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Ergonomics and Its Applicability in the Design Process in Egypt Challenges and Prospects

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***Abstract*—**Egypt suffers from a severe shortage of data and charts concerning the physical dimensions, measurements, qualities and consumer behavior. The shortage of needed information and appropriate methods has forced the Egyptian designer to use any other foreign standard when designing a product for the Egyptian consumer which has led to many problems. The urgently needed database concerning the physical specifications, measurements of the Egyptian consumers, as well as the need to support the Ergonomics given courses in many colleges and institutes with the latest technologies, is stated as the research problem. Descriptive analytical method relying on the compiling, comparing and analyzing of information and facts in order to get acceptable perceptions, ideas and considerations is the used methodology by the researcher. The research concludes that: 1. Good interaction relationship between users and products shows the success of that product. 2. An integration linkage between the most prominent fields of science specially Ergonomics, Interaction Design and Ethnography should be encouraged to provide an ultimately updated database concerning the nature, specifications and environment of the Egyptian consumer, in order to achieve a higher benefit for both user and product. 3. Chinese economic policy based on the study of market requirements long before any market activities should be emulated. 4. Using Ethnography supports the design activities creating new products or updating existent ones through measuring the compatibility of products with their environment and user expectations, While contracting a joint cooperation between military colleges, sports education institutes from one side, and design institutes from the other side to provide an ultimately updated (annually updated) database concerning some specifications about students of both sexes applying in those institutes (height, weight, etc.) to provide the Industrial designer with the needed information when creating a new product or updating an existing one concerning that category is recommended by the researcher.

***Keywords*—**Adapt ergonomics, ethnography, interaction design.

I. Introduction

SINCE the beginning of the creation man sought for solutions to the problems that disturbed or threatened his survival. The solutions were classified as products. These products were not as beautiful as they were functional. Due to the development of mankind, the improvement of these products in order to look more adaptive, usable and beautiful was also needed. Dealing with any labor laws or actions in accordance with natural laws, a two old Greek sectioned term named Ergonomics, *Ergon* which means work and *Nomos* which means "law" was firstly introduced by the Poland Wojciech Jastrzebowski in 1857 [1], [2]. During the First World War scientists began using Ergonomics in a limited way in order to study the soldier's performance during war battles. By the end of the First World War and during the Second World War, the interest and usage of that science has reached an unlimited end in order to study the soldier's minimum and maximum limits during combat operations. By the end of the war scientists tried to apply what they have gained in the field of Ergonomics on various fields of life that serves mankind.

The first conference named Ergonomics for that new science concerning various engineering, medical and applied sectors took place in Oxford by 1949 [3]. By 1950 the term Ergonomics was first officially used by the British professor Murrell while a corresponding term named "Human factors engineering" was used in the United States by 1957 [4].

Aiming to improve the correlation between human, product and environment is the main theme of Ergonomics, so it is necessary to study everything that affects the performance and safety of both human and product either by:

A) Checking whether the product is designed to fit the working environment in a process that can be called "making work suitable for humans".
B) Improving man himself by better means of selection of personnel and training to suit the working and environmental conditions.

II. Goal of the Research

Activating the role of both Ethnographic and Interaction design studies as examples of the most prominent sciences to enrich the field of Ergonomics in order to improve the Egyptian design process as happened in the Chinese experience.

III. Hypothesis

If we could use Ethnography and Interaction design as examples of the most prominent sciences in order to achieve an ultimately updated Ergonomic database concerning the physical dimensions, specifications and recommendations of the Egyptian consumers, a raise for the Egyptian industrial and economical policies and activities could be achieved as happened in China by the beginning of the third millennium.

IV. Definition

Ergonomics is the science that deals with the interaction between humans and other elements, and uses information, theories and design methods to improve human life and overall performance. Considering job design, regulations,

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products and functions and the way of matching them with the human needs, skills and limits could be stated as the main target of Ergonomic specialists. Or it can be defined as the science that the world has devoted to fetch, evaluate, address and display data concerning the human body and its relationship with product design and conditions that regulate its working environment. The design economy could be defined as a way of applying a huge amount of data concerning machines, system tasks, functions and working environments seeking a safe, comfortable use.

