom upwards [24]. However, the way in which participatory ergonomics approaches both the generation of knowledge and intervention of the object ergonomics is studying is, in our opinion, from a different paradigm, one that distances itself from positivism and is closer to a participatory paradigm [14]. It is participatory ergonomics practice that has led to this approach, albeit without thinking. The fact of involving the worker as promoter of change means that rather than being an object that is observed, he becomes a subject who builds. The person is not treated as an object, since all his human dimensions are involved, in a comprehensive manner. It should be stressed that participation does not consist of asking questions, but rather of involving participants emotionally and actively in the process: in other words, moving away from mere information to negotiation and making decisions by mutual agreement.

Participatory ergonomics has an approach that is in some way ethnographic, because it recognises and is based on people's 'ability to act', and is therefore directly associated with the notion of agency. Recognising the personal sphere and workers' ability to decide (agency) has had a major impact on the social transformations at work that have been achieved when the ergonomist changes in his praxis from seeing a human being as someone stripped of decisions and hence of agency and power to someone who is empowered and fully capable of acting and deciding. Quite apart from the instrumental advantages of participation, what is really important in its approach is its ontological implication, since it views the subject studied in a different way, recognising that the human being has social subject qualities.

5. **Some Implications of the 'Social Subject' Concept in Traditional Ergonomic Trends**

With a view to expanding on the 'social subject' notion, we reviewed a series of authors who have helped make the concept clear, from the philosophy and sociology perspective. According to Judith Butler [2], 'subject' is not interchangeable with 'person' or individual. She suggests that 'subject' should be viewed as a linguistic category and a structure that is being formed. No individual therefore becomes a

subject before first undergoing subjection or experiencing 'subjectivisation'. Excluding certain Activity Theory authors, ergonomics generally talks of human beings or individuals, when in reality what it is referring to is subjects. By way of example, every worker, without exception, is subordination and power in the terms stated by Butler.

5.1. *Journey and Project*

According to Gabriel Restrepo [18], as subject, everyone receives a mark that is impressed on him or her in the form of a journey and a project; in other words, there is a history and a power. According to the review carried out by Restrepo, the subjectivity and sociability of the subject are formed from recognition (Hegel), sexuality (Freud in relation to the father and Klein in relation to the mother), death (Heidegger, Sloterdijk), and power (Foucault). In comparison with the dynamic proposal put forward by this author, where the subject has a history which marks and defines him as well as an evolution that guides him, ergonomic analyses are traditionally static, without any history or context, as if the human being was frozen while performing an activity, irrespective of what he did before and how he projects himself, which is equivalent conceptually to stripping him - in analysis terms, at least - of what subjects him and what empowers him.

5.2. *Structure*

The first thing we would like to establish is that the term 'social subject' should not be taken as referring to a rigid structure, as concrete structuralism conceives it, where people are viewed as static subjects in the structure, but rather as relational and interdependent.

On the question of structure, Giddens understands it as being the 'structuring property', or structuring properties which provide the time and space 'connection' in social systems. Moreover, the author states that these properties can be viewed as rules and resources that are involved resourcefully in the reproduction of social systems [1].

In ergonomics, and especially in organisational ergonomics, the question of structure is predominant, even though it is not explicitly conceived in the terms stated by Giddens. Three basic dimensions are recognised in the structure of a work system: complexity, formalisation and centralisation [24].

When a start is made on designing a work system, the objective of the system is made clear, together with the respective mission processes and the most efficient flow in each specific work process, after which the structure is designed in the most relevant complexity, formalisation and centralisation terms, depending on the purpose of the system. This thus finally translates into rules and resources that are coordinated in the system and come to life whenever the subjects perform activities. Now, pronounced differences and disassociations often occur between the 'ideal' work system that is designed and the actual system that is commissioned. Rules generate practices, where the relationship is neither linear nor causal.

In view of the above, we are of the opinion that the approach that is used when designing socio-technical systems is limited, because it does not take more profound social aspects into account, a result once again of starting out from the concept of individuals or human beings rather than subjects. They call themselves socio-technical systems because they consist of a social subsystem and a technical subsystem, but the 'social' concept is simply because they are human beings and not because they are conceived as social subjects.

