A tool for architects

A TOOL FOR ARCHITECTS

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ABSTRACT: Architects are already aware that the XXI century inherited ecological concerns. Although several international recommendations defended reversibility in all interventions that reduce cultural significance, and presented rehabilitation in accordance to the sustainable use of resources, architects still do perform rehabilitations that unconsider the consequences of their design decisions, regarding the preservation of both built and natural heritage.

This paper will describe the method chosen in this PhD research, as well as, part of their content, motivation, and aims. This research follows since 2004, the PhDdesign method, with a first phase of design theory, exploring the problem field and taxonomy. Then, a second phase of design production: developing, producing, and testing the tool to support architects; and a third phase of design result, validating both theory and production. This PhD research is funded by FCT, in Portugal. Prof. Ir. Post and Dr. Ir. Erkelens are respectively the main and co-promoters.

Keywords –Built heritage, Design process, Lifespan, Rehabilitation, Tool

1. INTRODUCTION

The architect, when performing as building designer, requires knowledge and experience on the most diverse fields of the building universe (e.g. social and scientific sciences), which makes it very difficult as a single individual, to manage and systematize such a universe. John Habraken defended “creativity is a lonely act” (1982), sheltered in the designer’s mental boundaries, but the design process does not necessarily need to follow the same path.

The design process can and should combine the designer’s knowledge and experience with the knowledge and experience from other experts, owners, users, contractors, principals, public and private bodies, etc.

Usually the designer follows an individual design process, but he can also be part of a team where each designer should obligatorily follow the collective design process. This is very common, especially when working in a large-scale office, because there, each designer has a particular function (speciality), which should fit into the overall designer’s functions.

Society considers architects, first, as building artists and some architects are reticent to expose their procedural methods and followed “recipes” during their design developments, because they could be contributing to their own ruin, denigrating their own professional value.

This research considers this taboo obsolete, especially because if we compare the design processes among designers and question them about their procedural stages and activities, we find that most of them follow similar stages and activities. Otherwise, most designers know most design process stages and activities, even if they do not assume to follow it systematically.

The difference is actually, in how each designer interprets, synthesizes, and evaluates all the collected data, as well as his design product, as a real simulation result of all his perceptions, aims, and convictions. To support his decision steps, among his expertise, each designer needs to consult, during his own design processes, useful “tools” to support and help him achieving the targeted goals.

2. BACKGROUND

The international expertise recommendations and charters influenced both taxonomy and theoretic design process model. The Burra Charter (1979) defended already at that time that "change[s] may be necessary to retain cultural significance, but is undesirable where it reduces cultural significance. The amount of change to a place should be guided by the cultural significance of the place and its appropriate interpretation. When change is being considered, a range of options should be explored to seek that option, which minimizes the reduction of cultural significance. (15.2) Changes, which reduce cultural significance, should be reversible, and be reversed when circumstances permit. Reversible changes should be considered temporary. Non-reversible change should only be used as a last resort and should not prevent future conservation action."

In addition, also The Habitat Agenda (1996) presented rehabilitation in accordance to the sustainable use of resources. Article 10 stated "In order to sustain our global environment and improve the quality of living in our human settlements, we commit ourselves to sustainable patterns of production, consumption, transportation and settlements development; pollution prevention; respect for the carrying capacity of ecosystems; and the preservation of opportunities for future generations. In this connection, we shall cooperate in a spirit of global partnership to conserve, protect, and restore the health and integrity of the Earth's ecosystem."

Article 11 reinforced that "we shall promote the conservation, rehabilitation and maintenance of buildings, monuments, open spaces, landscapes and settlement patterns of historical, cultural, architectural, natural, religious and spiritual value".

Independently of the expertise recommendations, most designers, and built heritage intervenients have shown some inertia on facing the existing stock and its potentialities, economizing their creativity for their modern drafts in new construction. Even when intervening in built heritage, it is clear the priority given to the additions, forgetting the endless potential in the reuse or recycling of the pre-existent forms, components and materials, when they could be perfectly integrated together with the additions, stimulating with true creativity the generational dialogue.

Some designers are already concerned about reversibility in their interventions, as well as, maintaining a unique and coherent methodology in their process of design, independent from the building heritage classification, e.g. the Portuguese team Arq. Victor Mestre e Sofia Aleixo, however, it is not enough. There are still many designers, which do not value built heritage, possibly rooted in Corbusian idealisms, alienated to the reality of modern / future society.

