

Cognitive ergonomics quality of human-system interaction in metal furniture products

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Abstract: Cognitive ergonomics is one of the most important ergonomics disciplines associated with various aspects of design, among which is metal furniture design as a design system that is directly connected to the human- system interaction, hence, is a key towards achieving a quality interaction with humans. Cognitive ergonomics, in general, deals with the quality of work required in joint systems products. The research seeks to monitor the main challenges for cognitive ergonomics in designing metal furniture, through the harmonization of dynamics technology development and the complexities of social , cognitive and affective processes in the user environment, taking into consideration the diversity and multiplicity of human needs. According to ISO 9241-210, ergonomics quality is considered one of the most important modern standards and this paper provides a set of challenges and considerations associated with the quality of cognitive ergonomics in designing metal furniture products applied in various work environments at the present time.

Keywords: Cognitive ergonomics, human-system interaction, metal furniture products.

1. Introduction to Cognitive Ergonomics

Human factors and ergonomics are two different names for the same discipline, which is the science concerned with understanding the interaction between humans and other elements of a system.

Cognitive ergonomics is one of the most important ergonomics disciplines associated with various aspects of the design.

1.1 Usability in Cognitive Ergonomics

Usability is the performance of users and the possibility to achieve any function effectively; it is the facility for the user "to achieve tasks" that are put to him. Usability is also the study and the measurement of comfort and ease of use in relation to users interact with the system.

The greater the compatibility between human performance; and using the elements of the product or system; the greater amount of usability achieved. This means that the verification and check of the amount of usability reflects the extent of performance and quality of elements-use in ergonomics design,

The benefits of designing a usability system -summed up in fig. 1- are:

- Increased productivity.
- Reduced errors.
- Reduced training and support.
- Improved acceptance.

- Enhanced reputation. (Maguire,M.,2001)

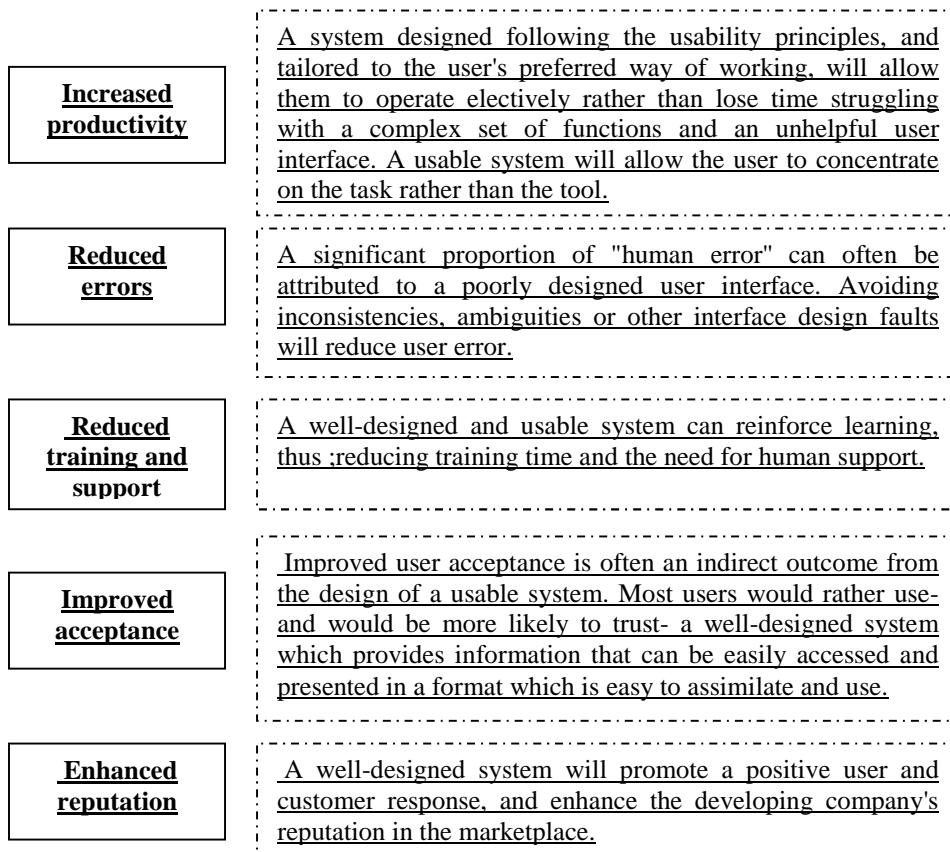


Figure 1. The benefits of designing a usable system

With all these potential benefits, it is fair to say that there are many systems that still are not designed for greater usability.