5.3. *Agency*

A further point worth analysing in the subject is 'agency', or the ability to act. Although the concept has been worked on by other authors, we will concentrate here on the arguments put forward by Anthony Giddens [1]. This author considers the subject to be a human agent - in other words, he possesses agency, or 'action'. Moreover, he connects the notion of action with that of structure, in that the latter is immersed in the conditions and consequences of the action. We will therefore clarify what the author proposes with respect to these terms. Giddens uses the words 'action' or agency to describe a continuous flow of conduct, a current of real or envisaged causal interventions by corporeal beings in the outcome of events in the world, and he considers it an error to understand action outside the context of historically-located modes of activity. In turn, he states that human behaviour has an intentional or purposeful character, one that is viewed as a process, and he associates this with reflexive follow-up on action. He also points to the rationalisation of actions, stating that this is the ability that human agents possess to 'explain' why they act as they do by giving reasons for their conduct. Furthermore, he defines the motiva-

tion for action as the organisation of the actors' desires or wishes, which extends to conscious and unconscious aspects of cognition. Intentions are also connected to certain unknown conditions of the action relating to unconscious motives operating on the outside and to unintentional consequences of the action, which are incorporated systematically into institutions' reproduction process and in turn condition the action [1].

In ergonomics we analyse actions all the time, because it is in them that the interaction between the subject and the other elements of the system ultimately manifests itself. Now, the concept of action in this field is very much flatter than that proposed by Giddens, since action in the hegemonic current of ergonomics is more of a mechanical sequence of operations performed by the individual and the system, which accordingly produces certain effects both in the human being and in the system. On the other hand, as the history is not relevant, the analysis concentrates on what can be observed at the time. A number of questions could be asked at this point, such as what does ergonomics do to understand action outside the historically-located activity? What consequences appear, in terms of the (limited) understanding of the subject? How would the understanding of the subject benefit - i.e. of his actions - if the analysis were to include aspects like intention, rationalisation, motivation and the unintentional conditions of the action?

5.4. Motivations

In order to study the question of motivations, we used as reference the proposal made by Bourdieu [4], who goes beyond the traditionally-adopted concept of motivations in scientific discourse by introducing the concept of social *illusio*, which contains the notions of social libido, inversion and *illusio*. We talk of motivations on the basis of this line of thought, but it should be taken in the broadest sense of the matter. Authors like Klippendorff [5] also refer to Bourdieu thought, in order to establish a difference between what could be extrinsic motivations associated with measuring the compatibility of technological devices and intrinsic motivations, which are more closely related to the notion of social *illusio*.

If work is taken to be one of the social practices, it is fundamental to establish what the French trend in ergonomics calls a situated approach for it to be 'real' - in other words, recognising work as a particular and historically-situated empirical reality, which corres-

ponds totally to the relational analysis in Bourdieu thought.

An interesting conception of the habit notion was put forward by Norros [25] in the approach to the situated historical-cultural activity analysis, in conjunction with the pragmatic (semiological) conception proposed by philosophers and sociologists like Peirce, Mead and Dewey, for explaining more fully the complex dynamics of constructing actions. However, we would like to reinforce and expand further on the notion, and this is why we refer to the social *illusio* notion in Bourdieu thought, which can include and boost the habit notion in Activity Theory, coined by Norros, by adding a recognition of social libido to motivation and conditions for action, as something more inherent in or incorporated into the subject that induces it (consciously or unconsciously) to action and to being capable of being recognised or simply being part of the game.

In line with the foregoing, we only establish and understand the complexity of motivations and their effect on work if this 'understanding' comes from the subject rather than, as positivist ergonomics claims, from the 'objectivised human being', where it is therefore stripped of any type of intention. This subject is 'subject' - the redundancy is valid - to differentiation principles like the economic capital and the cultural capital he possesses or to which he belongs. Every 'worker' (manager or assistant) establishes his social position, the position he adopts, and finally assumes his habits in a given field of work. In other words, it is understanding that each worker is subject to the field, to his habits, to his positions and the position he adopts. These three aspects act as the cornerstone for agreeing and thinking that 'being in the game' is worthwhile.

If the social *illusio* concept is recognised, an analysis, as system, is insufficient in itself for transforming work unless the habits of the different actors are recognised in the different fields. There are 'sensitive' people in ergonomic practice who can detect this in workers, especially in participatory interventions, because these participatory approach practices already recognise, albeit not explicitly, the incorporated structures (habits), and above all do not delimit or isolate the human being in order to 'objectivise' him.

5.5. Power

Michel Foucault [3] proposes the word technology for referring to the matrices of practical reason. He points to four types of technology: production tech-

nology, sign system technology, power technology, and 'I' technology [3]. The author states that these different types of technology almost never function separately. We have concentrated in ergonomics on production technology, and have expressed little or no interest in other types of technology. Now if, as the author states, all of them are in some way related, what are the consequences for understanding the interaction by the subject and the remaining components in a system of considering just one of these types of technology and ignoring all the others? Even more so, in terms of conception or projection, how can we pretend to generate a particular subject-object interaction (i.e. a given behaviour in the subject) if we do not take into account the way in which different types of power operate on him?