Such alienated rehabilitation interventions subtract and waste considerable quantities of components and materials, mostly within their lifecycle, without deepening the consequences of such acts, often mischaracterizing irreversibly and considerably the intervened building. Moreover, when subtracting the pre-existence to add and shape the new existence, the fusion between remaining and added technologies and materials, gets frequently in shock, due to the incompatibilities of characteristics and to the inconsequence of irreversible details.

3. RESEARCH AIM

The aim of this research is to contribute for the increase of lifespan (past, present, and future) consciousness in rehabilitation interventions of built heritage, through the development of a design process support tool for architects, when involved in rehabilitation design developments. By re-thinking the rehabilitation design process as a coordinated set of stages, and sub-stages, replacing the traditional experience-related process by a more conscious, rational, and theory-based approach; choices and solutions for specific design problems, traditionally taken base on

experience or individual thinking, can be now taken, base in technical awareness and attentive to potential alternatives.

Aiming to produce a useful, didactic, easy to use, and not time-consuming design process support tool; containing fundamental guidelines for every design phase, evaluation criteria and a technical support for architects, to better develop, assess and upgrade their own design developments; this research will pass through several test periods, to constantly verify and correct eventual faults or lacking subjects.

There is a lack of technical tools oriented towards rehabilitation design processes, and in specific towards lifespan ideologies, so we believe this study as a true contribution for architectural science. Rehabilitation interventions of built heritage can be lifespan conscious, respecting the past, implementing the present, and planning the future, independently of the building's official heritage classification. Consequently, architects will be contributing with their rehabilitation designs, for the preservation of both natural and built heritage.

4. RESEARCH METHODOLOGY

There are three main phases in this research (see Figure 1): the design theory, the design product, and the design result. The design theory includes LEVEL 1, where the background theory is presented and the problem field is explained, in order to introduce the phenomena of Heritage and Interventions; and LEVEL 2, where the theory, directly connected to the problem is framed and the definitions regarding Built heritage (what) and Lifespan rehabilitation (how) start shaping the research taxonomy.

The design product includes LEVEL 3 and LEVEL 4, where in LEVEL 3 the research focuses even more, into the case studies analyses and in the prototype development. Two architects were chosen in Portugal and the Netherlands "re-architecture", presenting their design processes of two building rehabilitations: one building classified and the other building unclassified by a Governmental Safeguard institution.

These case studies were needed to verify that conscious architects maintain their design process, in both classified and unclassified building. They do not neglect their significance to future generations, neither their condition as existing available resources.

The researcher has also developed two twin trimesters with students involved in rehabilitation designs, one in the Netherlands (September – November 2005) and another in Portugal (January – March 2006), so that the researcher could identify knowledge lacks or unnecessary information in the theoretical model, which will be the content of the prototype development (website).

The success and usefulness of this design process, when used by the students of two different countries, will verify if such design process can or cannot be used to support the rehabilitation of several building typologies, in different countries, serving only as base of further developments, always different in each building and designer.

LEVEL 4 includes the data collection and the prototype production (website). Even if the researcher has developed the global structure of both website and database, at this level, the researcher is counting with the support of an architectural student assistant to infill the database (integrated in the website) and a computer science assistant to support the materialization of the prototype.

LEVEL 5 includes the pre-test and test, regarding the acceptance of the prototype as a useful support tool. Similar trimesters to the ones developed in LEVEL 3 will be implemented, but this time, providing to the student free access to the website and its knowledge content, in order to analyze the differences regarding earlier design processes.

If the students in the pre-test, as the architects in the test show interest and declare its usefulness and contribution in the quality of the rehabilitation design this research can in LEVEL 6 (DESIGN RESULT) take its positive conclusions as well as develop further recommendations regarding remarks or faults found in all this research process.

