Entity and identity of metal additions in ancient buildings

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Highlights

The project for historical heritage has to deal with the building-material, which is synthesis of structure and form, history and projection, tradition and innovation. Its complexity requires a multidisciplinary approach that evaluates simultaneously all the aspects, recognizing the mutual interferences and resolving them with compatible solutions. The research aims to understand how such interferences have been resolved in Italian architecture, in order to acquire a technological shared know-how that allows a wider group of designers to develop original solutions.

Abstract

The research investigates the role of steel in pre-existence, at first confined to consolidation, later extended to reuse. The metal artificial nature and the untraditional constructive system make more complex the issue of addition visibility in pre-existence, employed for static purposes or functional aims. Anyway, the iron entity is expressed each time in a specific way, which is compatible to the historic building, concealed among the masses involved, or highlighted in its essentiality.

Keywords

Consolidation, Reuse, Steel, Concealing, Highlighting

1. INTRODUCTION

Each project for the built is based on the recognition of the formative processes of pre-existence as content of material and intangible resources: the research about the ancient building provides tools for define the role of steel in the project, now as a strengthening medium for conservative purposes, now as an instrument capable of adapting pre-existence to new uses. The role in consolidation has often been played avoiding significant changes to the formal aspect. Otherwise, in reuse and functional requalification, the addition combines with pre-existence allowing also the transformation of the architectural image, since the building is considered an individual with a personal history, which structure and distributive, constructive and formal systems are tied by a close relationship.

The changing role of steel in the built is investigated in attempt to unify
the intentions of different experiences through the analysis of the causal relationship between technical and design choices. The survey focuses on how steel participates to the construction of the architectural space, in order to define the extent of its presence. The transposition of “concealment” and “highlighting” concepts into different modalities of adding steel, gives new interpretations of the projects that use it, to underline its potential as a synthesis material of structural and formal functions.

2. HISTORY AND ITS HERITAGE

The use of metallic elements in historical buildings, especially in combined form with masonry, has ancient origins: until the eighteenth century, when its use is still the result of craft and oral tradition, the elements are affected by the formal aspect, due to the footprint and individual craftsmanship, as well as the use and the function they perform. Consolidare, or rather restaurare, indicates the consolidation and restoration work without any distinction: the intervention has the character of arrangement, care, preservation, giving venustas importance not less than firmitas and utilitas. Consolidation methods are oriented towards a local reinforcement, or to addition of structures, which have themselves an architectural value, even if they are motivated by static reasons.

The subsequent interpretation of consolidation as a scientific process aimed to conservation minimizes the creative impact on pre-existence; the industrial production of profiles of each type, shape and quality also transforms the work of designers from forger-modellers to assemblers of preformed and available elements, limiting the creative-individual component. The more detailed studies on building science promotes consolidation as a scientific matter based on calculations and static tests, distinct from restoration, intended instead as an operation concerning the aesthetics of monuments.

The immediate consequence of this interpretation is to consider architecture no longer as an indivisible unit, but as a sum of historical-artistic and technical-structural values [1]. Dealing with the latter, consolidation can work only on the building frame, as suggested by the Restoration Charters that allow the use of all modern means for static purposes: they legitimize also the manipulation of existing materials provided that modifications do not appear in surface [2]. The dissatisfaction about the results of the post-war reconstruction raises the demand for a general review of the principles and restoration methods, even because monument is no more the single architecture but also the historical

