6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

User'stypology for designing

Lucila Mercado Colin[a]1, Alejandro Rodea Chavez[b]

[a]*Universidad Autonoma Metropolitana unidad Cuajimalpa, Av. Vasco de Quiroga 4871, Col. Santa Fe Cuajimalpa, Delegacion Cuajimalpa de Morelos, Distrito Federal 05300, Mexico.*
[b]*Universidad Autonoma Metropolitana unidad Cuajimalpa, Av. Vasco de Quiroga 4871, Col. Santa Fe Cuajimalpa, Delegacion Cuajimalpa de Morelos, Distrito Federal 05300, Mexico.*

Abstract

When referring to the process of user -centered design -UCD- it is about a number of features that together establish foundations for the interaction of systems in which the user can carry out its activities effectively, efficiently and satisfactorily. In terms of design referring about users should mean there are known the characteristics of the people for whom a design is directed, however, quite often designers have not approached real users when carrying out its design process, and replace it with their own beliefs about who the user is. Some of the features that distinguish the UCD from other perspectives of design are its iterative nature, in which are stablished as a relevant design process stages those of evaluation, in which incorporation of real users participation is fundamental. Each of these features has an impact on the process and /or outcome of the design process, allowing users expresses their selves during the lapse of interaction with products, and leading and reflecting their experiences, their skills and knowledge in various ways. Intending to get a closer observation of users characteristics and their differences, here are stated some aspects that aid the task of identifying aspects of the design process that would allow defining the user's characteristics: the user profile.

*Keywords:*User's typology; systemic; User-centered design process

1. Introduction

The intention of this paper is tackle some determinant aspects for defining types of users, involved in pointing out the functional characteristics of products developed from the perspective of user-centered design aspects.

----

* Corresponding author.
 *E-mail address:*lmercado@correo.cua.uam.mx

In the field of applied ergonomics to Interface product Design (which considers people, activities, mediating objects of these activities and the use environment) it is been an increasing interest to integrate the users during the development process of those interfaces product. User-centered design is considered as a methodology that functions guiding the process of definition, hierarchy and relationship and emergence of information, which will give structure to the overall development process by working with system variables.

User Centered Design processes are characterized among others by:

- Approaching to problem with a systemic vision, which implies an inclusive vision considering the user,   tasks, mediators' objects and environment of use (UOAE).
- Integration of end-users in the stages of inquiring and evaluation.
- There is an appropriate distribution of the cognitive demands of objects with Users.
- Iterative design solutions allow feedback the whole process throughout the evaluation processes, which would allow meeting the developmental advance level of a process.
- Capabilities and limitations of users in their physical, cognitive, emotional, and social dimensions are clearly identified.
- The products of design process (resulting designs) are evaluated at some point validating it.

The features to be addressed in this paper, by considering those determine the view that permeates the process of user-centered design are:

- The systemic perspective to observe the relationship of everything and not isolated parts in order to determine, prioritize and define the system and to define the scope of a proposed user-centered design.
- The Iteration; that allows modifying within the development of the design process the order in the sequence of steps in accordance with achieving a set of goal previously stablished. Iteration or repetition of steps prevents the development of a linear design process, transforming it into a process that articulates times and results, establishing with it the level of development of a project.
- The stages of the design process.
- At the stage of inquiry is necessary to define the objectives, system requirements and how the variables will be related to get closer to end users of the products. For it is necessary to determine the perspective from which inquiry will be carried out - qualitative or quantitative perspective-because both differ each other in the way how is approaching the problem, and in the type of data seeking out to describe the relationship between variables. Given the different approaches to user looking for qualitative or quantitative data, is necessary to identify the instruments that will ensure getting useful information for the purposes pursued.
- Evaluation Stage. This stage is strongly related to property of iteration of the design process, as it is by assessing the level of development of the project designers or design team are feedbacked. Information obtained in an evaluation process allows arising recommendations of intervention, in order to continue the developmental process of the design in a better way. In an evaluation process is necessary to consider the various types of users with whom is needed to contact, for doing it, it is useful to define typologies of users, so that there is no discrepancy between the physical and cognitive demands that the object makes the users, cause it considers the capabilities and limitations of the them; as a counterpart, with the use of those typologies, those demands that the user makes the object, such as response speed, feedback, and so on are not overtaxed.
- Real users participation; It is necessary to know relevant information of end users of the product, considering the characteristics of the product to be designed or evaluated and the type of interaction that will set the user with the system, it means, if the interaction with the system will be primarily at the physical, cognitive or affective level. As a result of user interaction with mediators objects, are set to the object user's demands; Users need the object has features that address the cognitive and physical limitations of them, to address their mental models and experience in the use of certain object.

