SOME CONSIDERATIONS ABOUT HUMAN FACTORS IN ENVIRONMENT DESIGN: WHAT INTERIOR DESIGN AND ARCHITECTS SAY

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The design process has been discussed for a long time. From the Cartesian to romantic point of view, many authors propose distinct approaches to include users in this process. This paper presents a discussion on whether or not design methods are used by designers and architects. To illustrate design processes of these professionals, an exploratory survey was conducted. The intention was to find out details about design practice and additional information about the knowledge and application of human factors/ergonomics by these professionals in the built environment projects. In this paper, just the results related to human factors/ ergonomics topics are presented and discussed.

METHOD, METHODOLOGY

To start this discussion, it might be useful to define two terms that cause some confusion: *method* and *methodology*. Several books present scientific methods for research, but don't define what a *method* is. On the other hand, books about design processes suggest specific *methodologies*, without explanation.

A definition is proposed here, based on Webster and Oxford dictionaries (2013):

Method – from latin *methodus*, from greek *methodos* - 'pursuit of knowledge', from *meta-* (expressing development) + *hodos* 'way'. Here, understood as a way, technique, process of or for doing something; a particular form of procedure for accomplishing or approaching something, especially a systematic or established one.

Methodology – from new latin *methodus +-logia – logy*. Here, understood as a body of methods, rules, and postulates employed by a discipline; a particular procedure or set of procedures used in a particular area of study or activity.

After established the difference between these two terms – *method* is a way for doing something, with *methodology* is a body of methods -, it is possible to present the main problem that instigate this research: do designers and architects follow a methodology in their practice? If yes, in which phase in their design process do they include human factors/ ergonomics issues?

CONTEXT: DESIGN PROCESS

In 1984, Broadbent affirmed that "Most of the pioneer design methodologists discussed the nature of design as a science before proceeding to their personal descriptions of techniques which, hopefully, designers would be tempted to adopt in practice. And, almost, without exception, they took a Cartesian view of designing; breaking the problem down to fragments and solving each of these separately before attempting some grand synthesis."

According to Broadbent (1984):
"each theorist used a different terminology, there were differences in the scale and the level of abstraction at which they tread the parts of a problem, but to quote only the best-known examples, Asminow (1962) with his design elements, Jones (1963) with his factors, Archer (1963) with his sub problems and Alexander (1964) with his misfit variables were all clearly trying to apply Cartesian methods in Design."

Compared with Broadbent who understood the design process scenario being Cartesian, a lot of changes can be seen nowadays. Quoting Aspelund (2010): "Design processes can be likened to a romantic relationship". In his proposition, the author state: "In the first stage, *Inspiration*, an idea has taken hold of you. Everything is exciting about your idea it is fun and wonderful. You are infatuated. You stay all night with your idea, take it everywhere with you, and love being seen with it. Strange behavior emerges. You find yourself taking risks and acting impulsively".

Even this romantic idea is very interesting, designers and architects know that design is more than this "love at first sight". Design implies responsibility; and for HF?E (Human Factors and Ergonomics) professionals, the way a project will affect users and the environment, all concerns related to safety, well being and performance (Acosta et al., 2011).

Design requires a creative action, background, knowledge and experience. A design process presents complex challenges, and the designer must define the user's activities and its social and psychological consequences. When considering a rigorous procedure while designing it`s possible to say that similarities are found with the mechanism that science proceed - "isn't a comparison of issues between design and sciences, but a contemporary way to tidy up a creative thinking" (Fabricio & Melhardo, 2011).

According to Muckenheim & Demel (2012) "design methods in architecture never lose their relevance." The authors also mention that "our society has reached such a high degree of understanding that even simple design tasks often require a high complex system of intellectual realizations and resulting design procedures in order to gauge solutions that

effectively reflect our cultural development".

In this context, it's necessary to take the use into consideration (or not) of some kind of methodology by designers (in this research, architects, interior designers) while involved in the design process. And more than this, how these professionals are considering human factors/ ergonomics aspects during this design process methodology.

Lawson (2005) defines that the easier way to represent design processes is from the sequence of decisions of three phases: analysis, synthesis and evaluation. This sequence should be considered as a part of a design process that must be a set of flexible, articulated and with interactive cycles.
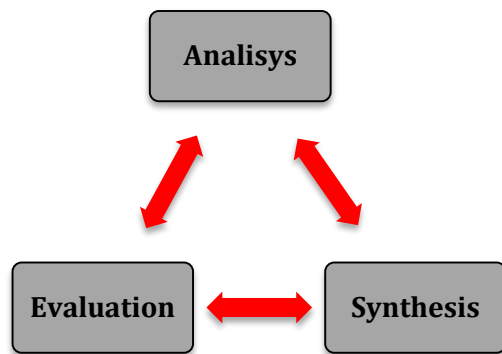

Fig. 1 – Sequence for design process proposed by Lawson (2005).

The analysis phase is the stage in which the main elements that compose the design problem are identified. In this stage goals and objectives are defined, as well as the main criteria for building performance; its main restrictions; and future impacts for users, clients and neighborhood from the solutions.