I. INTRODUZIONE

Ogni progetto per il costruito si basa sul riconoscimento dei processi formativi della preesistenza, interpretata come contenuto di risorse materiali ed immateriali: l’indagine sull’edificio fornisce gli strumenti necessari per definire il ruolo dell’acciaio nel progetto, ora come mezzo resistente per fini conservativi, ora come strumento capace di adeguare la preesistenza alle esigenze di riuso. Il ruolo assunto nell’ambito del consolidamento è stato spesso ricoperto nella storia evitando modifiche significative all’aspetto formale. Diversamente, nel recupero e nella riqualificazione funzionale l’attività dialoga con la preesistenza sostanzialmente trasformando l’immagine architettonica, in quanto la preesistenza viene interpretata come un individuo edilizio con una storia personale, la cui struttura portante, il sistema distributivo, costruttivo e formale sono legati da uno stretto rapporto. L’evoluzione del ruolo del materiale ferrigno nel costruito viene indagata con il tentativo di unificare l’orizzonte intenzionale delle diverse esperienze, attraverso l’analisi del rapporto di causalità tra scelte tecnologiche e formali. L’indagine si concentra sui modi di partecipazione dell’acciaio alla costruzione dello spazio architettonico, volti a definire l’entità della sua presenza: la trasposizione dei concetti di “dissimulazione” e “rivelamento” alle diverse modalità di apporto di acciaio alla preesistenza, restituisce una nuova lettura degli interventi che vi ricorrono, così da mettere in evidenza la potenzialità dell’acciaio come materiale sintesi di funzioni strutturali e formali.

2. L’EREDITA’ STORICA

L’impiego di elementi metallici nella fabbrica storica, soprattutto in forma combinata alla muratura, ha origini antiche: fino al Settecento, quando il suo uso è ancora frutto di mestiere e tradizione orale, gli elementi di dimensioni contenute risentono, oltre che dell’uso e della funzione che sono chiamati ad assolvere, anche del luogo formale dovuto all’impronta marcatamente individuale della lavorazione artigianale. Il consolidare, o meglio restaurare, indica indistintamente l’azione del consolidamento e del restauro: l’intervento ha il carattere di adattamento, cura, manutenzione, conferendo alla venustas un’importanza non minore della firmitas e dell’utilitas. Le tecniche di consolidamento si orientano verso un intervento di rinforzo locale dell’elemento di fabbrica, oppure verso l’aggiunta di strutture che, pur essendo motivate da ragioni statiche, hanno esse stesse un valore architettonico. La successiva interpretazione del consolidamento come procedimento scientifico, finalizzato alla conservazione riduce al minimo l’impatto creativo sulla preesistenza: la produzione industriale di profilati di ogni tipo, forma e qualità trasforma il lavoro del progettista da forgiatore-modellatore ad assemblatore di elementi preformati e disponibili, limitandone la componente creativa-individuale. L’approfondimento degli studi relativi alla scienza delle costruzioni favorisce l’affermarsi
heritage.
From the ‘50s, the exhibition stands of ancient palaces support experimentations of new forms, material combinations and linguistic codes, expressing the dialectic continuity between old and new. Overlooking the insertions of new structures in existing buildings of the late nineteenth century, destroyed few years later, these are the first experimentations of steel as “architectural material” in historical contexts, aimed to assert the autonomy of the project from history and to generate an architecture that is fully expression of the present time. The use of contemporary materials does not refuse tradition, which “creates new experiences, from the knowledge of the past” [3], emphasizing the historical continuity.

Operating between tradition and innovation, pre-existence is transformed and transfigured to give life to another architecture: in this dialectic contest in which “old and new are compared on equal terms, in the same perceptual ring, both contribute to the performance with their entity, presenting in person rather than through metaphorical figures “[4]. No longer disguised, steel becomes the expressive vehicle that feeds the new architecture, showing its ability to dialogue with ancient materials in a game of contrasts that whenever gives different meanings to the historical building.

Figure 1. Traditional uses in consolidation: Pazzi Chapel and Antonina Column. Insertion of metallic volumes of the late 19th century: Quirinale Hotel and Augustus Mausoleum. Expositive metallic stands: Museum of Palazzo Bianco and Sforza Castle.
3. THE ENTITY OF METALLIC ADDITIONS

From concealment to highlighting, steel plays a different role in relation with the project purposes, now aimed to conservation, now to reuse, even admitting transformer operations.