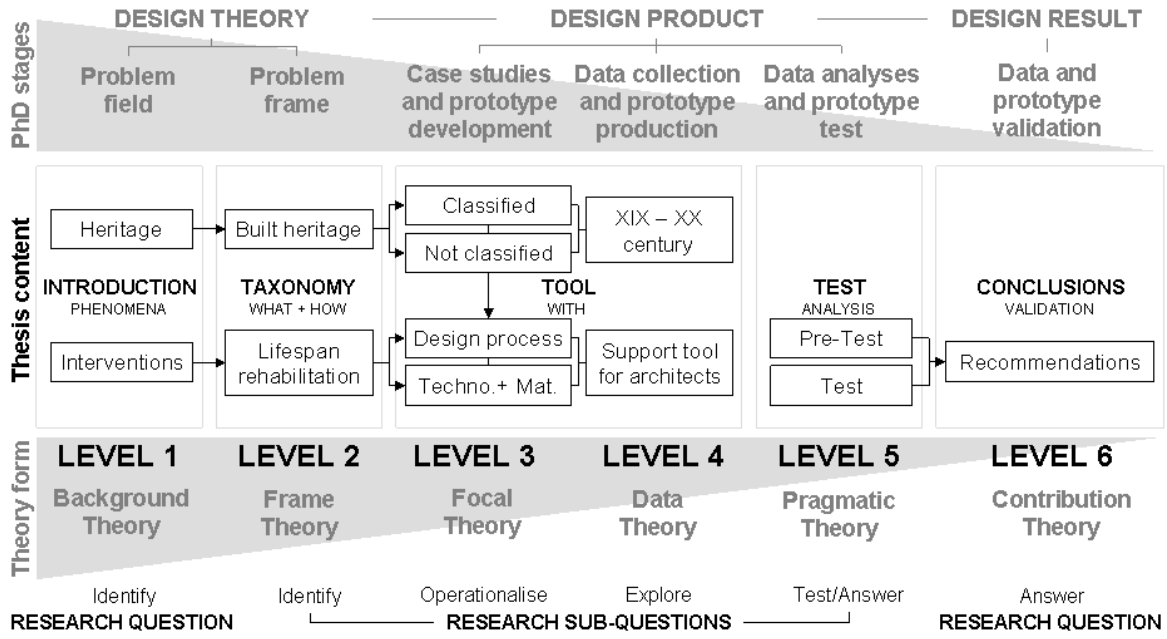

Fig. 1. PhD research design

5. TAXONOMY

5.1 What is built heritage?

Built heritage is normally target of rehabilitations with variable criteria, priorities, actions, and intervenients. Not all the buildings are equally perceived, varying according to its category, safeguard institution, town hall, political master plans, evaluation processes, etc.

In a theoretic utopia, the classified buildings are more protected in rehabilitation interventions, than any other current building, because it has been attributed to them a certain cultural value, which functions as a protection shield, if not for the entire building, at least to some relevant spaces and components.

However, what does normally happen with the current buildings, old or new, target of rehabilitation if there is no control? Should or should not they also be considered as heritage? Are or are not they also product of past generations? Do or do not have inherent cultural values?

For example, in Portugal, regarding the non-classified buildings, the intervenients in rehabilitation interventions – architects, contractors, owners, etc. – have to be the ones with a coherent ethical position regarding their design / construction decisions, because frequently many interventions do not require the municipalities' approval. Nevertheless, a question rises. How to control the intervenients and the building process in such situation? Which positions/solutions can be considered ethically correct and coherent, if society changes idealistically, from generation to generation, changing also their regent cultural values?

In the theoretical development of this PhD research, the built environment is subdivided in two sectors: the built heritage and the built newness. Built heritage is the taxonomy for all the existing buildings that passed down through one or more generations – around twenty-five years

– just like an object of inheritance that a precedent generation left for the following ones. Therefore, even if not interesting by any particular reason, built heritage will always represent the daily environment of humanity and provide a sense of local continuity anchored in the past toward the uncertain future.

Associated to their inhabitants or actions, built heritage represents past traditions of architectural design, craftsmanship, and ways of living and building in their own contemporaneity. It can always contribute to the development of future incoming generations, even if not in its totality, as an existing resource of structures, components, and materials. Existing buildings should not be simply demolished without considering its resources management and assessment.

Built newness is the taxonomy for all existing buildings built by the regent generation. Remarkable buildings from this innovative sector can also be classified as built heritage, by the regent generation, however, mostly built newness, has no part in built heritage, because in fact, it has not been inherited by the regent generation. One of the possible motivations for considering built newness as built heritage can be when such a building is a true and emblematic symbol of their time. So true, that they wish to proclaim to the next generations such particular situation.