Usability attributes are divided into five sections including: learnability, efficiency of use, memorability, few or non catastrophes and subjective satisfaction· as shown in the next figure.



Figure 2. Usability Attributes

1.2 User-Centeredness as a Design Approach in Cognitive Ergonomics

Centeredness design is an approach to interactive systems development, that aims to make systems more usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, as well as usability knowledge and techniques. This approach enhances effectiveness and efficiency, it improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance. (EUROPEAN STANDARD, EN ISO 9241-210, 2010)

User-centeredness as a design approach has resulted from the emerged fields of usability. One of the earlier disciplines in this field is the cognitive ergonomics and interface design studies (Bremner 2007)

The Usability Professionals' Association (2011) has assembled a more detailed list of principles for usable design, which includes:

- Usefulness (value, relevance)
- Consistency (consistency and standards, real-world conventions)
- Simplicity (simplicity, visibility, self-evidence)
- Communication (feedback, structure, sequencing, help and documentation)
- Error prevention and handling (forgiveness, error recovery, undo and redo)
- Efficiency (efficacy, shortcuts, user control)
- Work load reduction (supportive automation, reduce memory load, free cognitive resources for high-level tasks)

User-centered design is a controversially discussed topic in regards to creativity, innovation and the boundaries of design as a profession. By including the user in the design process, the design team can be aware of the risks and opportunities of a shared approach. User-centered design does not only concentrate on the user in the sense of an external consumer of a product or service, it exists within design teams and within the mind of the designer itself. (Merdes, C.2011)

1.3 Human –System Interaction in Cognitive Ergonomics

The field of “interaction design” encompasses scientific and engineering disciplines, the human and social sciences, and the design disciplines. (Victor, K. & Liam, B., 2009)

Human –System Interaction is a recent development that has arose from studying the human-factors and system interactions. It reflects the interactive relations between the user and the system, and achieves the specific purposes and uses of the system and examines the ways in which people will work with a system in a specific field.

Human –system interaction addresses the set of issues concerning the manner in which a user or operator interacting with a system carries out activities to meet system or user objectives. The particular forms of human –system interaction govern the extent to which both the overall system and users meet objectives in efficient and save ways and reduce the occurrence of human error .(Sage ,A. P., Rouse ,W. B. ,2011)

Ntuen, C. A., Park,E. H. (1996) considered human –system interaction still and will continue to be the major interest to many researchers in engineering, computer scientists, psychologists, and social scientists.

2. Cognitive Ergonomics quality

Quality is generally treated as a property of a product, thus the product view of quality seeks to identify those attributes which can be designed into a product or evaluated to ensure quality. Quality: the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs. (ISO 8402)

The specification of product quality provides the requirement for the quality system. Manufacturing quality is achieved if the product matches the specification, although the quality of the final product can be no better than the quality of the specification.

Cognitive ergonomics quality deals with the quality from the perspective of usability, user centered design and ergonomics of human-system interaction.

2.1 Usability

Usability is defined as the effectiveness, efficiency and satisfaction a user experiences during the usage of a system (ISO9241-11, 1998; ISO9241-210, 2010). Usability refers to: The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use, where usability is the primary goal: here, a multidisciplinary design effort is required (ISO9241-210, 2010)

Quality in use in any particular system depends not only on its usability, but also on the appropriateness of the provided functionality for a given task, the performance that users can achieve using the system and the reliability of the system (Bevan,N., 1997).

2.2 User Centered Design

User centered design, as described in ISO 9241-210 (2009), is the primary and universally accepted design-for-usability method.