In consolidation, the attitude towards steel is of cautious suspicion, because it is able to impose a dimension and a rhythm entirely new compared to those of the built. The maximum level of compatibility, between the needs of conservation and those of static security, should be guaranteed without imposing substantial alterations to architectural elements, favouring an undeclared employment of metal components. Steel concealment, which isn’t exactly the same of addition invisibility, denies “the contemporary production the right to participate in a direct, immediate and visible way to the event of structural consolidation” [5]: it doesn’t matter if it is a physical concealment through the ancient material, or a virtual one through additions with indifferent forms compared with the existing ones.

Excluding steel from the definition of the building shape, the technical role determines the extent of the concealment factor. The criteria, which define the dissimulation gradient, are assumed at first in respect to the boundary conditions of the building: the original constructive system offers to steel different possibilities of physical and visual interaction, commensurate with its nature. A second criterion is declined in relation to technical standards and regulations: if they initially suggest concealed solutions, later they prefer to add new items in accordance with the principle of reversibility. A third criterion, finally, is formulated in relation to strategies and design guidelines, which make significantly different interventions aimed at achieving the same goal.

In reuse, the technological innovations are welcomed: the project, working “within the rules” [6], searches compatibility between ancient and contemporary technologies, establishing a strong relationship both with the analytical moment that with the constructive one. This approach is finalized to the functional rehabilitation of ancient buildings, ensuring their suitability to new uses. The design strategy governs the relationship between addition, historic factory and urban context, and defines the steel entity; however, the formal aspect, as well the constructive one, is defined essentially by technological choices. The role assumed by constructive solution in fact goes beyond the simple technique, understood as obvious and immediate solution of multiple requirements, to play the complex role to express the exact image and the honest truth of the building. The different combination of elements, that is plenamente espressione del momento attuale. Il ricorso a materiali contemporanei non rinuncia affatto la tradizione, che sostanzia la continuità, “crea nuove esperienze, a partire dalla conoscenza di quelle passate” [3].

Operating tra radicamento nella tradizione e tensione verso l’innovazione, la preesistenza viene trasformata, trasfigurata, risignificata per dare vita ad un altro organismo: in questa contesa dialettica in cui “antico e nuovo si confrontano ad armi pari, nella medesima arena perceptiveologica, entrambi contribuiscono allo svolgimento della scena con il loro corpo, presentandosi all’osservatore in prima persona piuttosto che attraverso sfumature figurative. La “architettura” dovrebbe, essere garantito più dissimulato, l’acciaio divide il veicolo espressivo di cui si nutre la nuova architettura, mostrando la sua capacità di dialogare con la materia segnata in un gioco di contrasti e chiaroscorsi che ogni volta assegna significati differenti alla fabbrica storica.