Table 1. Built heritage temporal location

XIX century		**XX century**				**XXI century**	
1850 **1875**	**1875** **1900**	**1900** **1925**	**1925** **1950**	**1950** **1975**	**1975** **2000**	**2000** **2025**	**2025** **2050**
Built Environment (2025)							
Built heritage						Built newness	
Built Environment (2005)							
Built heritage						Built newness	

It is our belief that this built environment sub-division – if efficiently stimulated among governments and policies, stockholders, constructers and technicians – will contribute for a true change on how society perceives the built heritage, as well as, a direct influence in the actions and choices regarding built heritage interventions. Such an extreme position ends with interventions influenced by stylistic favoritisms, building categories, or other more subjective matters; because all existing buildings, built by earlier generations are classified automatically as heritage.

This patrimonial democratization has the purpose of reinforce the necessity of treating built heritage with impartiality. In such way all buildings that would not integrate the cultural values, normally attributed to heritage buildings would immediately take part of the built heritage world, because they would have, inevitably, as existent and available material resources, a very high inherent ecological value.

Figure 2 presents the cultural values network developed for facilitating the cultural values identification, by the built heritage intervenients / designers. It includes beyond the expertise values: historic, aesthetical, scientific, and social values, recommended by the Burra Charter (1979); the non-expertise values: age value theorized by Alois Reigl (1903), the economic, the political value, and the ecological value.

<table>
<tr><td>Evidential</td><td>Notable</td><td colspan="2">Artistic</td><td>Conceptual</td><td>Technological</td></tr>
<tr><td>Educational</td><td>HISTORIC
(authenticity)</td><td colspan="2">AESTHETICAL
(original)</td><td>SCIENTIFIC
(rarity)</td><td>Workmanship</td></tr>
<tr><td rowspan="2">Management</td><td rowspan="2">POLITICAL
(symbolic)</td><td>HS</td><td>AS</td><td rowspan="2">AGE
(patina)</td><td rowspan="2">Maturity</td></tr>
<tr><td>PE</td><td>AE</td></tr>
<tr><td>Entertainment</td><td>ECONOMIC
(worthy)</td><td colspan="2">SOCIAL
(identity)</td><td>ECOLOGICAL
(continuity)</td><td>Existential</td></tr>
<tr><td>Use</td><td>Allegory</td><td colspan="2">Emotional</td><td>Spiritual</td><td>Essential</td></tr>
</table>

Fig. 2. The cultural values network

5.2 How should lifespan conscious rehabilitations be done?

This research has theorized built heritage interventions in a scale, from one to seven, dependant on their scale of impact and risk for the building. Every intervention scale has two possible sub-scales: the passive and the active approach. Focusing in the subject of this chapter, the intervention of rehabilitation was considered the intervention scale five, in-between restoration – scale four and reconstruction – scale six. Rehabilitation is an intervention that integrates actions from other types of interventions, from both inferior scale – deprivation, preservation, conservation and restoration; and superior scale – reconstruction and demolition.

Table 2 presents the global scale of intervention, sub-scales, definition and targets, regarding the categories: substance, function, performance, built and resources. As earlier referenced, the rehabilitation intervention can have a passive approach, maintaining the original or current function – reuse, but it can also have an active approach, introducing a new function – adaptation.

Even if representing different approaches, one normally more invasive than the other, both sub-scales target towards the building substance, in the relationship between the subtracted and the added reality, facing the remainings from the pre-existence towards the new existence.

By pre-existence, we define the building in the pre-intervention phase and by new existence the building in the post-intervention phase. With the purpose of improving the building performance in all its fundamental features, the rehabilitation focuses mostly in the built heritage, perceiving its forms, components, and materials as potential resources.

A rehabilitation intervention is considered lifespan conscious when respects and considers the three temporal realities during its design process: the past, the present, and the future. The past is considered when the designer plans and designs about the preservation, reuse and recycling of the pre-existence, as much as possible. In other words, the designer needs to plan in his design developments the use / destination of every pre-existent form, component, and material; independent of its classification as subtraction or remaining reality (see Figure 3).