Foucault argues that exercising power refers to the way in which certain actions modify others: the government of men by other men [3]. In line with this, to govern is to structure the possible path taken by others, and the effect of the relationship of power itself would not lie in the field of violence or struggle, or in that of voluntary union, but rather in the area of singular means of action [3]. Following the consequences of Foucault's proposal with respect to the act of governing, ergonomics, as a profession and even as a discipline, exercises a type of government over subjects insofar as it sets out to establish and regulate more or less considered and calculated action modalities, aimed at acting on the action possibilities of others. Put another way, ergonomics ignores or gets round the reflection on power, but exercises power in all its action scenarios.

6. Discussion

In ergonomics, the term 'social subject' and everything that that notion implies has not been tackled explicitly. Definitions of ergonomics, including the one proposed by the International Ergonomics Association (IEA), talk of 'man', 'human being', and in the best case, 'person'. Only scholars working on Activity Theory talk about 'subject'. This is in line with technological determinism [26], where the hegemonic mainstream of ergonomics, as a scientific discipline, lies. However, as a practice, interventions centred on activity and participatory ergonomics [16] show an approach that is related to the notion of 'social subject'. Activity theory recognises the relationship between subject, language and context, while participatory ergonomics assumes tacitly that the human being is a 'social subject', recognising agency, experience, motivations and creativity.

Participatory processes have been incorporated into ergonomics and occupational health regulations and standards, due to the positive effect they have in practice. The charisma of the process leader has also been associated with them. We are of the opinion that apart from the reasons already acknowledged, success lies in the fact that this approach implicitly recognises that the worker is a social subject.

Human models used by ergonomists implicitly accept the existence of one or more description levels - i.e. biological, cognitive, psychic and social - but they concentrate on just one or two levels [27], in most cases assuming that only the level tackled level is the relevant one. Consequently, the understanding of the human being is fragmented, and the health-disease process is explained only at the level analysed, with the interaction being divided and "frozen" so that it can be understood.

Ergonomics, as an autonomous discipline, concentrates on understanding and intervening the interaction between human being and technology, but the understanding of and intervention in this interaction depends on how the elements that are interacting are conceived; in other words, on what the human element is and how it is understood, and what the technology is and how it is understood. Ergonomics therefore needs to lead the discussion of how the human being is conceived, and symmetrically, how technology is conceived.

When we recognise the human being as a social subject, it becomes easier to understand and intervene the health-disease process: it is accepting that a person does not get ill instantly, suddenly. Talking of human beings means that risks can be recognised, something that is important from the administration and assurance perspective, especially in work accidents, but talking of social subjects allows other dimensions to be recognised, ones which determine a specific interaction, such as agency, motivation, structure and power.

Changing the concept of 'human being' to 'social subject' is equivalent to 'unfreezing' ergonomics, because it means recognising that interaction is not static, but rather a flow where journey and project are part of the interaction.

7. Conclusions and Future Work

Ergonomics is currently moving in three paradigms: the traditional and still hegemonic trend is strongly inserted into the positivist paradigm, while the Activity Theory trend approaches interaction

from a constructivist perspective and participatory ergonomics does so from the participatory paradigm.

The traditional trend offers an 'objectivised' view of the human being that has enabled a deeper understanding to be gained of specific, fragmented aspects of the human being, but it is nevertheless limited when it comes to achieving changes in the real work situation. The Activity Theory and Participatory Ergonomics trends have a conception that is much closer to the human being as social subject.

There is a need to build bridges between the different paradigms, rather than a general definition of ergonomics like the one accepted and promulgated by the IEA. Rather than searching for a unified theory it is a question of performing a triangulation where the concept of social subject can act as a bridge.

We propose changing the notion of 'human being' to that of 'social subject', recognising that what a person does now and how he/she does it is determined by his/her history (route) and by his/her project, and not just by what traditional ergonomic instruments can register. This should be applied even if we are concentrating on measuring biomechanical movements or cognitive responses, so as not to forget that data gathered in an analysis from a specific viewpoint is just that, a limited, fragmented and static picture of the interaction.

Recognising human beings as 'social subjects', with their routes, projects, structure, agency, motivations and power, can contribute to a comprehensive understanding of interactions between these and technology, in order to improve the understanding and intervention of the health-disease process.

