Chapter 12
Implementing Coevolution in Design Methodology for the Conservation and Reuse of Architectural Heritage

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Abstract In several scientific fields, the Coevolution concept proved to be inspiring for innovative attitudes. The idea of Coevolution is a relatively recent development of Darwinian evolution and adaptation models, based on the detection of species, whose evolution processes show some interdependencies with each other, allowing to describe evolutionary changes as based on a reciprocal interdependence. The example of plants and butterflies is the most popular, but interdependencies may be much more complex. Besides the field of Biology and Natural History, studies on Coevolution have been carried out in many other contexts, such as History and Archaeology, Humanities, Management, Sociology, Applied Economics, Organization Science, and even Aesthetics.

Keywords Built cultural heritage · Conservation design · Conservation planning · Relational notions

Introduction

In several scientific fields, the Coevolution concept proved to be inspiring for innovative attitudes. The idea of Coevolution is a relatively recent development of Darwinian evolution and adaptation models, based on the detection of species, whose evolution processes show some interdependencies with each other, allowing to describe evolutionary changes as based on a reciprocal interdependence. The example of plants and butterflies is the most popular, but interdependencies may be much more complex.

Besides the field of Biology and Natural History, studies on Coevolution have been carried out in many other contexts, such as History and Archaeology, Humanities, Management, Sociology, Applied Economics, Organization Science, and even Aesthetics. A synthetic review of this panorama has been carried out in Della Torre

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(2023), arguing that coevolutionary thinking could be inspiring also for architectural design methodologies, at least as dealing with conservation and reuse of historical buildings, or for the revitalization of landscapes and urban settings.

For instance, Italian "territorialist" scholars deal with the territory not as with a simple system, but as with a complex living system (Magnaghi 2017): ecosystems are studied by the implementation of sophisticated tools, whose background is exactly the metaphor of territorial components as coevolving living beings, and the idea that cultural landscapes should be understood as complex adaptive systems. Several studies (as an example Rescia et al. 2012) included both the concepts of emergence and coevolution, while the concept of "extended evolution" has been used to understand traditional agriculture landscapes as "living knowledge systems", whose preservation becomes a resource for the future, promoting interactions with new players in the frame of new societal processes (Laubichler and Renn 2015; Niles and Roth 2016).

Moving from the fundamental attitudes to the management of territorial processes, it is worthy to observe that in recent years, coevolution has been increasingly applied in planning studies, to analyze and model development and resilience processes, identifying interdependencies that are the bulk of coevolutionary processes, as the key to manage the involved actions and processes (Brunetta et al. 2019; Haider et al. 2020).

Actually, heritage is obviously connected with historic evolution and time, and according to some important authors, such as Amedeo Bellini (Bellini 2000) and Bernard Fielden (Fielden 2003, p. 3), conservation should be understood as a careful management of change. On the other hand, an increasing awareness can be detected of the need of giving preservation activities a sound basis rooted in social and economic processes. Therefore, the implementation of coevolutionary models could be really useful to produce resilience in a becoming world and in front of the contemporary big challenges.

The ultimate purpose of historic preservation has been generally defined as giving a future to the past and a past to the future. At once it was a matter of historicism in European culture, but now this mindful attitude on Time and Becoming means to implement the ethics of responsibility. This attitude has also an evident relationship with the concept of strong sustainability (Moioli et al. 2014; Buriti 2019).

Nevertheless, heritage processes cannot avoid being connected with life: in particular, architectural conservation happens in the frame of the social, economic, and practical rules of the contemporary world. Therefore, there is a high risk that conservation activities on architectural heritage are thought of as ordinary building works, following the logic of a short-term service life. The aim risks being limited just to meet the needs, or maybe the appreciation of the present, instead of giving the future more opportunities, even still vague here and now.

