INNOVATING BUILT HERITAGE: ADAPT THE PAST TO THE FUTURE

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Summary

The contemporary worldwide targets towards sustainability, especially when regarding the building sector, have been guiding many researchers and technicians through the development of new challenges in the building industry. Many outlines came throughout, but mostly considering new buildings, where new technologies as well as new materials did not have to deal with a pre-existent environment.

With a large scale of urbanized areas, from past and present generations, we face an entire stock of resources that has been underestimated, by society and consequently by their social actors. This same stock of resources embodies different buildings, technologies and materials, mostly designed without any predetermined lifespan and built without giving much importance for the service life of their spaces, structures, and materials.

Re-Architecture: Lifespan rehabilitation of built heritage is a PhD research surveying a conscious way of intervening in the existing stock, taking into account all the necessary aspects of the building process, from pre-design, design, construction, use, further interventions and demolition, considering in advance the reuse or recycle of all included materials. Born as a concept in 2002, such research is now under development in the BTO Department, Eindhoven University of Technology, orientated by Prof. Ir. Jouke Post and Dr. Ir. Peter Erkelens.

1. Introduction

Old buildings face many problems of inadequacy regarding their natural aged or functionality, mostly aggravated by the lack of maintenance or inappropriate use. Either for abandon, technical ignorance or lack of capital to intervene, involuntary or not, the fact is that these promising new development areas, just in the city centre, make their stockholders dream economically higher, not measuring resources for building a total new building, fulfilled with modern infrastructures adequate to the contemporary living, even if that means to totally destroy a building that partially, if not totally could see its components been reused or recycled.

Such interventions and their waste of resources are many times sheltered by the urbanity scale of rehabilitation, believing in a true contribution for the built heritage preservation. There is even a current tendency of, when not totally demolishing the old structure, to hide this new innovative building behind the envelope of the old building. As if it wasn't enough sometimes even the new building sees its façade being constructed exactly as the one demolished before, but with the use of modern technologies, losing character and lifespan.

We could understand, even if debatable, part of this intervention philosophy emerging after natural and humankind calamities (earthquake, war, etc.) because then a huge urban area is totally destroyed within several monuments and built heritage, but not for exclusively economical aims.

What happen to the so debated authenticity? Shouldn't we build according to our contemporaneity? Shouldn't we embrace the fact that all obsolete buildings should and can be reused, but respecting the existence and their heritage character? We believe that something can be done in order to fulfil this gap: Interventions can reuse or recycle the maximum of the existent resources and integrate all modern infrastructures regarding the XXI century needs.

2. The lifespan of built heritage

By built heritage, we consider all the existing buildings that passed down through one or more generations, just like an object of inheritance that a precedent generation left for the following ones. Even if not interesting by any particular reason, they 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, they represent past traditions of architectural design, craftsmanship, and ways of living and building in their own contemporaneity.

Built heritage can always contribute for the development of future incoming generations, even if not in its totality, as an existing resource of structures, elements, and materials. Existing buildings should not be simply demolished without considering its resources management. It is our believe that after these principles had been stimulated among governments and policies, many stockholders, constructers and technicians will have necessarily to start thinking about their actions and choices regarding built heritage interventions.

But what to do with all these old buildings? Wouldn't it be much easier, as commonly defended, to simply demolish it and build a totally new and updated building, much profitable, flexible, and functional? In fact, old buildings face several pathologies that depending of its gravity of scale can represent a considerable application of economic resources in specialized technicians that need specific conditions, material and time to work. This fact is not well received by common stockholders that think "no need for specialties", because they know what to do, and in the end, they treat old buildings, using exactly the same technologies they are acquainted for building new buildings, independent of the building original composition.