Generally, when each design project is developed, it should be determined all useful aspects that would feed the design process. First of all, is needed to address the question what will solve the problem (problematize); secondly, is mandatory to explain how to do it (conceptualize); thirdly, to present solutions (models), and finally, to assess the

characteristics of each possible solution (evaluate). Through the systemic perspective previous stages are related in such manner that each step affect positively or negatively the overall outcome.

2. The systemic perspective

This systemic perspective helps one hand to determine the relationships of interaction established between the system variables, and by the other hand, to determine the emerging information generated from the interaction of such variables.

Through the analysis system (UOAE) is feasible to identify how will relations of binomial variables would be, user- environment, environment - activity, activity- object, object - user; the interrelation of these variables will identify the conditions, resources, knowledge and skills required to interact with the system; This helps to define the limits and scope of the system, which promotes knowledge of the context in which target Users will be involved. System variables are related as follow:

- "A User is involved.
- That User is doing something.
- That User is doing something with a product, system, or other things"(Tullis, 2008).
- That User is doing something with a product in a specific use of context.
- The capabilities and limitations of Users in their physical, cognitive, emotional and social dimensions are considered, related those with the User activities with the product, and having a perspective in which the observation of information allows be both, qualitative and quantitative.

Moreover, defining variables and their relationships, contribute to methodologically determine the scope on a project, by duly establishing what relationship of variables are of interest, as well as the depth to which those will be observed . I means which variables' relationship will be work in the design process, and the level of complexity that this relationship should be explored.

From a systems perspective, variables have a common goal, which is linked to the target set for the design process, and the results thereof; this is, the objective must relate the following variables:

- Who is the user;
- What activities are to be done by the user;
- What mediator objects are useful for this purpose;
- What characteristics those mediator objects need to be adequate;
- Where the system is used.

One of the most important qualities in a system is the possibility of catching emerging information, that is, arising data from the relationship of the variables, such new information only responds to the status those variables have in relation to that particular context.

Working from a systems perspective ensures that the system will work properly, promoting welfare, safety, comfort, ease of use, usefulness of a system, and above all ensures that the user reaches his or her own effective, efficient and satisfactory objectives.

In systemic vision is necessary to clearly determine those characteristics of each of the subsystems (user-object-activity- environment of use) that interact in the system and from which, -once knowing how they interrelate-, together with emerging information may define variables that were observed.

In the UOAE system, all variables are impacting each other, being interdependent each other because all of it are interrelated.
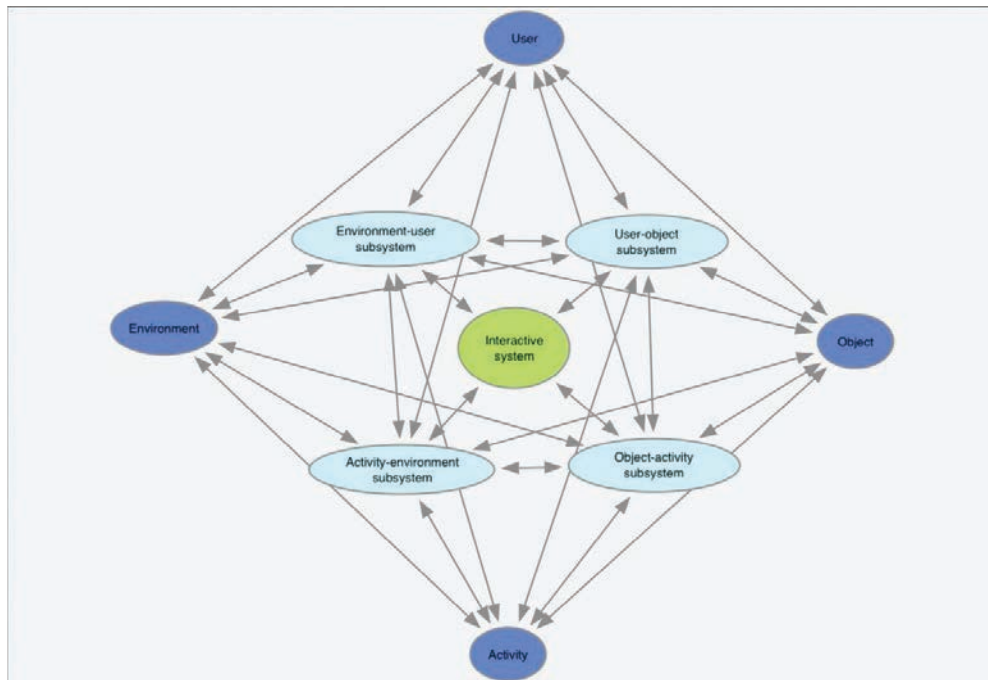
Figure 1.Systemic Map. Model representing the relationship of variables in a UOAE system