In the field of conservation, thinking in terms of long-term responsibility means to open to different criteria for decision making: the set of values coming from the past should be appreciated not in the mirror of the present attitudes, but in terms of coevolutionary potentialities. Referring to the step "from being to becoming" proposed by Ilya Prigogine, some years ago I proposed that conservation should focus

on preserving, above all, the potentialities for coevolution (Della Torre 1999). What matters in this proposal is the displacement of the focus, from the level of the facts to the level of potentialities. It would be impossible to imagine such a step, without the previous step to anthropological approaches that, few decades ago, produced a renovation of heritage understanding, moving from the traditional authorized heritage discourse to the interest for other and different contents and relationships, which build the territorial tissue and the involvement of broader communities (Smith 2006). In this perspective, "heritage studies are no longer a matter of chasing the significance of the best artworks, but of recognizing the significance of networks" (Della Torre 2023).

On the basis of previous papers (Della Torre 2019, 2020, 2023) proposes to structure the implementation of coevolutionary thinking in heritage studies on four lines, which could be developed and implemented in the practice of built heritage conservation, and therefore also in the consistent educational programs:

"Long term vision: in the step from conservation to planned preventive conservation, the whole process is re-designed, and the purpose of conservation gets redefined as well, conserving not just objects, but their the coevolutionary potential;

Evolving significance: a methodology based on the creativity of architectural design, which takes the significance as forever given, risks to miss the aim. Designers' attitude should include research on the values included in the significance concept: that entails a step from adaption to coevolutionary reuse;

Heritage as a world of interdependencies: heritage reuse programs are easily understood under the perspective of territorial planning; hereby heritage is recognized no longer on the basis of excellence, but of the density of relationships, and social engagement in heritage becomes a major factor for sustainability, implementing coevolutionary practices in heritage programs;

The relationship among program and project: design not understood as creation (from nothing) but as a problem-solving activity, implementing coevolution between the program and the project".

While the themes of long-term vision and evolving significance have been already introduced in other papers, pointing out the idea that conservation should aim at transmitting to the future the coevolutionary potential of architectural heritage; the other two lines are more directly related to design activities and may deserve a wider discussion in the context of this book.

A Design Methodology Implementing a Coevolutionary Attitude

The implementation of coevolutionary thinking in conservation design means to exploit the awareness of coevolution for a better design methodology, ready to be also a reference for architectural conservation education.

On this point, it is unavoidable to deal with the discourses, which advocate for the value of creativity for design in unstable environments. According to some authors, research-by-design methodology would be a suitable approach for highly complex problems, which require counterintuitive thinking and the development of new knowledge (Roggema 2017). Architectural conservation is a critical point in this picture, because it encompasses a difficult balance between knowledge and creativity. Put otherwise, the challenge is in the designer's attitude: architecture (architectural design) aims at being considered as a form of knowledge, but conservation of built cultural heritage applies several scientific analyses to build the knowledge that gives the foundations to operational decisions. In other words, the knowledge produced "by-design" tends to be quite free, while conservation uses to be linked to a set of strict conditions, beginning with the aim of passing to the future (as much as possible) what has been inherited from the past. Designers often tend to minimize that methodological knot, separating what has to be conserved and what can be removed. Conservation therefore is a boring duty, limited just to the protected elements, while creativity is architectural creativity, often oriented to form a new architectural realm. Under a coevolutionary perspective, this is undoubtedly a mistake: nothing can survive if not evolving, and nothing is worthy to be demolished without very good and multiple reasons. The last sentence comes from a strong sustainability perspective, in the frame of a long-term vision, and the imagination of coevolutionary potentialities. As said above, conservation is the management of change, not freezing something unchanged in a completely new frame. Creativity will help to find the best solutions for careful changes. Coevolutionary thinking opens to innovation and change and makes significance dynamic, but it aims at keeping for the future the inspiring role that heritage can play, as well as it implies a deep and never ceasing research on the significance and discussion of the significance-based program.

Such a set of bounds makes the role of creativity, in comparison with the customary practices of architectural design, definitely different and peculiar. In the above-described perspective, creativity is implemented to reset and solve problems, conserve buildings through innovative uses, introduce new devices while exploiting the native performances of historical solutions, and also engage users in more careful attitudes.