3. L’ENTITÀ DELL’AGGIUNTA METALLICA

Dalla dissimulazione allo svelamento, l’acciaio assume un ruolo differente in relazione all’obiettivo del progetto, ora finalizzato alla conservazione, ora al riuso, ammettendo anche operazioni di tipo trasformativo. Nell’ambito del consolidamento, l’atteggiamento nei confronti del materiale ferrigno è di cauta diffidenza, estendendo in grado di imporre una dimensione ed un ritmo del tutto nuovi rispetto a quelli adottati dalla costruzione. Il massimo livello di conciliabilità tra le esigenze della conservazione e quelle della sicurezza statica dovrebbe essere garantito senza imporre sostanziali alterazioni agli elementi architettonici, così da prediligere un impiego non dichiarato delle componenti metalliche. La dissimulazione dell’acciaio, che non necessariamente coincide con l’invisibilità dell’aggiunta, nega “alla produzione contemporanea il diritto a partecipare in forma diretta, immediata e visibile all’avvento del consolidamento strutturale” [5], sia che si tratti di un occultamento fisico attraverso la materia antica, sia di uno di tipo virtuale con aggiunte in condizioni di indifferenza formale rispetto alla figuratività messa in gioco. L’esclusione dell’acciaio dalla definizione della forma dell’edificio attribuisce alla tecnica il ruolo di fattore determinante l’entità della dissimulazione. I criteri che determinano il gradiente di invisibilità sono assunti in primo luogo rispetto alle condizioni al contorno dell’edificio: la tipologia del sistema costruttivo originario ed i materiali esistenti offrono all’acciaio diverse possibilità di interazione fisica e visiva, commisurate alla sua natura. Un secondo criterio è declinato rispetto alle norme tecniche, che a tutti gli effetti influenzano la prassi: se inizialmente suggeriscono tecniche di intervento celate alla vista, successivamente prediligono soluzioni in aggettato nel rispetto del principio di reversibilità dell’intervento. Un terzo criterio, infine, è formulato in rapporto alle strategie e agli indirizzi di progetto, che rendono significativamente diversi interventi finalizzati al raggiungimento del medesimo obiettivo.
their size, as well as the mutual point and the interface with the ancient, define a linguistic code which can be expressed with lightness and transparency; analogy or contrast, or be the second dialectic-creative pole; it also can be at the service of the historical tracks when they cannot be reassembled in a unit, with the aim of showing the ancient text and simultaneously to show itself. Both in consolidation than in recovery, the dissimulation and highlighting gradients define some different intervals, useful to understand how and how the formal choices are the result of specific technological solutions.

4. THE ITALIAN EXPERIENCE BETWEEN CONCEALING AND HIGHLIGHTING

The identified categories tell about the entity and identity of metal additions, inserted now with utilitarian instances now with formal ones: they have indefinite limits, because the particular nature of historical architectures requires every time specific solutions, tailored to the characteristics of the existing, to the original spaces and the conditions of reuse. The projects that use totally disguised metal elements, support the invisibility of the addition to ensure the preservation of the architectural image. Addition is hidden through a careful subtraction of material in the resistant elements, deprived of their load-bearing function, in turn transferred to metal profiles with reduced thickness. This strategy is used in the reuse of Pammatone Hospital in Genoa (Giorgio Olcese, Giovanni Romano and Giulio Zappa, 1961), where the increase of loads due to the new function requires the reinforcement of the stone porch. The addition is put inside the ancient structure subtracting the stone material at the centre of the columns and inserting in each of them a metal profile: the insert is not declared and the reversibility of the intervention is denied [7].

Similarly, more complex items are hidden employing architectural elements that ensure the preservation of the image. The choice to replace the roof of Naples’s Cathedral (Roberto Di Stefano, 1975) using metal structures is justified, for example, by the presence of the wooden ceiling, which conceals the steel presence. In the transept, steel configures the roof structure with metal trusses and corrugated sheet, as well as the reticular beams that holds up the ceiling; in the apse, instead, the metal structure draws a dome with the same geometry of the old one, with ribs fixed to the base to a concrete curb and joint in key to a tambour [8].

In any case, either operating removing material or disguising the addition,
total concealment reduces, or even deletes, the load-bearing function of the original components, working mainly by substitution. In contrast, metallic elements are visible if they are in addition, favouring the reversibility and the recognisability of the contemporary work: however, they are only whispered because the new, as “apparent, but not flashy, visible but not ostentatious, different but not brash” [9] is neutral and it has not a significant formal identity. In Fuentes Castle in Colico (Lorenzo Jurina and Marco Dezzi Bardeschi, 2006), steel is added without modifying the external configuration of the ruin: pairs of Dywidag bars are arranged vertically on both sides of the masonry, punctually connected to the wall along the height and placed in slight tension [10]. Metal presence is perceived as a modern product but it does not compromise the vision of the monument because it does not take an active part in the configuration of the formal unit.