The Executive International Ergonomics Association Council had also defined Ergonomics as the domain of science that concerns with understanding the interaction between humans and other components in their system, and that is a profession that applies scientific theories, principles, data and appropriate methods in a design that can achieve a more comfortable, safer, better performance of functions [2].

Ergonomics is about "fit": the fit between people, the things they do, the objects they use and the environments they work, travel and play in. If good fit is achieved, the stresses on people can be reduced. They are more comfortable; they can do things easier and faster and even with fewer mistakes [5], [6]. It can be also described as "an engineering science concerning the physical and psychological relationship between both machines and their users. The role of the Ergonomist is to assess these interactions trying to improve the efficiency and reducing strain and discomfort [5]. Applications may include the layout design, the place where the machine gauges and switches could be placed etc." [5], [6]

Many authors and writers have dealt with the concept of Ergonomics and human factors engineering, its definition and explanation which can be summarized as follows:

Slack refers to human factors engineering as a doorway, which mainly depends on the physical variables relating to the work design, which is based on the human body in order to facilitate operations and environment standards [7].

Al Ahmar indicates that human engineering is an engineering science concerned with the physical convenience and psychological connection between machines and humans when handling and use, so the human engineering specialist should evaluate these interactions in a way to improve performance and reduce stress and discomfort [8].

While Fredrick reported that the human engineering is a way of finding a friendly working environment for both workers and users, in order to reduce the predicted injuries or risks [8].

Bashir and Aldahshan explained in their book "Occupational safety" that Ergonomics is the science that improves and styles any work environment to suit the human health, so it can be said that Ergonomics is the study of psychological relationship between human beings, environments (tools, equipment, facilities, etc.), job requirements and methods of performance [8].

Referring to the previous mentioned definitions, we can conclude that in order to get the maximum benefit from Ergonomics we should achieve the following aspects:

1- Understanding the interactions between humans and other components in their system.
2- Achieving compatibility and convenience among, humans, objects and working environments (working environments and conditions).

In order to achieve that the researcher indicates that we should draft a joint cooperation between Ergonomics and the latest fields of science such as Ethnography and Interaction design, that we will take a look on them as follows:

A. Interaction Design

By the eighties of the last century, Moggridge managed to realize a new term firstly known as "soft Face" then modified to "Interaction Design" [9]. Interaction design is the art of drafting a facilitated interaction style between humans (or their agents), using products [10]. It can be described as a combination of theory and technique from one side, psychology and art from the other side in a way that constructs a special design approach that differs from other scientific and engineering ones. It concerns with the behavior of products, with how products work. Interaction designers spent a lot of time trying to define these behaviors having a main goal of how to facilitate interactions [10]. So, we can simply describe the discipline of interaction design as defining the behavior of artifacts, environments, and systems, therefore it concerns with:

- The way of defining the form of products, and how it relates to their behavior and way of use.
- Expecting the effect of product use on human understanding and relationships.
- Reconnoitering personal, cultural and historical characteristics of both people and products that may be estimated users and contexts [11].

So, we can describe the Interaction Design as the design of products that are usable, learnable and effectively used, which means that the product should be designed to be a good tool in terms of efficiency and effectiveness, in addition to providing users with an enjoyable experience when used.

Counting the number of interactive products in our daily lives is considered one of the most difficult tasks, where multiple and different shapes and forms of interactive products took place. Mobile cell phones, computers, coffee makers, ATM machines, photocopiers, printers, CD players and many more of a huge list of products could be counted. In case of thinking to what extent are these products usable, how many of them are extremely simple to use, how much time is wasted in an attempt to turn on or try to understand how it works, so it became very necessary to take users into consideration while designing an interactive product.