We will not deny that economical values are important, but we have reached a time where also other factors should to be taken into consideration. Our planet is facing serious ecological problems that everyone has to become conscious. It is undeniable that built heritage gets obsolete, degraded, outdated, and old-fashioned; however, not every building components have the same characteristics, behavior, present the same pathologies, neither have the same lifespan. A building is considered as a combination of "several layers of longevity of building components." (Duffy, F. 1990), but the analysis of the building components and their lifespan cannot be restricted to the substance of the building, forms, components neither materials. Francis Duffy distinguished four layers in a building: *shell* for the structure, *services* for all the technical installations, *scenery* for the internal partitions and *set* for the furniture.

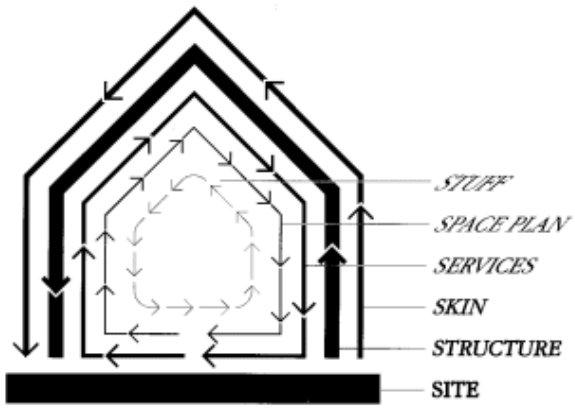

Figure 1 Shearing layers of Change (Brand, S. 1994)

Those "four S's" have been later expanded for "six S's" by Steward Brand, subdividing the anterior terminology *shell* as ***skin*** for the external surfaces and ***structure*** for foundations and load-bearing elements; altering the previous *scenery* to ***space plan*** and *set* to ***stuff***, maintaining from Duffy's theories the term ***services***. He also referred two more "S's", but as you can perceive in figure 1 only ***site*** takes part of the "shearing layers of change" within the intention of adding concepts such as geographical setting, urban locations and legal lots into the building components layering. Human ***souls*** come only mentioned as a possible seventh and last "S" from the layering hierarchy.

In figure 2, Brand's "shearing layers of change", most oriented towards commercial buildings, were re-structured focusing our target of survey: built heritage, which has to be regarded particularly due to its vast range of forms, elements and materials. For example, in some heritage buildings *skin* and *space plan* are synonym of *structure* and do not follow the lifetime expectancy of thirty years, but much more than 300 years, varying according to the building environment, inherent cultural values and individual features.

Environment is considered as all the circumstances and conditions that surround, affect, and influence the development and survival of every existing building or the group of buildings, combining the former *site* and *soul* in only one term. S*ite* is here replaced by geographical and physical environment, embracing not only

the building setting (altimetry, morphology, biology, resources), but also the climate to which the building is exposed to. S*ouls* became the anthropological environment, embracing not only the users, “servants to our stuff” (Brand, S. 1994), but the entire group of social actors that interact with built heritage as leaders (stockholders, politicians), experts (historians, archaeologists, architects, engineers) or simply as constituents (owners, users).

Every human being has their own principles and intentions towards reality and in this particular case to what built heritage values, but in some cases their approaches and reactions appear quite stereotyped, following their social groups. The **cultural values** are then no more than invisible filters created by society to overlook reality, changing from generation to generation, from social group to social group, from human being to human being. As target of a hierarchical overview of significances, an existing building can be appreciated by its historical, aesthetical, scientific, age, ecological, social, economic or political value. Even if these are the most subjective of all the layers presented, cultural values are the ones that most influence and model decisions of intervention, often independent of the building features and grade of conservation.

A building is not subjective but a living product of its own contemporary society, with substance, function, production complexity, performance and costs. These **features** are not static but change constantly with time. Without an intervention, the substance of the building gets more and more degraded, the function more outdated, the production complexity more simple and the performance less efficient. Only the building costs increase, parallel to its historic, aesthetical, social, economic and political value considered by its anthropologic environment.

