Sustainable design graduation studio
MSc Architecture, Urbanism and Building Sciences [Building technology]
Faculty of Architecture and the built environment

Title: Transparent Restoration
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Reflection

Aspect 01 . The relationship between research & design

The current thesis deals with an innovative restoration approach, which introduces structural glass as the main restoration material in order to consolidate and safeguard a historic building. Research has been an integral part of my project and was based on literature derived from both the theory of conservation and the glass technology. The most valuable tools derived from the first phase of the literature review were the methodology to approach a restoration work, the main restoration guidelines as well as a first insight on how different glass configurations can be used to substitute for the missing parts. Apart from a general overview of when and how glass could be used in restoration instead of conventional materials, a case study was chosen on order to further investigate the topic and conclude with a final product. That led the way for further research simultaneously with the design in order to directly address to aspects such as manufacturing, construction and assembly. Research and design were in close relationship throughout the entire thesis, as the topic, in both its origin and development, sets a lot of challenges and demands a versatile approach.

Aspect 02 . The relationship between the theme of the graduation lab & the subject/case study chosen by the student within its framework.

The sustainable design graduation studio focuses on innovative technologies that can contribute to the façade, structural or climate design in respect of sustainability. The subject selected presents a twofold sense of sustainability in terms of recycling, which relies both to the concept itself but also to the design product.
Cast glass is a relatively new approach of using glass in a structural way, having few realized reference projects and a lot more research yet to take place. This idea of cast glass components, however, is even more intriguing when combined with an interlocking structural system. Such a system rejects the use of adhesives and embraces a faster and easier assembly mode. The most valuable advantage of that system is that it allows for reversibility, which is one of the requirements set in the beginning of the thesis, as it addresses to restoration purposes. However, its manufacture process that demands high temperatures and energy has made glass a rather environmentally unfriendly material. Aiming at a more sustainable environment, the recent advancements have made glass recycling possible; however, a great effort and energy is still needed to separate it from additional materials, which makes glass coming from the construction field to be rarely recyclable for glass products manufacture. Thus, the concept of reversibility does not only fulfill the design criteria but also turns glass “green”: the absence of any adhesive sustains the glass units still pure after use, eliminating waste in the production line and makes a more sustainable use of it.

On the other hand, restoration is assumed to be the process of managing change[1] and if managed properly it can result in a more effective and productive way to take advantage of our built stock. This "recycling" of buildings is closely related to the idea of sustainability from an environmental and economical point of view. Maintenance is the most challenging issue in such cases; however, glass is an abundant natural resource that requires almost zero maintenance, durable enough and, taking into account the emerging technologies e.g. on protective coatings and a basic maintenance, it is assumed capable to consolidate a monument for the estimated period of a century.

Aspect 03 . The relationship between the methodical line of approach of the graduation lab and the method chosen by the student in this framework

The methodical line of approach of the graduation lab is technical-scientific study and design research or execution of a design.
The methodology chosen in the current thesis is based on a technical-scientific study and design by research. The findings derived from the research are used as an input for the design principles, while research still continues as new aspects emerge. An integral part of the project is the fabrication of physical models to get the know-how of the main product of my design: a cast glass interlocking unit. Furthermore, an experiment is conducted to validate the assumptions made and the decisions taken, as well as to provide an input and first estimation regarding the structural aspects.

Aspect 04 . The relationship between the project & the wider social context

The current research could set a basis on how to approach restoration works aiming at transparent solutions, by means of structural glass. This field is yet to be explored and established as an acknowledged restoration technique, thus there are no guidelines or scientific references we could address to. The findings and results of this research could become a future reference for architects, archaeologists and engineers who are involved in this discipline.
Innovations in the glass industry during the 20th century have added another dimension in glass design, allowing for 3D configurations rather than flat panes, such as columns, solid blocks and grid shells. The emerging technologies constitute glass today a primary structural element gaining more and more attention as it allows for full transparent enclosures [Apple Cube 2.0, NY]. These are the basic qualities and advantages of the transparent restoration concept; the combination of transparency and structural performance. Purity of glass can result in an honest dialogue of the visitor with the current setting as it has been shaped along with the monument throughout the centuries. The historic fabric can be assumed to be part of the landscape and the treatment it gets should be respectively gentle and discrete, in order not to alter this image of natural decay.
Dematerialisation can once again be a design tool in another sense than that of the modern movement. What the current restoration approach embraces is the literal transparency as "an inherent quality of substance"[2] by means of structural glass. Reconstruction and "deconstruction" are two interrelated concepts embodied in a monument that has been consolidated with glass; the material reconstructs by filling the form but at the same time creates the illusion of absence.

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[1] Orbasli, A. (2008). Architectural conservation : principles and practice. Oxford :, Blackwell Science.

[2] Rowe, Colin, and Robert Slutzky. 1963. "Transparency: Literal and Phenomenal" eds. Todd Gannon and Jeffrey Kipnis. *Perspecta* 8: 44–54, from Carvalho, P. L. L. d. (2014). (De)materializing Detail: Technology, Structure, Design Development of a reinforced glass connection technique. Doctoral Thesis, Universidade do Minho.

This exact concept of material and immaterial solutions could be the answer to an on-going debate between “restoring” and “preserving” a monument. There is a fine line suggesting that any intervention should be kept to the minimum in order not to undermine or alter the aesthetics of the existing structure, while at the same time it should be efficient enough to consolidate it. Nowadays, these two ambitions are often conflicting and materiality is considered a crucial aspect in the field of restoration. In this innovative approach, glass, being neutral, acts in a rather subtractive than additive way to the monument causing minimum visual obstacles and allows for a simultaneous perception of the monument both on its original and ruinous state.

As theories on restoration have changed throughout time, the spirit of each era has greatly contributed to their evolution. In our times, of technological advancements and continuous innovations in different disciplines, restoration and general monument conservation are highly regarded as a matter of national identity in close relation to the promotion of tourism. The use of glass in adequate and viable restoration scenarios could prove a significant design tool not only to safeguard our built heritage but also as a direct demonstration and reflection of the dominance of technological development of our times.