The more complex the products have become the more challenges the designers should face in order to encourage users to use these products. Thus, we can say that the main aim of the Interactive design is to reduce the learning ability curve and increase the efficiency and accuracy without any reduction in the beneficial value of the product, which leads to the increase of production and user satisfaction.

The following points should be taken into consideration when attempting to design an interactive product:

- Targeted user or group.
- Services and activities that should be provided by the product.
- The place or environment where the product should be launched and used.

B. Ethnography

The term Ethnography was firstly used by Campbell in 1807 as an alternative to "The science of describing communities" [12]. Its origin comes from the Greek word "Ethnos" which means sex. It can be defined as a descriptive study of lifestyle, traditions, habits and productive arts of a group or community. Or it can be a set of techniques and systematic ways that can be used by humanities researchers to detect the format implicit meanings or conditions related to a particular social phenomenon in order to highlight a vision, cultural concept or a particular social value [13].

Jacobs defined Ethnography as a description of social, economic patterns and cultural heritage of communities or people with different social levels [12].

While Herskovits indicates that Ethnography is the description of civilizations and the discussion of their theoretical problems that relates to the analysis of human habits in disparate human societies [9]. Also, Mauss explains Ethnography in his book named "The subject of Ethnography" as the study of human products (whether tangible or intangible) and the factors that rule its borrowing or spreading operations among people [13].

The Ethnographic studies have gained a great importance due to its effectiveness and ability as a tool and information resource that guides the researchers and designers to understand user needs, the actual desires and expectations of the desired product and express them in a creative and productive way [14]. Some ways of applying Ethnographic researches can be summarized as follows:

1. Personal conversations or interviews: Based on a group of participants interviews, conversations can be open without any borders or limits or closed and specific with previously written questions, the dialogue may deviate to some sub-topics relevant to the main one.
2. Survey or questionnaire: Closed or open-ended questions could be used, although it is preferred to use close-ended questions as they are easier to answer, analyze and publish using internet.
3. Observation:

- Direct observation takes place in the real environment or in an environment that simulates the real one through taking or writing notes concerning the user's behavior and its surrounding circumstances.
- Indirect observation: Using several resources such as diaries, records, etc., as means of gathering information describing the way of using products. A simply noticed invasion of various kinds of Chinese goods and dominations took place throughout the whole Arab markets in general and the Egyptian market in particular. Cars, motorcycles, vehicles and their accessories and spare parts, household appliances, clothes, toys, sanitary appliances, construction tools, kitchen décor appliances and many other products can be easily noticed. Seasonal goods and products relating to social and religious events such as Ramadan lanterns, praying rugs, head wear, etc., can be widely spread and easily found (Fig. 1).

Fig. 1 Different shapes of Ramadan lanterns

All of the above is due to the Ethnographic studies that have been made by the Chinese aiming to understand the habits, traditions, natures and behavior not only for the Egyptians but for all Arab societies.

Practicing sales activities of many minor goods, Chinese have Longley sent their citizens to various cities and villages initially targeting housewives. Noticing the conservative distinctive character of many eastern communities and its reflection on the unwillingness of housewives in hosting a stranger while their husband is out or at work, the Chinese carefully made sure that most of the vendors are ladies to avoid that point. The upgraded stage of that took place by a couple of sellers one of them is a male while the other is a female, when ringing the doorbell if the housewife answers the lady continues the selling process but in case of the absence of the housewife the seller guy (man) took place.

The low per capital income which has forced the head of the family to have more than one job in order to increase his family income could be clearly noticed not only in the Egyptian societies but also all the Arab ones has led to the appearance of a wide range and different forms of cheap Chinese vehicles willing to help the head of the family to increase his income throughout a small project (Fig. 2).