References

- [1] Giddens, A. 1979. *Central Problems of Social Thought*. Berkeley, University of California Press. pp. 49-95.
- [2] Butler, J. 2001 [1997]. *Mecanismos psíquicos del poder. Teorías sobre la sujeción*. Madrid: Ediciones Cátedra; Instituto de la Mujer, Universidad de Valencia.
- [3] Foucault, M. 1991 [1983]. *El sujeto y el poder*. En: *El sujeto y el poder*. Bogotá, Carpe Diem Ediciones.
- [4] Bourdieu, P. 1997. *Razones prácticas sobre la teoría de la acción*. Barcelona, Anagrama.
- [5] Krippendorff, K. 2004. *Intrinsic motivation and human-centred design*, *Theor. Issues in Ergon. Science*, 5: 1, 43-72.
- [6] Stephans, R. A., 2004. *System safety for the 21st century: The update and revised edition of system Safety 2000*. New Jersey, United States: Wiley-IEEE.
- [7] Navarro López, V. 1998. *El Concepto Actual de la Salud Pública*. En: Martínez Navarro F, Antó JM, Castellanos PL, Gili M, Marsset P, Navarro V. *Salud Pública*. Madrid. McGraw Hill-Interamericana: 49-54
- [8] Imada, A.S. 2007. *The value of participation in ergonomics*. En: Pikaar, Koningsveld and Settels (Eds) *Meeting Diversity in Ergonomics*. Elsevier. 91-98.
- [9] Jastrzebowski, W.B. 2000 [1857] *An outline of ergonomics: or the science of work based upon the truths drawn from the Science of Nature*. Commemorative Edition. CIOP, Warsaw.
- [10] Coriat, B. 1991 [1979]. *El taller y el cronómetro. Ensayo sobre el taylorismo, el fordismo y la producción en masa*. Siglo XXI: México D.F.
- [11] García Acosta, G. 2002. *La ergonomía desde la vision sistémica*. Unibiblos: Bogotá.
- [12] Murrell, H. 1965. *Ergonomics: Man in his working environment*. Chapman and Hall: London and New York.
- [13] IEA – International Ergonomics Association. 2000. *Definition of ergonomics*. <http://www.fees-network.org/what-is-ergonomics/iea-definition.html>. Accessed: March 13, 2009.
- [14] Guba, Egon & Lincoln Yvonna. 2005. *Paradigmatic Controversies, Contradictions and Emerging Confluences*. In: Denzinger, Norman; Lincoln, Yvonna (Ed). *The sage Handbook of qualitative research*. Sage (3 Ed) Sage Publications. 191-215.
- [15] Wilkin, P. 2009. *The ideology of ergonomics*. *Theor. Issues in Ergon. Sci.* ifirst 1-15.
- [16] Imada, A. S., 1991. *The rationale and Tools of Participatory ergonomics*. In: K. Noro and A. S. Imada, eds. *Participatory ergonomics*. London: Taylor & Francis. 30-49.
- [17] Daniellou, F. & Rabardel, P. 2005. *Activity-oriented approaches in ergonomics: some traditions and communities*. *Theor. Issues in Ergon. Sci* (6) 5. 353-357.
- [18] Restrepo, G. 2008. *La promesa de Telémaco: arqueología del sujeto*. *Universitas Humanística* No. 65, Bogotá, pp 49-71.
- [19] Brown, J.S., 1986. *From cognitive to social ergonomics and beyond*. In: D.A. Norman, and S.W. Draper, eds. *User-centered system design: new perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum, 457-486.
- [20] Holden, R. J. 2011. *Social and personal normative influences on healthcare professionals to use information technology: towards a more robust social ergonomics*, *Theor. Issues in Ergon. Science*, First published on: 28 March 2011 (iFirst)
- [21] Nosulenko, V.N., Barabanshikov, V.A., Brushlinsky, A.V. & Rabardel, P. 2005. *Man-technology interaction: some of the Russian approaches*. *Theor. Issues in Ergon. Science* 6 (5) 359-383.
- [22] Rabardel, P. & Beguin, P. 2005. *Instrument mediated activity: from subject development to anthropocentric design*. *Theor. Issues in Ergon. Science* 6 (5) 429-465.
- [23] Daniellou, F. 2005. *'The French-speaking ergonomists' approach to work activity: crossinfluences of field intervention and conceptual models'*, *Theor. Issues in Ergon. Science* 6 (5) 409-427.
- [24] Hendrick, Hall W. (2002) *An overview of macroergonomics*. En: Hendrick, Hall W. & Kleiner, Brian M. (Eds) *Macroergonomics: Theory, methods and applications*. Lawrence Erlbaum Associates, (pp 1-23) Mahwah, New Jersey.
- [25] Norros, L. 2005. *The concept of habit in the analysis of situated actions*. *Theor. Issues in Ergon. Science* 6 (5) 385-407.
- [26] Bijker WE, Hughes TP, Pinch TJ. 1989. *The social construction of technological systems: New directions in the sociology and history of technology*: the MIT Press.
- [27] Daniellou, F. 2001. *Epistemological Issues about Ergonomics and Human Factors*. In: Karwowski, W. ed. *International Encyclopedia of Ergonomics and Human Factors*. London: Taylor & Francis.