So it is needed to define a timely manner the knowledge, skills, attitudes and/or behaviors a user(s) subsystem must have, in order to develop their activities (subsystem), which must also be defined in detail. For example, knowing how often a person performs the activities implies answering such questions as, during the interaction with the object repetitive activities are promoted?, or even static activities?; how long does the activities last?; are the activities of high or low physical and/or cognitive demand?; is the user being exposed to some type of risk?. This means, meeting the user involves determining the cognitive, emotional, social or physical resources that should be assigned during the interaction.

This way of approaching the problem requires the determination of features that the object subsystem has, so that it would be possible to define physical resources demand (anthropometric, physiological, biomechanical, anatomical) that will involve during interaction, or cognitive resources demand (mental resources such as attention, language, perception, learning) that user will put in action while interacting with the system, to avoid exceeding his or her capabilities that could cause a risk, loss of time, money, detonation of negative emotions and so on.

The environment of use subsystem will determine the effect environment has on the activities and users' characteristics.

3. Iteration or repetition of stages

The iteration is latent throughout the development of the design process, which allows go back or forward in the process, according to the requirements and needed adjustments at each stage. Iteration of stages promotes the process feedback, through the analysis or evaluation of results with which to compare the obtained against expected.

Evaluation stage in its formative mode has basically the function of determining the development level of the process reached out, also to identify inconsistencies in the process, errors or omissions so that recommendations for amendments are set or the next step is set to cyclically continue such process.
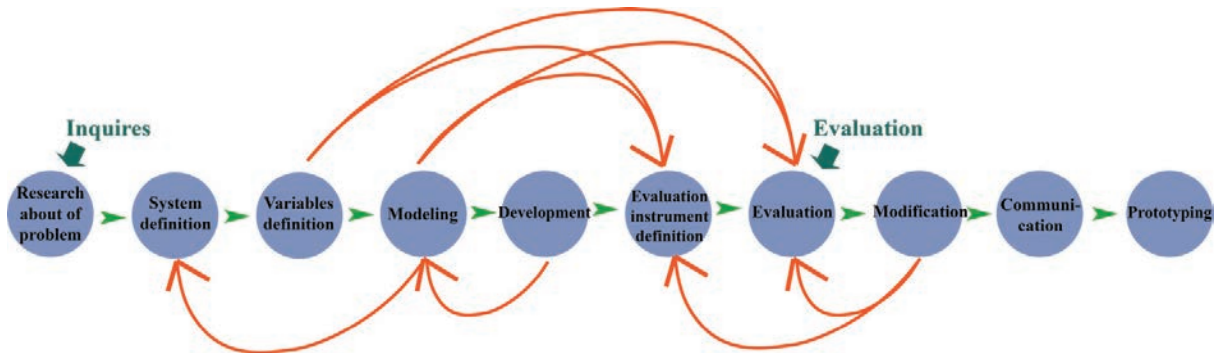
Figure 2. Feedback processes and the relationship of it within different stages.

The design process "Generally emphasizes the importance of generating a solution concept at an early stage of the process, thus reflecting the nature of design thinking aimed at problem solution. This initial solution conjecture is then subjected to an analysis, evaluation, refinement and development. Sometimes of course, the analysis and evaluation stages show fundamental flaws in the initial guess, and therefore it has to be abandoned, generating a new design concept and starting the cycle again. (Cross, 2008)" "Well defined problems have a clear goal, wright answers and rules or well-known procedures that should gather an answer. The characteristics of not well defined (or wicked problem) could be the following"(Cross, 2008).