It describes user-centered design as a multi-disciplinary activity, which incorporates human factors and ergonomics knowledge and techniques, with the objective of enhancing effectiveness and productivity, improving human working conditions, and counteracting the possible adverse effects of the use.

Human – Centered Design is characterized by: The active involvement of users and clear understanding of task requirements: The interaction between user and technology, The iteration of design solution : Multi disciplinary design " ISO - 13407

2.3 Ergonomics of Human-System Interaction

Ergonomics of human-system interaction (ISO 9241-210:2010): Human-centered design for interactive systems provides requirements and recommendations for human-centered design principles and activities throughout the life cycle of computer-based interactive systems. It is intended to be used by those managing design processes, and is concerned with ways in which both hardware and software components of interactive systems can enhance human–system interaction. ISO/TS 18152:2010 for Ergonomics of human-system interaction - Specification for the process assessment of human-system issues presents a human-systems (HS) model for use. ISO/IEC 15504-conformant assessment of the maturity of an organization in performing the processes that make a system usable, healthy and safe describes processes that address human-system issues and the outcomes of these processes. It details the practices and work products associated with achieving the outcomes of each process.

3. Cognitive Ergonomics quality in the Design of Metal Furniture Products

Electronic and digital evolution led to the great development and expansion of the control elements and use of products and systems, it resulted the need for more quality and more accurate use performance and. So it became necessary to have a plus interest in cognitive ergonomics in design of products and systems to achieve the highest levels of usability

Cognitive ergonomics quality is considered one of the quality fields associated with various design fields, including metal furniture as a system located directly within the human-system interaction, and linked to the achievement of the quality of the interaction with a human.

3.1 Quality Considerations in Metal Furniture Products

The design research in the field of metal furniture ensures the ability of quality in maximizing the added value and competitive advantage of the metal furniture products, which became one of the fundamental ideas in product development strategies.

Achieving the goals of quality depends on the adoption of good design service-oriented functional purpose in the most successful way, through innovation, brainstorming, flexibility and the ability to change for the better.

According to the cognitive ergonomics; quality definition which is associated with the use of specific standards in metal furniture field, includes:

- Utility: The output of the service given by the metal furniture product
- Capacity: The sufficient quantity to the ability of the type of the metal furniture product.
- Credibility & Reliability.

Metal furniture usability activities can be divided into the following:

1. Research studies on users' needs and their priorities and the general context of use of metal furniture product.
2. Evolution: Note Rating and testing of usability standards of metal furniture product.
3. Design development: achieve the design concept of the of metal furniture product according to the standards of usability.

Access to a good design for metal furniture products which achieve high quality in all its properties and beneficial in its final form, requires the development of a design plan that begins with studies of the design, production and marketing to find out the requirements of users and different levels of quality.

Achieving good designs that meet user acceptance, and appropriate quality standards needs applying Cognitive Ergonomics Quality considerations in Metal Furniture Products Design. This will provide the access to all the benefits of the product functional strength and durability and the use of appropriate materials for high quality performance.

The next figure explains the steps to apply cognitive ergonomics quality considerations in metal furniture products design