Table 2. The scale of intervention

intervention			description	target				
				substance	function	performance	built	resources
scale one	deprivation	passive abandon	leave the building fall into decay and obsolesce, without any concern	subtractions	original or current function	decrease	environment	none
		active vandalism	contribute to the building's decay with destructive and intentional actions					
scale two	preservation	passive inventory	register, study and analyse the building (documental and physical)	remainings			heritage	decorations and traces
		active prevention	clean and arrest decay in a routine basis to control degradation			maintain		
scale three	conservation	passive maintenance	repair small conditional damages in the general building context					
		active safeguard	repair medium damages and treat decays in the general building context					
scale four	restoration	passive restitution	repair large damages and consolidate punctual fissures / lacunas			restore		forms / components / materials
		active reconstitution	consolidate and rebuilt lacunas according to the building aesthetics	sub. / rem. / add.				
scale five	rehabilitation	passive reuse	combine earlier / later activities, subtract the exceeding and add the required forms and components			improve		
		active adaptation			new function[s]			
scale six	reconstruction	passive rebuilding	rebuild the building partially or totally, based on historic documents	additions		replace	newness	components / materials
		active building new	build new buildings, reusing existing urban fabrics and infrastructures					
scale seven	demolition	passive reduce	demolish the building, but reuse or recycle the components/ materials				environment	
		active waste	demolish the building, without reuse or recycle the components/ materials					

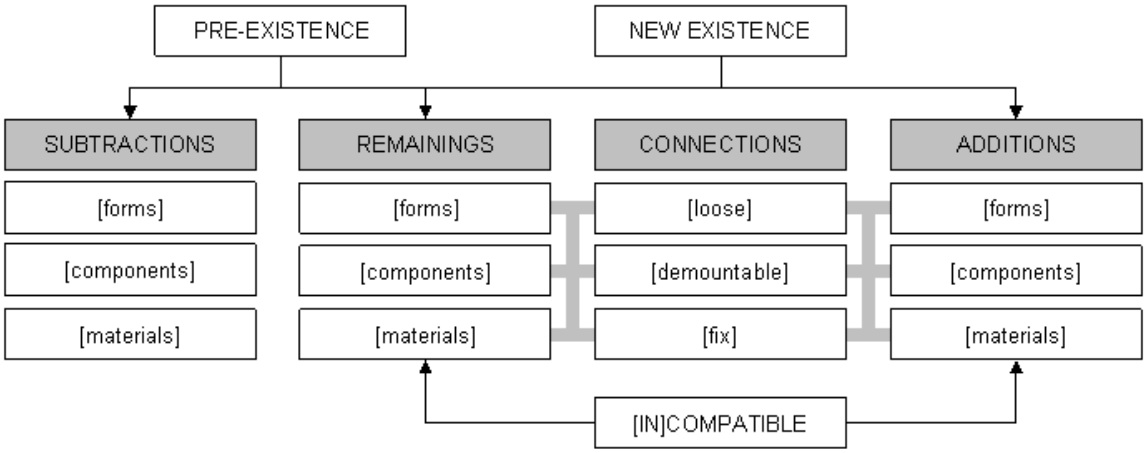

Fig. 3. The four parallel realities in rehabilitation

Normally, the architects involved in rehabilitation designs are already used to develop "reds and yellows" drawings (reds – additions / yellows – subtractions), but actually, how many designers really reflect and weight the areas drawn in yellow? Should or should not a designer have to justify consciously and plan all the building subtractions? This reasoning process is one of the baselines of this theoretic design process model; however, there are two other realities, which still lack enlightenment.

The present is considered when the designer plans the improvement of the building and environment, its significance and condition (e.g. energetic efficiency), trying to reach in the new existence the levels of comfort and economy necessary for the contemporary life. The present reality is already considered by most of the designers, however, this research defends that the true equilibrium, in rehabilitation designs, comes from the adding together of the other two realities (past and future) to the present reality.

The future is considered when the designer plans the additions in the new existence, based in the effective compatibility between the remainings and the additions characteristics. A very important factor, from the new additions, is the different connections between remainings and added components. For this reason, it has been identified particularly, as the fourth parallel reality, even if somehow it makes part of the two realities, building remainings and additions.