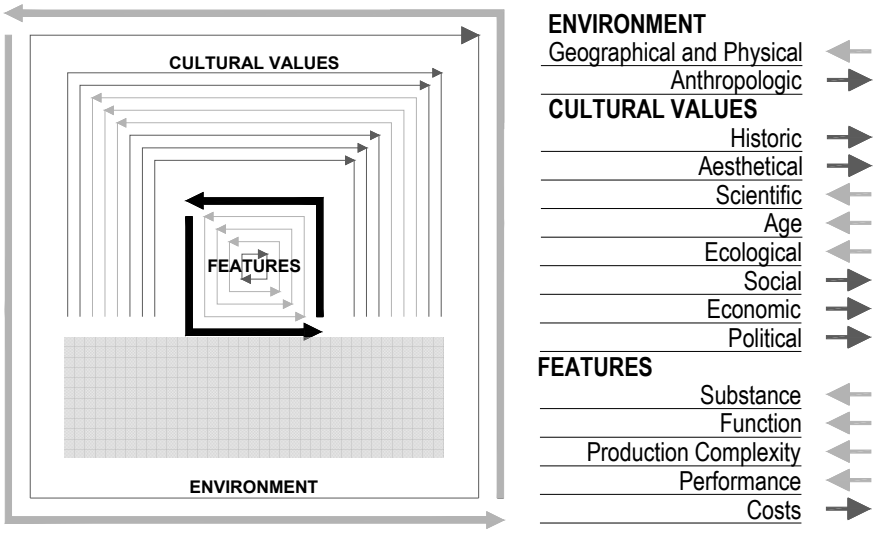

Figure 2 Built heritage “shearing layers of change”

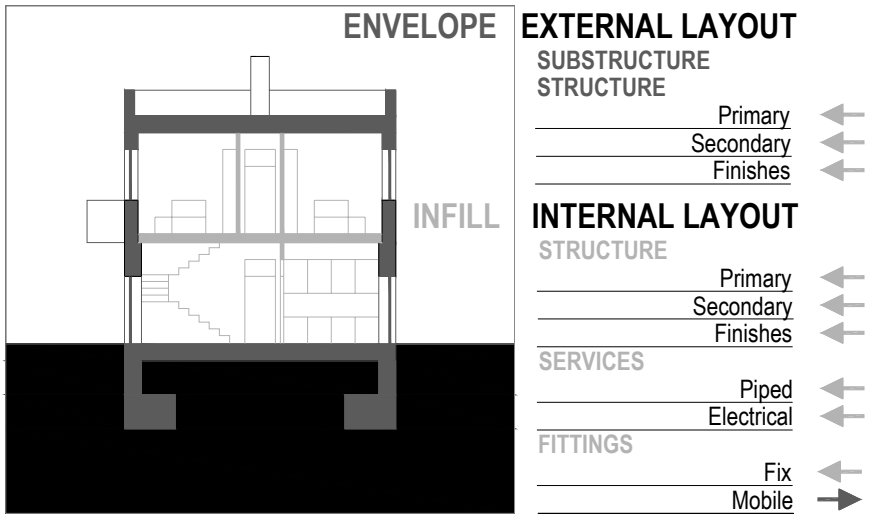

Figure 3 Built Heritage substance

Substance is subsequently the big aggregate of all the 5 remaining Steward Brand “S’s”. Totally objective and precise, it encloses all building time layers in three possibilities of materiality: either as forms, regarding the spatial planning and necessary areas for the specific function in question; as components, regarding the building composition and elements (external and internal layout); or merely as materials regarding the availability of resources (stone, bricks, concrete, wood, glass, etc.).

Thus, by zooming in the substance layer in the components option (figure 3) we find two main groups, the external layout **envelope** – substructure and structure (primary, secondary and finishes); and the internal layout **infill** – structure (primary, secondary and finishes), services (piped, electrical) and fittings (fix and mobile furniture). Both envelope and infill have three sub categories of layers regarding their lifetime expectancy and flexibility: long, mid and short term. Without any intervention, again the shearing layers of change do not progress, except for the mobile fittings (furniture, decorations, electrical equipment, etc.), that with a shorter lifespan are more sensible to society’s changing fashions and technological developments.