4. Design process stages

The process of user-centered design is divided into several stages, in some of these is necessary to define some aspects that will impact on user participation in such process. The following briefly describes these steps.

- Inquiring about the problem to solve. This stage is the first approach to the process; in it investigation about the context of the user, their needs and circumstances are done.
- Definition of the system. In which is needed to establish a context of use, who the Users are, what is the activity developed by Users. Such information is being determined through collected data at previous stages.
- Definition of variables: It means to be aware of which aspects are wanted to control or to observe during the design process. Variables are defined in terms of stated objectives and the emerging information from subsystems' relationship between user and object, activity and object, activity and environment, and user and environment.
- Definition of instruments. Correct type of appropriate instruments is selected, to obtain the required information. Considering kind of data (qualitative and quantitative), the human dimension that requires to be analyzed (social, emotional, cognitive or physical) , the implementation phase (inquiry or evaluation) .
- Evaluation; at this stage, there are used different instruments to measure or to observe the interaction of the system´s elements Formative assessments are a means of feedbacking process, and summative assessments determine the level of development reached out by the product or system.

5. Evaluation Stage

In the process of user-centered design, inquiring stage addresses the information will solve the problem (problematize); This Involves knowing who, what, when, where and how the system works and its interactions, taking into account user -object- activity- environment variables, which obviously consist of raw materials for the definition of the system development.

By the other hand, an evaluation stage of product design should observe all aspects that impact -positive o negatively- over the user interaction with the activities, object and the environment of use, this is the overall UOAE system.

Evaluation of the product is useful for feed backing during the design process. Such evaluation requires considering consistency between interface of product complexity as well as users' experience (rookies, advanced or experts), as well as the mental models users' has to deal with at the interaction. Because of that it is important to define a typology of the user, centered in the relation of user-object-activity and environment.

This implies that it is necessary to determine the objectives that meet the designed object, in that the objective is related to the characteristics to be evaluated. If there are not an objective, evaluations should not be useful to feed backing processes, neither can be set the level of development reached a project when complete.

Not a tribial matter is the selection of suitable instruments. Previously is needed to determine the type of data (qualitative and quantitative) that better suits the problem; the human dimension that requires analysis (social, emotional, cognitive or physical) and the implementation phase (inquiry or evaluation) during the development of the design process in order to having an effective approach to the users. Such task would be done by emphasizing on the analysis of some aspects that can bring utility by showing system's characteristics.

In order to improve the inquiry stage of the design process through that approach, it is been resorted to using diverse techniques that provide qualitative and quantitative data, necessary to include the social, emotional and cognitive user's characteristics during the development of the interface design, generating with it, an Users typology that considers dominance of perceptual aspects, interpretation according to an entrenched but inaccurate mental model and capacity of transferring knowledge into new situations.

Below two exemplary instruments are shown to demonstrate the type of information that should be analyzed to justify the selection of tools, when looking to get closer to users during stages of inquiry and evaluation.

METHOD	UTILITY	KIND OF OBSERVED DATA		HUMAN DIMENSION VALUATED				DESIGN STAGE OF USE		
		Quantitative	Qualitative	Affectivity (Satisfaction)	Cognitive Issues	Physical Issues	Social Issues	Inquire	Formative Evaluation	Summative Evaluation
RULA	Assessment of potential risks to Upper Limbs; It is based on the analysis of extreme postures adopted by Users during an activity.	X				X		X		
Focus Groups	Get different opinions of a group of Users on specific topics; Usually a small group of users is guided by a facilitator in a semistructured or unstructured session in order to get feelings and judgments.		X	X	X	X	X	X	X	

Fig. 3.Two examples of instruments showing whether qualitative or quantitative information is gathered with it.

6. Real Users: Auxiliary technics to define Users' typology

The characteristics of users (previous experiences, attitudes, knowledge, motivations and other) are determinant in those of the product. Because is necessary to consider the level of complexity a product is, or the cognitive and physical demands it that does to the User, and vice versa, the user's demands to the object; Such information is useful in determining some aspects of mental models which users apply filtering the information they receive during the interaction with those objects.