Noticing the emergence of many negative phenomena such as spinsterhood and the rising age of marriage for girls and their relation on one way or another to the phenomenon of unemployment and the huge increasement of marriage costs, also the keenness of mothers to buy and store things for a long period of time waiting for husband or groom, the combination of all has led to the appearance of what is called "The Chinese gold" a cheap kind of jewelry with attractive designs, bright shapes and colors but containing a very few percentage of gold or even without gold as a solution used by some families in order to overcome the unaffordable marriage costs as being cheap as opposed to what its appearance reveals (as shown in

Fig. 3).

Fig. 2 Various kinds of vehicles used in small projects

Fig. 3 Chinese gold

The special interest of those communities to the religious events, old habits such as "Sbua of the born child (the seventh day of the born child)" and other habits and the relevance of that on buying certain goods and accessories, as well as the great passion to the football sport in particular, different ways of encouraging teams and even national ones throughout various leagues and occasions is also noticed (as shown in Fig. 4).

Fig. 4 The kinds of ceramic souvenirs gifted in celebrating sbou of the born child

Not even ignoring wealthy range of people who like phenotypic, peculiar and distinctive behavior and are keen to draw attention, acquisition of fads that help to highlight themselves, Chinese have also made precious looking products having a certain added value which support the behavior of that range such as cell phones, sunglasses, lighters, etc. (as shown in Fig. 5).

Fig. 5 Wealthy look products with added value

V. Conclusion

1. Good interaction relationship between users and products shows the success of that product to what extent.
2. In order to achieve a higher benefit for both user and product we should encourage and activate an integration linkage between modern fields of science specially Ergonomics, Interaction Design and Ethnography to provide an ultimately updated database concerning the nature, specifications and environment of the Egyptian consumer, which gives the designer a great ability to create and invent more and more products that meet the consumer needs.
3. The importance and urgent need to emulate China's economic policy based on the study of needs and market requirements long before any market activities.
4. Applying the concept of integration between modern concepts and disciplines such as Ethnography and Interaction Design to activate the role of Industrial design in Egypt as an effective support to the economic policies based on renovation and development (Fig. 6).

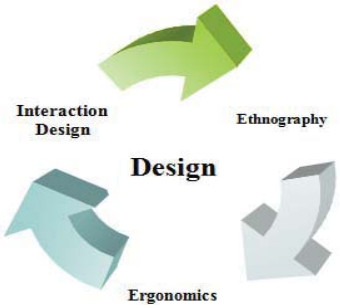

Fig. 6 The concept of integration between Ergonomics, Ethnography and Interaction design in the design process

5. Applying Ethnography helps to provide highly efficient products, more suited services to the user, through collecting as much information as possible that concerns with users and user environment and also user involvement and interaction as an effective element in all design stages either by recording his opinion, impressions about the product or his participation throughout the performing tests that can save time and provide a highly and well noticed cost benefit for both manufacturers and economy.
6. Using Ethnography supports the design activities creating new products or updating existent ones through measuring the compatibility of products with their environment, wishes of usability and user expectations.
7. A large proportion of Ethnographic studies should be allocated in order to generate ideas, simulate creativity to achieve the design team needed vision that gives the ability to design new and innovative products stemming from the engagement of design work staff with the targeted product environment and watching how users use their products and the corresponding ones.

VI. Recommendations

- Activating the role of a group of both sexes Ethnographic researchers able to provide the designers and Ergonomic specialists in Egypt with an ultimately updated database concerning the various dominations of the Egyptian society, manners, customs and traditions, user environment and requirements as a first priority that chutes the designer to the community where he lives and resides its latest phenomena and variables in order to help him to design and innovate products that meet the highest level of luxury and performance quality required by the user and matching with the environment.
- Contracting some kind of joint cooperation between military colleges , sports education institutes from one side , and colleges and institutes concerning Design activities from the other side to provide an ultimately updated (annually updated) database concerning some specifications about students of both sexes applying in those institutes (height , weight , ….etc) which can provide the Industrial designer with the needed information when creating a new product or updating an existing one concerning that category .

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