Some methodological proposals, some decades ago, went in the direction of coupling (material) conservation and (freely designed) additions to comply with functional requirements. Conservation would be not value-based but total and absolute, additions designed with a great freedom, even creating dramatic contrasts as concentrating the design bounds only in the material permanence of the built fabric. But in most cases, this method doesn't fit the multiple aims of a long-term sustainability, so that it is necessary to refer to a well described, and open to developments, program in order to manage requirements and performances of the building elements.

Other theories on design methodology are inspiring on that point, even if not recent, and referred to projects in fields other than architecture and more interested in computational models (see for instance Maher et al. 1996; Maher and Tang 2003), as they apply the concept of coevolution to creativity in the design process, in terms of a mutual and evolving interdependency between the solution and the problem (Dorst

and Cross 2001). As Nathan Crilly says, "rather than just solving a problem, design involves developing both an understanding of the problem and the possible solutions until a good match is found. Ideas for solutions might drive a reinterpretation of the problem, which, in turn, prompts new ideas for solutions. These changes to the representation of problems and solutions might be relatively minor, such as a change in emphasis or a refinement. However, they can also be radical, opening up entirely new parts of the design space. Creativity can thus be seen not just in the solutions that are offered, but also in the problems that are posed, and in the dynamic interplay between these processes" (Crilly 2021).

In architectural preservation, such paradigms find very clear examples of implementation, also in the field of reuse. The emerging keyword here is the "performance-based approach". For example, the "save and preserve" researches on energy efficiency for historic buildings have been carried out mainly by exploring traditional solutions, the performances of traditional materials and habits, getting out of the unthinking implementation of standards. In seismic prevention, a performance-based approach had to be implemented in order to customize retrofitting measures for historic masonry buildings, taking into account the construction history, the embodied resources, and the kinematics of damage, instead of staying focused on numerical models and safety standards defined for limit states not realistic for historic structures. For accessibility as well, a performance-based approach opened to better, non-standard solutions (Treccani and Arenghi 2016: 112–113). The same happens with safety in case of fire, to be obtained with a comprehensive strategy, not just with some adaptations.

The conceptual basis of the performance-based approach should not be understood as chasing a customized solution, but exactly as the creative development of the problem, through the investigation of both the ultimate target (energy saving, accessibility, safety, seismic resistance…) and the "hidden" resources of the historic building: resources that are hidden because not recognized through the customary models.

The coevolutionary methodology, therefore, has to do with the program and a twofold work of understanding and developing: on one side, there is an investigation and evolution of the needs to meet, and on the other side, there is an investigation of the resources of the historic building. This investigation goes hand in hand with the production of knowledge, which is an idiosyncratic character of conservation as a discipline. The problem–solution coevolution happens through the development of knowledge and of the acknowledged significance (i.e., cultural values).

The significance of the building is therefore a crucial part of the design methodology, and requires special attention paid on the nature and the statute of the values taken into account.

The requirements involved in the use of the buildings are evolving along with societal needs and attitudes. That entails frequent misalignments with the actual performances of old buildings, adding obsolescence to the natural ageing of historic constructions. Such problems can be solved, managing the related changes in order to answer the needs while keeping the values, implementing the long-term vision depicted above. Put otherwise, in the frame of the built environment industry a

conservation sector can be identified, which deals with the cultural significance and the enduring life of historic buildings as facilities for contemporary needs. The capability to make old buildings fit with new uses has been identified with a condition for architectural conservation, advocating adaptive reuse as an alternative to demolition and substitution of the built stock. Furthermore, reuse is seen as being part of broader urban regeneration strategies, thereby also promoting a more sustainable built environment, exploiting the energy embodied in existing buildings, and also thanks to community involvement and related social benefits.

In the conservation sector, adaptive reuse is part of a conservation strategy, with its methods and tools: adaptation is described in the Burra charter, for instance. Outside the specialized sector, in the built environment sector at large, adaptive reuse is often carried on in a short-term perspective, focusing on the use-values, and implementing a design-based methodology.