Synthesis phase is related to a creative phase of decisions. In this stage, designers propose ideas and possible solutions that cater to goals and satisfy restrictions and opportunities observed in analysis phase. According to Markus (1971, *ap.* Andrade et al., 2011) synthesis comprises ideas that can express partial solutions and the combination of partial relations, that can lead to global and consistent solutions, that can be implemented.

There's no optimal solution for a design problem, but a large number of acceptable solutions, some more satisfactory than others - in some aspects - and for different clients or users (Lawson, 2005).

The evaluation phase aims to ensure that the proposed solution is the most acceptable. Therefore, in this stage designers try to find failures before production, sales and usage (as changes are more expensive), and the proposed solution is compared with goals, restrictions and opportunities that the design must cater to, defined in analysis phase.

Lawson's design model presents the main phases in a design process as a sequence, but comprises a schematic and flexible characteristic, once each phase should be continuous

and articulated with other. Good result towards this sequence of decisions depends on communication between each process phase - communication among phases and actors is a condition for success.

Lawson (2005) affirms that this kind of process mapping is usually theoretical and normative: it seems to be more a reflection about the design process than an experimental observation. This author also says that the idea that these phases and/or stages occur in a given order, or that they are distinct events, is questionable. It is possible that design is a process in which problem and solution arise together.

HF/E IN DESIGN PROCESS

Lawson's model isn't the only one that integrates the 3 phases, as a cyclic process. Design thinking (a concept that first emerged in 1980s with the rise of human centered design) proposes: "It follows a collaborative, team based cross disciplinary process."(Curedale, 2013). This author also mentions that it's an "approach that seeks practical and innovative solutions to problems".

Maybe the design thinking approach could be useful for designers and architects, working with HF/E professionals. Quoting Curedale (2013) this approach "combines the wisdom and skills of many disciplines working in close and flexible collaboration. Each team member requires disciplinary empathy allowing them to work collaboratively with other disciplines".

According to Acosta et al (2011) "the importance of involving people in Design Process in order to understand their needs and values has been pointed out by many authors and in many fields". These authors (citing Cross, 2003) also point out that there are many different approaches once a design process is a "future thought structure aimed at solving a problem". For them, there are five main trends established in these approaches to involve users in design process:

- Collaborative design;
- User centered design;
- Usability
- Universal design;
- Experience-based design;
- Additionally other transverse approaches, methods and techniques, as participatory design, ethnographic studies, and scenario building are seen as well.

When considering HF/E specialists, their knowledge and skills (Dul *et al*, 2012), say that these professionals "can also play an integrative role in design decisions, based on their knowledge and skills of design as an activity (including mental processes of contributors to the design, and collective interaction processes). Furthermore, they can stimulate and moderate design processes by, for instance, translating engineering terminology or concepts to end-user terminology and vice versa."

When a digital culture influences the design and architecture and computational methods are used, this can give

rise to many new design methods. According to Muckenheim & Demel (2012) HF/E professionals could apply these features as valuable design tools.

Talking about the build environment, the HF/E professional still have some obstacles. Some authors, as Attaianese & Duca (2012) argue that a specific methodology is lacking: "Despite the most acknowledged definitions of ergonomics or human factors that ergonomic design of environments bring the same concerns as any other kind of systems, and even though a poor building design affects a whole physical, cognitive and organizational aspects of a given situation, a comprehensive methodology purposed to designing ergonomic buildings is still lacking. "

METHOD

To gather information about the design practices and the how is considered human factors/ergonomics knowledge in projects, an exploratory research was conducted, using a questionnaire. The goal was to listen to professionals, and find out which kind of design methodology they use, and how human factors/ergonomics can be included during the design process to achieve a better end product solution.

Research tools

The main question for this survey: *Which is the base / starting point of an architect/ interior designer when developing a project?* Some questions about the design methodology and design process and HF/E topics are included as well. A pre-test with 4 professionals was performed and these subjects could comment their opinion about questions and difficulties to answer these.

After this phase, a final version was defined with 11 (eleven) questions. A total of 20 (twenty) professionals was contacted and they received a link to WUFOO – so they could answer whenever possible – in his/her personal email.

A Consent Form was included, and just after the agreement, the volunteer could answer the questions.

Participants

All selected professionals were selected from a list of local architects or interior designers that work in their studios or work in planned furniture stores, with experience in home and interior design – they are.

The subjects should also fulfill the following criteria:
 - work on environmental design (architects, interior designers);
 - professionals should have direct relationship with their clients;
 - have at least five years experience as a professional;
 - they must carry out the projects without middlemen (the project is executed only by the designer's team).

Professionals were contacted and received the emails with the questionnaire link during July 2013. After answering all questions a final click did sent the completed questionnaire to the researcher, and the data were organized and analyzed.

RESULTS AND DISCUSSION

Results

Out of 20 (twenty) invited professionals 11 (eleven) questionnaires were correctly completed. In this paper, just the questions results related to human factors/ ergonomics topics are presented.