3. The Lifespan rehabilitation of built heritage

Interventions are becoming more and more common in what concerns reusing or giving new uses to existing buildings, but our question is how are they being done? Do they consider all cultural values in harmony with each other or do they simply ignore all values except for the political, economic and social ones? Sheltered by the urban scale of rehabilitation, interventions can often be quite destructive and represent a huge amount of resources waste.

The following figures 4 and 5 represent two rehabilitation interventions, one in Portugal and other in the Netherlands, where both buildings have been demolished, but in the Portuguese case, the specter of what once was the main façade was left for inheritance. Portugal is not yet as developed as the Netherlands on sustainable matters, so there was no waste management and all materials have been sent to the Landfill without any previous ecological consideration, neither material division.

An inevitable question rises: If the intervention program is to end up with an old building in appearance, why to totally or “partially” demolish and rebuild it exactly the same in form and style? Was the building in such a conservation state that nothing at all could be recovered and reused? It is difficult to believe how the new technological structures can compete in quality and lifespan with the old structures that survived throughout all kind of adversities during centuries, but evidentially historical aesthetical and scientific values didn’t take much priority in these cases.

Figure 4 Rehabilitation of an old villa in Cascais, Portugal

Figure 5 Rehabilitation of an old quarter in Eindhoven, The Netherlands

Authenticity is so proclaimed in international charters and declarations, but still in old urban areas we find abundantly this type of interventions. If it is highly recommended that every intervention is done with the available tools and technologies in your contemporaneity, why to pretend that the building apparent exactly the same as tree hundred years ago, even if in fact is a XXI century building? Can’t we do something to subvert this economical exploitation tendency? Table 1 presents the scale of intervention for each building feature that can among time demonstrate or be responsible for building pathologies. Such pathologies will eventually stimulate interventions, and choice possibilities are valuated by a one to five scale [I to V], according to their sustainable weight and use of natural resources.

With this scale it is not our purpose to declare that for every feature and building case, only scale V intervention is the best and should be the option to choose, because by the fact that you are considering to reuse an existing building and its urban infrastructure is already more sustainable than just let it there abandoned and go built in some other place else without any infrastructures. However, in what regards the intervention sustainable weight there exists an ideal standard - wasting the least human, energetic and natural resources possible, which does not happen in scale I where disregard, demolition and waste are the mainly rules.

Table 1 Scale of intervention

				Scale	
Features	**V**	**IV**	**III**	**II**	**I**
function	use	reuse (upgrade)	readapt (compatible)	readapt (incompatible)	not use
substance forms	use	reuse (upgrade)	partial additions or subtractions	partial additions and subtractions	global mutation
substance components	arrest decay, repair, consolidate or reinforce (compatible)	partial substitution (compatible)	total substitution (compatible)	partial substitution (incompatible)	total substitution (incompatible)
substance materials	use	demount and reuse in a different situation	demount, recycle and use	demount and recycle	demolition and waste
production complexity	very easy	easy	reasonable	difficult	very difficult
physical and technical performance	improve	maintain	recover	decrease	replace
costs	profit immediate	profit short term	profit mid term	profit long term	no profit

An intervention does not need to reach the standard ideal in every feature, because also, the building and the design program cannot allow that expectation, but the goal is to pursue sustainability always, even if dependent from the circumstances of every building feature. For example, if you have an intervention in hands, where the design program purpose is to change the function of the existent building into an incompatible one (scale II), you will necessarily have to make more spatial additions and subtractions to the existent form of the building (scale II) than if it was a reuse or even a compatible function. This situation is and was very common in every historical center of the world, especially regarding the last century considerable percentage of housing sector that has been converted into services (commerce, services, etc.) and the deactivated functions such as industries, religious and educational buildings that have also been target of rehabilitation, especially if located in the CBD (central business district).