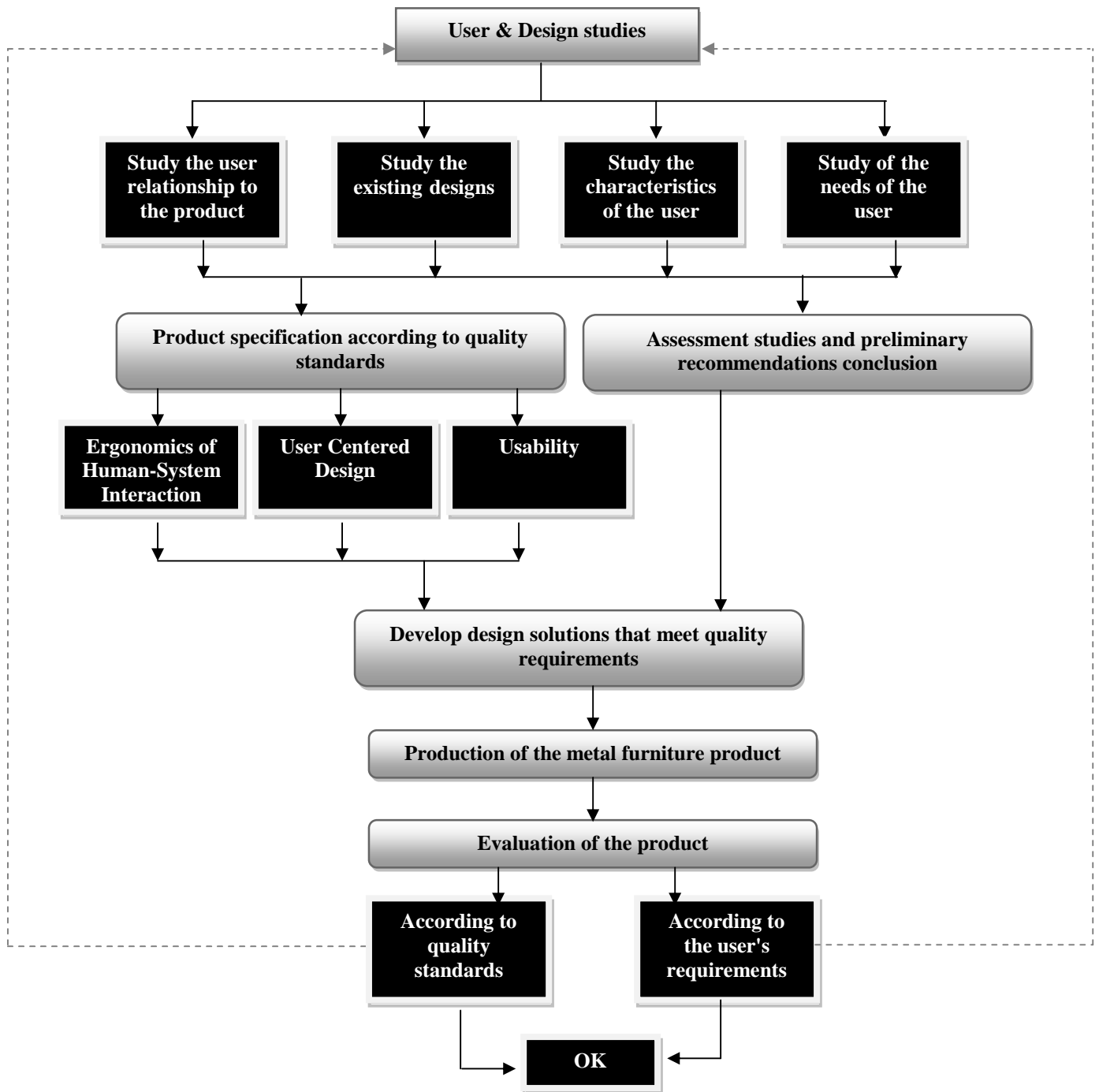


Figure 3. Applying Cognitive Ergonomics Quality in Metal Furniture Products Design

4. Conclusions

There are many challenges for applying cognitive ergonomics quality in metal furniture products, which can be summarized as follows:

- Metal furniture as an industrial product which requires a high degree of innovation and development, as well as building a continuous quality strategy able to invent new products and markets, extends the user's attention

through the confirmation of the quality standard on the user centered design. This can be done through the provision of metal furniture products needed by the user in the current stage and providing products that meet his expectations for the future.

- Cognitive Ergonomics quality in the field of metal furniture won't create a competition between products but between industrial enterprises, hence the production of metal furniture in the industrial sector in the future should adopt strategic thinking, whether technical, administrative or marketing, this strategy aims to apply quality standards in levels of usability, user centered design and human-system interaction.
- The field of metal furniture is full of future prospects in terms of diversity and abundance of design solutions, the use of raw materials and advanced technologies which suit the interactive technological age; this is evidenced in the metal furniture industry boom in production methods and computer-aided manufacturing, increasing the ability to profiling, precision and quality.

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