Demographic data
 * *Age* - Due to fixed criteria, professionals are distributed in 4 age groups, with a majority concentrated on 25-34 years old (4 subjects) and 35-44 years old (4 subjects);
 * *Gender* – Considering 11 answer, there was slight equilibrium of female (n=4) and male (n=7) subjects;
 * *Background* – the sample comprised 7 Architects and 4 Interior Designers;
 * When asked "*how long have you been working as a designer?*" they are experienced professionals, and defined as criteria, and in this sample 7 subjects has more than 10 years working as a designer.

Method, Methodology or "practice"?
As affirmed by Lawson (2005) design isn't an easy task. It's complex and sophisticated. Isn't a "mystic talent" of certain subjects with "secret power", but an ability that must be learned and practiced, as a person practices a sport or a musical instrument.

Maybe this can be an explanation for the answer about "*Which kind of design methodology do you use as a base?*". .Answers of 4 (four) professionals say "*I use only my own experience to develop my projects*" and 2 (two) say that they don't use any kind of methodology.

A possible explanation for this answer could also be that "design methodology" was also understood as an academic expression, as mentioned in some comments. Once the majority (n=7) are in this business for more than 10 years, they understand that this is an "*obsolete and conventional way of designing.*"

When asked about "*In your opinion, design methods and techniques are enough to achieve comfort, health, safety, and space functionality principles? And also, that can contribute in environment aesthetics?*" Out of 11 (eleven) answers, 7 (seven) subjects answered that "*the methods I know, sometimes are enough for the project.*"

It's possible that professionals believe that they have their own *modus operandi* while designing an environment, and after years working, skills are accumulated through praxis.

An interesting aspect in answers was that subjects mentioned that they know - and sometimes use – HF/E techniques and tools in their projects. When questioned about HF/E concepts (as an example, human-machine system, anthropometry, and environmental comfort) they say that don't know these concepts. It seems to be controversial. This can be explained once in interior design, there are more easy HF/E aspects like designing for the end-user to make him/her perform well.

Considering which phase/stage HF/E principles are considered and applied, 8 (eight) affirm that HF/E is considered during project specification and 3 (three) during all stages. It's interesting that when analyzing the answers there seems to be a contradiction regarding HF/E. When questioned about how professionals consider HF/E in their projects they state to use interviews, preliminary photos, maps and floor plans, and user's needs.

When asked about "*Do you evaluate/ analyze the environments that you design, considering your client's opinion, after they are implemented? "If yes, how do you do it?"* professionals say that they don't do a "*systematic evaluation*". Seven of them affirm that these evaluations happen "occasionally" and three say that do it "*always*". When they were questioned "*How they proceed the evaluation*", nine out eleven said that they evaluate in "*informal interviews*", and two "*Just wait for the client's feedback.*"

Making a comparison between these answers and Lawson (2005) design process – *Analysis, Evaluation, Synthesis* - as a cyclic process, answers are again controversial. If design processes are continuous and its believed that praxis can "feed" this cycle, it's possible to say that evaluation is an important phase in this process, a fundamental stage for the professional, so he can develop his/her own design methodology.

Non-systematic procedures or tools applied in a inconsistent way support the previous answers that most of them don't use methodology, or decide for their "*personal way"* in design process.

Discussion

During the development of interior design activities, mainly residential layouts, several aspects must be considered, as furniture, lining, covering, painting, textures, illumination, thermal comfort, ventilation, among other issues. All these aspects must be considered by the architect/ interior designer, supported by HF/E knowledge.

The challenge of these professionals is to translate the needs, desires and emotions of users to design requirements and therefore, some tools are essential in design process and design methodology.

Architects and designers, investigated in this experimental research, say they don´t use the knowledge of HF/E, but they do it in other ways - often intuitively. The practice is understood as "*methodology*"? Maybe this is a scientific word, once *method* and *methodology* are formal words, and weren´t understood the way

FUTURE WORK

If vocabulary was a problem in questions presented in the questionnaire of this research, a revision trying to change the terms definitions related to HF/E domain can be considered. In addition, it´s valid for future research to investigate how these professionals make use of knowledge in HF/E -how HF/E principles are applied on their design activities?

This study presented a limitation, concerning on the number of respondents, and a non-regular distribution among age (and as consequence, experience working as a designer) and background. A new investigation must be conducted to equilibrate the profile of these professionals, with a larger sample, and check if there are significant differences from the answers obtained in this first research.

A future research is the relation between praxis and work: can it generate a new and unique methodology, after several years of practice? How different/ similar are the praxis of designers and architects? Due to a high level of complexity in design process it can lead us to new design methodologies? How HF/E principles can interfere, integrate, collaborate with these new methodologies, during design process?

An additional discussion can be a consequence of this scenario. Muckenheim & Demel (2012) mention that "the search for architectural individuality or uniqueness can be considered one of central theme in contemporary architecture design. But uniqueness and inimitability on their own will not create quality." Besides that, computational technologies can be used to improve the quality of our build environment. But are HF/E professionals, as well designers and architects pursuing this quality, as a team?

There are some of several questions that can hold attention of environmental designers' researchers.

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