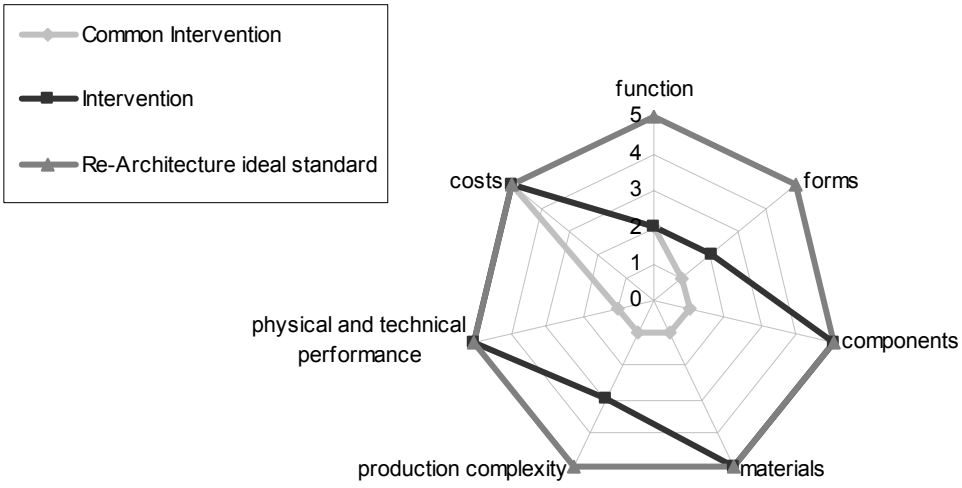

Figure 6 Scale of intervention

Nevertheless, the intervention scale regarding functional and formal spatiality, the status of conservation and cultural value of the building substance has to be observed consciously. Then you can start by choosing to think sustainable through;

- maximizing the use of building components that are still presenting good performance and state of conservation (scale V);
- reuse for some spatial additions the components or materials subtracted earlier (scale IV and III), by arresting decay, repairing, consolidating and reinforcing whenever necessary;
- send to recycle the exceeding components (scale II), contributing for the growth of recycling materials in the construction industry;
- and only as last hypotheses, send the materials that cannot be recycled (hazardous, obsolete, etc.), to the landfill as waste (scale I).

With this philosophy of intervention (rehabilitation), you will improve the performance of the building instead of totally replacing it (demolition), especially if you also consider some regeneration measures (passive and active) in its technical and physical behavior facing the geographical and physical environment.

Additionally, not only rehabilitation has an easier production complexity if you compared it to the entire process of demolition and building a total new building, but also the costs/profits of such intervention do not rise, because proportionally the percentage of resources reused will decrease the use of new resources. Figure 6 presents a summary of the building features explained in the previous paragraphs and the sustainable area disparity when confronting a common intervention and a conscious intervention.

4. Conclusion

The existing building stock has to change, allowing, and facilitating changes. Always appropriate in several uses, buildings cannot be synonym of dilemma anymore, but synonym of answer. Even if a building and their designers cannot challenge the uncertainties that the future might bring, something has to be done in order to subvert social tendency that accept the fact that every building can be demolished and new can be built instead. The Land filled wastes in industrialized countries show that already 20 to 30% of the global waste goes to Construction and Demolition waste.

An intervention cannot be seen anymore as an isolated action. It has to consider the existing building and its interrelations, before and after intervention (pre-design, design, construction), providing all necessary information for a better use, maintenance and further interventions that will certainly take place in the future.

If it is always expected in built heritage interventions an improvement regarding the inhabitance conditions in quality, comfort, safety and salubrity, a step forward should be taken in order to make ecology a rule and not the exceptional consideration. As presented sustainability is easily achieved in every building feature, even in what regards ventilation, lighting, thermal isolation, acoustic insulation, domestic water systems and the energy needed to provide an update till the contemporary standards.

We believe that something can be done in order to fulfill this gap: Interventions can reuse or recycle the maximum of the existent resources and still integrate all modern infrastructures regarding the XXI century needs.

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