New elements are placed in addition also in metallic structures because of the linearity and the smallness of the existing profiles: anyway, the matric affinity favours their concealment for mimesis. In Central Market in Florence (Giorgio Romaro, 1975-1976) the new structure is recognizable only for the colour, which is used so that “the eye can more easily make abstraction observing the space” [11]. The existing roof is suspended to the new structure, while new diaphragms are designed to increase the structural rigidity. Near the old gables, thin metal profiles compose new structures of columns and crossbars, with St Andrew’s cross, which are barely noticeable compared to the extension of the wall.

When these additions also acquire a formal meaning, concealment is denied and their participation in the architectural configuration becomes active: the metal elements are placed in view, with the task of satisfy not only static requirements, but also the figurative ones. As a result, steel is used respecting not only static laws, but also the proportions and the rhythms of the old, or the architectural rules that have designed the shapes. In Sacromonte Chapel in Varese (Lorenzo Jurina, 2006), the vaults are reinforced with steel profiles in intrados, shaped according to their curve geometry and reconnected to foundations: the metal frame underlines the structural ribs as visible additions [12].

In St. Benedict Abbey in Salerno (Ezio De Felice, 1965), recovered as museum, the addition is more complex and underlies to the idea of re-design all the building. The static problem of a lead outside wall is faced retaining it in the found position: a metallic structure, formed by steel trestles reconnected to the opposite wall, shore up the facade, ensuring a containment action. The steel structure provides a solution to the static problem, but at the same time,
establishes a dialectic game between old and new that qualifies the interior space: the continuity of the wall is opposed to the punctuality of the metal trestles, that repeating themselves assert their language, following the rhythm of the stone columns of the original planimetry [13].

The denied dissimulation introduces the use of steel in an unveiled form, capable of implementing the transformation and adaptation to new uses. In this context, the role of metal material is not only to help to preserve the testimonial value of the historic building, but also to pass on its architectural meanings: from concealed material with a role related to the technical aspect of consolidation, steel is placed in a visible position satisfying the formal requirements, so as to actively participate in the architectural configuration of the construction, giving it a renewed expression.

Its presence can be confined in a small space, or dilated in quantitative or dimensional terms, revealing a transformation for punctual and defined units, which often configure connections or complex volumes: in many cases, the exceptionality of the addition allows to recognize it as “other” from the old and to experiment linguistic codes that operate by analogy or contrast. For example, in the Museum of Palazzo Rosso in Genoa (Franco Albini, 1950),
steel defines the octagonal stair, suspended directly to metal rods. The need to give a contemporary interpretation of the ancient signs is reflected into the spiral geometry of the connective, which is in continuity with the lively and dynamic space of the baroque palace [14]. Punctual or not, the metal presence in a confined space circumscribes the transformation and justifies innovative languages: in Palazzo Gonzaga in Guastalla (Massimo Carmassi, 2001-2008) steel configures a strong but lightweight intervention, employing thickly squared steel, juxtaposed with fixed axis. The new library tower and balconies, realized within the little cloister, create a light-dark game coherent with the will to create an intervention as transparent as possible: it brings to light the hidden richness of the palace and allows to read in watermark its various layers, including the contemporary one [15].

The diffusion of metal components, even in diversified forms, multiplies the connection points with the old, making each of them unique: the nature of the added items establishes a dialectic relation with the existing, modifying the roles of rule and exception over and over again. The repetition of metallic elements elects steel as the main character of the requalification: in Manica Lunga in Rivoli’s Castle (Andrea Bruno, 1960-1995), the new cover is composed of steel ribs, repeated at intervals of 2m over a length of 140m. The metal presence is significant, but not at all out of place: it perfectly answers to the need to make understandable the unrealized project of the eighteenth century and at the same time to preserve the expressive values of an architecture in fieri. The mixtilinear shape of iron trusses, rectilinear at the supports and curve at the centreline, is the result of both formal and technological requirements, designed in detail with particular care to the joint between the components and with the masonry wall [16].