Often, it is possible to make formal loose additions, also in the building interior, leaving them "fixed" by their own weight. In case of building components additions, it is often inevitable to have fix connections to the remainings, however, this same connection can always be planned and designed, with dry details, fitting systems, etc.. Then the designer would only opt for irreversible solutions in extremely necessary cases.

Consequently, most of the added components can be removed or substituted if necessary, aiding maintenance activities, replacement activities, and even future interventions. Specially the interventions planed and developed by the owners / users, which the expertise can no longer control. It is not expected from a designer the possession of the entire knowledge, regarding all technologies and behaviors of every material and components available in the construction industry. Therefore, when he chooses for a solution, not always, it reveals as the adequate solution.

By only considering and planning, the additions connected to the remainings, with flexibility and reversibility; such small design decision, already brings big advantages to the design, because, in case of clear inadequacy or deficiency, components could be removed immediately and easily, without further complications.

Another fundamental factor in the decision making process of the additions, regards its effective durability versus the building service life. The designer must always think about the optimization of his solutions, and adequate his choices to this two lifecycle references.

When consciously considering the preservation of the past and controllability of the future, the designer is considerably contributing for the reduction of design mistakes, which normally emerge after the rehabilitation design is constructed or later during the use period. Case by case, this will prevent future demolitions, and consequently reduce the amount of reusable construction and demolition waste (C&DW), because then, only obsolete components, which have no other destination than incineration and landfill, are going to be wasted.

6. TOOL FOR ARCHITECTS

The tool for architects has as basis a theoretic model structuring the stages and sub-stages of a rehabilitation design process. This research "theoretic model" progressed from the theoretic model developed Roozenburg, and Eekels (1991), which has also progressed from the theoretic model develop by Jones (1963).

Jones has defined the main three stages – Analysis, Synthesis, and Evaluation – and later on Roozenburg and Eekels added two other stages to Jones's design process, Simulation and Decision. Both theoretic models, where considering the design process generally, however, its adaptation and focusing towards the rehabilitation design processes turned out quite adequate.

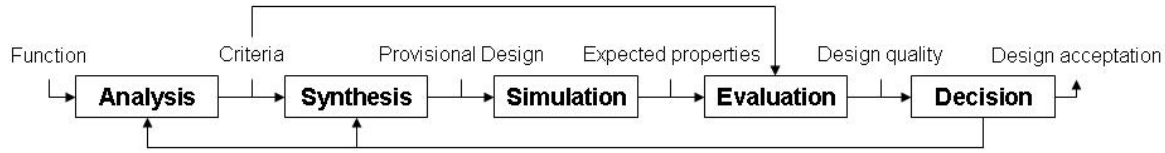

Fig. 4. The five-stage design process (Roozenburg and Eekels, 1991)

6.1 With which design process, technologies, and materials?

The design process of a lifespan rehabilitation intervention re-designs the original design process. Several differences are clearly identified; fragmentation, positioning, and relationship between the design process stages, but the most important distinction is the establishment and contents of the inherent sub-stages.

Every existing building is different; however, the design process, as long as conscious of the entire building environment, significance and condition, can be developed as an ideal model, that the designer can follow, for the rehabilitation of every existing building.

In the ideal procedure the designer involved in a rehabilitation design, will go through the design process stages and sub-stages, finding procedural, evaluative, and technical guidelines to support his rehabilitation design lifespan oriented.

Inversely to an original design process, the designer, involved in a rehabilitation design, has to deal with an existing building that had passed already through an original design process, and depending on its lifespan, through few interventions. There is an entire reality, the designer should observe, instead of merely look or ignore.

Therefore, this research develops a design process subdivided in two building lifecycle stages: pre-design and design stage, the first building-oriented (pre-existence), and the second intervention-oriented (new existence). Figure 5 presents it schematically. In the support tool, every sub-stage will have a clear explanation and guidelines suggesting common procedures.