In order to define user's typology, it is necessary to know the mental model of the, expert, the "concrete" expert (advanced) and the novice users have. Accordingly with Romero (In Knapp 2010) some aspects of mental models evolution phases are as follow:

1st stage: The novices:

- Dominance of perceptual aspects
- Knowledge transference from previous environments

2nd stage: The "concrete" expert:

- Interpretation according to an entrenched but inaccurate mental model.
- Disorientation in the face of novel and scarce flexibility. Conservative style of navigation
- Quick decision making but frequent errors.

3rd stage: The expert

- Capacity of transferring knowledge into new situations
- Rapidity and precision in execution

The way users solve problems is based on the type of experience that he or she has been exposed to, and the goals he or she have to use that object.

Some of the important aspects to define user's profiles (meaning not necessarily a unique expertise profile level) should consider the patterns of group behavior and the differences that distinguish different groups within a population. Following are briefly described three techniques contributing to define users' typologies during a User Centered Design Process.

The first one technique that helps determine the typologies of users is the definition of user profiles. This technique is intended to represent specific end-users characteristics of a product. People are a representation of a potential user, not an average user nor an existing user; This is a "built" user, generated from collected data during the investigation stage. These data are used to identify patterns which will become the characteristics that give identity to people and represent usage patterns, motivations, behaviors, experiences, sills, knowledge and the patterns of thought an actual user has. All this represented in a descriptive narrative.

User (people) profiles are connected to the scenarios, putting in context the characteristics of users and their responses (actions) when interacting with the system.

The second one technique is the scenarios, which allow understanding people when facing difficulties over the interaction process. How they solve simulated problems and make active decisions in the process.

To meet the people it is needed to apply a set of techniques that allows the observation of information which would be valued in the context of user goals and design objectives.

Scenario planning (narratives) is useful for describing how the scenario can aid defining the requirements for product interface design, by focusing on the actions user's does within the overall system.

The third one technique is use cases, which is useful to define the typologies of users. Requirements should stablish the specific characteristics of use, performance and technological aspects; meaning how the system is, what it does and how it does it. Use cases are scenarios in which it can be seen how the system works, it is, use cases show how the user interacts with the object when doing those activities for which the object was created. Use cases describe how tasks are performed within the system, which can include other actors.

7. Discussion

It is necessary designer analyze all relevant aspects of a system during the development of the design process which will have impact on the user, in order to define how must the intervention process should be, seeking for prevent or reduce the negative impact on the user the relationship between the variables of the system could have.

The designer must understand mental models, previous experiences and motivations of the various types of user who will be involved in the development of product applying a process of User Centered Design.

The use of techniques that help defining the differences in experience levels among novice, advanced and expert users is essential in order to get convenient design outputs. }of a capital importance is to delve into the techniques (scenarios, people and use cases) that help designers to define and test user profiles, as well as to identify the nodes on which it is productive, given the level of feedback into the design process. User typologies are useful from the starting point to begin the development of a project, which would constantly have periods of feedback throughout evaluations.

References

[1] Anderson, J. Cognitive psychology and its implications. New York, Worth publishers. 2010.

[2] Cross N. Metodos de diseño. Mexico: LimusaWiley. 2008.

[3] García C., F. La investigación tecnologica. Investigar, Idear e Innovar en ingenierias y ciencias sociales. MexicoLimusa. 2007

[4] García G. La ergonomia desde la visión sistemica. Bogota: Universidad Nacional de Bogota. 2002.

[5] Jones J. Design Methods. NY: John Wiley and Sons. 1992.

[6] Laurel, B. Design Research: Methods and Perspectives, Cambridge: MIT.2003.

[7] Lindlof T., Taylor, B. Qualitative Communication Research Methods. CA: Thousand Oaks. 2002.

[8] Mercado L, Rodea A, Evaluation as Tool in the User Centered Design (UCD) Process, 5th International Forum of Design as a Process. Advanced Design Cultures.Guadalajara.2014:219-225.

[9]Knapp, A (Comp.)La experiencia del Diseño. Experiencia de usuario, modelos mentales y expectativas. Madrid. Anaya Multimedia. 2002:234.

[10] Te'eni D., Carey J., Zhang P. Human computer Interaction. USA.Wiley.2007.

[11] Tullis, T, Albert B.Measuring the User Experience. Burlington. Morgan Kaufmann. 2008:4