Other times multiple metal elements are employed, preferring variation to repetition: anyway they are perceived as part of a unitary design. In Castelvecchio Museum in Verona (Carlo Scarpa, 1956), a long iron beam passes continues along the building, trying to overcome the original stiffness of the spatial system: the beam is not composed of standardized components but of coupled C-profiles with steel plates, bolted, to the upper and lower ends, to an angular profile. A particular attention is paid again to the intersection point between the beam and the partition wall: the first reduces its resistant section in correspondence of the wall; the second redraws its profile subtracting matter in the contact point. In addition to change the interiors, steel designs the cover with the existing wooden beams and configures some walkways. The presence of steel is in Castelvecchio extended to the whole
complex in different forms, always in view, integrated with other materials: the combination with other elements tells different stories that approached, but dissociated, begin to dialogue [17].

This conversation creates a system between pre-existence and steel, realizing another building, different from the historical one, with a new identity. In Fortezza fortress (Markus Scherer and Walter Dietl, 2006-2007) different volumes are designed with the same linguistic code: the grey surfaces contrast with the stone walls, establishing a perceptual balance between the masses. Steel configures two connecting bridges between the two bodies of the lower yard as volumes with an open section: they are completely metallic in structure and coating, suspended over the water with different geometries, overlapped to move the stiffness of the right corners [18].

In St. Augustine Convent in Genoa (Franco Albini, Franca Helg and Antonio Piva, 1963-1979), reused as Museum, the transformation involves not only the singular architectural object but also the context. If on the one hand, in fact, the ancient ruins are preserved, reassembled by anastylosis to reconfigure the colonnade of the court, on the other hand, steel is used in direct form to redesign the destroyed volume. The new metal structures are visible in the whole and in the detailed elements, assembled inside the court nearby.
5. CONCLUSIONS

The research highlights the potential of steel in the project for pre-existence, expressed in a commensurate way with its aims. Its use currently represents one of the best solutions: in consolidation, it allows to give positive answers not only to the structural aspect, but also maintenance, already important in the design process to define the final solution in relation to the specific case. Steel allows to control over time the performance, as well as to supervise the added structure and all the building, through a programmed cognitive approach. In addition, the knowledge of the structure through a model, which is approximately representative of the real, facilitates the prediction of situations of degradation or instability, to simulate the physical-mechanical effects, to analyse the building safety, and to establish the thresholds of maintenance work.

In reuse, steel substantiates the building transformation, configuring additions for a functional, distributive and spatial reconfiguration: this inevitably involves a formal renewal of the factory and maybe of the contextual relationships. The intervention participates in the building layering process, changing and changeable in the future, configuring shapes and volumes recognizable as a product of contemporary culture, which add value and new synthesis to the built. At the same time, steel allows to store and transmit to the future significant architectural, spatial, environmental and historical values, thanks to the flexibility and reversibility of the constructive system.

As part of the Italian experience, the approach to the built is sensible to the power of history and its characteristic features: it researches in tradition its novel character, subordinating the new technical knowledge to an intellectual action that critically evaluates codified solutions and proposes new ones. This Italian balance between tradition and innovation, but also between ethics and technology, is condensed in the constructive detail, which is the projection in the real of the old-new relationship. For Carlo Scarpa, the joint is the element that generates the project: it “is considered as a kind of tectonic condensation; as an intersection that absorbs everything in part, regardless of the fact that the connection in question is a joint or a carrier or, even, all things considered, a wider connection component, which may be a straight or a bridge” [20].

The joint puts different elements in a functional interdependence relationship: its design cannot refuse a creative process of craftsmanship that checks all the aspect of construction from the design moment. The hand-made building-materia is modelled with instruments similar to
those used for its realization: only the craftsman’s work can in fact complete the building [21], allowing it to communicate its meanings through the just created system of correlations.

6. REFERENCES