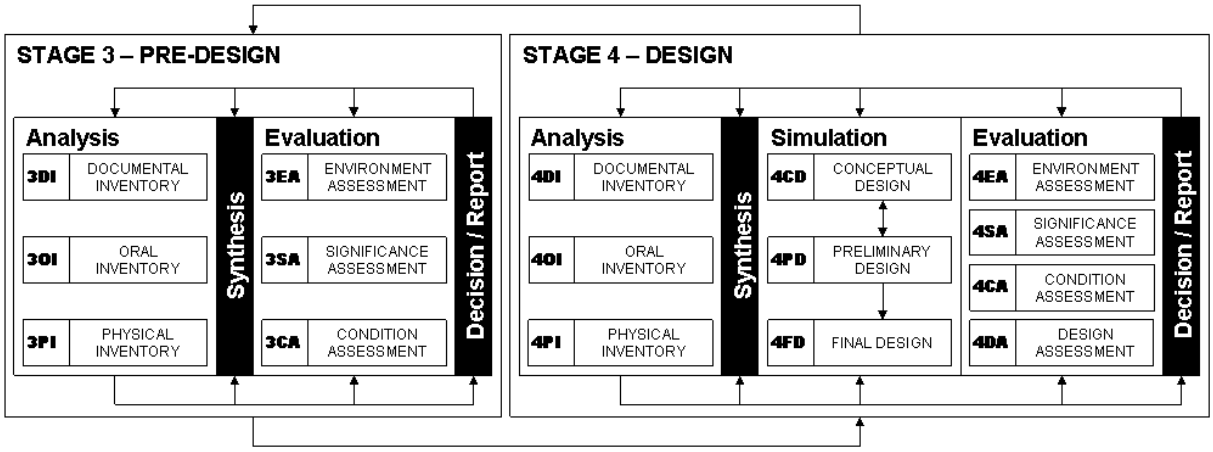

Fig. 5. The Lifespan rehabilitation design process

The intention of this research was to provide a design process, to the architects involved in rehabilitation designs, supportive in their varied sub-stages of reasoning and decision-making, but not to provide the solution to all their problems. Even if this design process already coordinates numerous sub-stages, there are certainly other sub-stages missing, especially the most specialized ones, oriented towards specific building typologies, environment, material, etc., however, this already goes beyond this research aims.

In the design stage, the designer analyzes the existing building, via the documental (3DI), physical (3PI) and oral (3OI) inventories. Then he synthesizes all important information towards the three following evaluation areas; and based on the most reliable evidences, he evaluates the building's environment (3EA) significance (3SA) and condition (3CA). The decision / report sub-stage documents the whole process.

In the design stage, the designer analyzes the rehabilitation intervention via a similar process to the pre-design stage, however, now; the analysis is requirements-oriented, confronting them with the building pre-design report. He synthesizes the most important information and starts simulating the materialization of ideas and convictions in several different periods: conceptual (4CD), preliminary (4PD), and final design (4FD).

After all the design developments, the designer evaluates the advantages and disadvantages of the chosen solutions, and can directly compare the evaluation, pre and post rehabilitation, regarding the building's environment (3EA – 4EA), significance (3SA – 4SA) and condition (3CA – 4CA). Still integrated in the evaluation sub-stage, the designer can evaluate his own design results (4DA).

In such design process, the designer can always go back and improve his solutions. The designer concludes his design process, when he finally decides specifically for a design form, technique, and materials. The decision / report sub-stage documents the whole process and respective design solutions.

7. CONCLUSIONS

The rehabilitation design process, while theoretical model has suffered several mutations, not concerning the stages itself, but mostly regarding their inherent sub-stages. First, the researcher has presented and compared the theoretic model, with the design process model of two international architecture offices, used to develop rehabilitation designs of both classified and not classified buildings. The a Portuguese architecture office was Victor Mestre │ Sofia Aleixo, in Lisbon, and the Dutch architecture office was Jouke Post, in Rotterdam.

Second, and still under development, the theoretical model is being used by students, Portuguese and Dutch, in order to find lacunas in the model, as well as, identify the stages with more importance and difficulty during the entire design process. It is the purpose of this theoretical model, to become a useful support tool (international), and that is why such periods are so important.

This design process intends to provide technical knowledge to the designer. With such support, he will be able to develop a professional work, based on the international recommendations and technical guidelines. The designer will be able to develop comparisons among solutions and develop a self-critic evaluation, regarding his ethical and technological appetencies. This design process may seem a rigid structure; however, it does not intend to force or substitute the designer's reasoning and decision-making process. It aims to provide him a theoretic model, techniques, and materials, to support his own design decisions.

We believe, that by the end of this PhD research, a prototype of the tool will be available in the internet, ready to support architects developing lifespan conscious rehabilitation designs in built heritage.

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