Adaptive reuse has also been proposed as an autonomous discipline (Plevoets and Van Cleempoel 2013), in which design should encompass the targets of producing something new as well as conserving and exhibiting the nonmaterial significance of the place (Plevoets and Prina 2017). In this perspective, significance used to be defined once forever, thought as a permanent character of the place itself: the task of the designer would be not to deepen understanding and to produce new knowledge (put otherwise: to develop the significance), but to enhance just that given character, by creativity. The word and the concept of "character" are here introduced citing a recent paper by Elwazani and Katara, who recall the ICOMOS 2008 Québec Declaration on the Preservation of the Spirit of Place to identify the "character" with concepts as the spirit of the place, often called the genius loci (Elwazani and Katara 2019). Actually the sense of place links with cultural values, building configurations, and building integrity, but to be productive and to become a methodological tool, the operational connection with time, actors, and attitude to investigation has to be explored, and somehow modeled. For that purpose, the coevolutionary perspective could help. Coevolutionary thinking helps to understand how and why the sense of a place can be understood. It could be meant as steady and permanent, maybe threatened by new events and trends, and therefore to be protected or restored; or it can be understood as highly dynamic, as it emerged and emerges at any time from the meeting of the place with the social actors and the percipient subjects, so that changes that altered the original character may be appreciated as additions, which shaped a new character, more complex but just for that more interesting, and open to different futures. Put otherwise, nonmaterial significance and architectural character require to be understood not as static attributes of things, but as the outputs and outcomes of curiosity, scientific research, and social engagement.

In other words, "creativity has to be found in the investigation attitude, and coevolution is not binary, between the solution and the problem, but involves the evolution of knowledge: a knowledge that has to be built investigating in many directions and implementing many tools, getting rid of the schemes, that is often unlearning the prejudices linked to contemporary mainstream attitudes" (Della Torre 2023).

In terms of methodology and education, therefore, the implementation of coevolutionary thinking leads to multidisciplinary investigation as the distinctive feature of a productive methodology for conservation design.

Real-Task Education Practices: The Link Among the Project and the Program

The implementation of coevolutionary thinking in conservation design requires, therefore, the development of a twofold reasoning: taking into account long-term effects, the sustainability of projects will depend both on the capability of the program to deal with coevolutionary processes, and on a positive response of the design to the evolution of the program itself, which is necessary to frame the project into the reality of the context.

Under the educational perspective, the experience of preservation (see Ottoni 2021 for reflections on the Italian academic environment) often takes the role of introducing students to the reality of materials, to the issues of durability and repair techniques, and to the real issues of finding reuse opportunities.

While education to creativity often aims at keeping creativity free from the weight and the limits of reality, the courses of Preservation (Conservation, Restoration) use to involve students in a real-task experience, leading them to a hands-on study of the historic building, reasoning on the reuse through contacts with the real territorial context, that is exploring the interdependencies (for instance see Della Torre et al. 2019).

The core of the real-task exercise is reasoning on the complexity of sustainability as a matter of long-term vision, taking into account an evolving significance, in the frame of participatory programs, which could produce more sustainable references just because they accept to be not definitely fixed.

Heritage conservation/reuse processes must include territorial links and take care of competent communities, as this is crucial to make the process sustainable. For that purpose, coevolutionary thinking is a mighty tool to improve the understanding and management of social dynamics.

Focusing on the program phase, programs of heritage reuse are easily understood as related to planning disciplines. That is the good reason why some programs for the reuse of historic properties have been developed implementing coevolution concepts, mainly dealing with the social implications of reuse processes. Among these studies, it is worthy citing the paper by van Knipperberg and Boostra, working on the outputs of the Horizon 2020 Openheritage project, which analyzed several cases of heritage reuse, spread across Europe (van Knippenberg and Boostra 2021; van Knippenberg et al. 2022). The interpretation of territory as a field of interdependent forces influencing each other produced successful models In planning studies, (see for instance Gerrits 2008; Wang et al. 2017), to deal with complexity referring to coevolution. It seems possible to detect a common will and a common background with the model of

the "trading zone" developed by Christer Gustafsson as a theoretical foundation for comprehensive wide-area projects implementing an "upstream" perspective, based on the idea of a four-pillars sustainability (Gustafsson 2011; CHcfE Consortium 2015: 195–197).

The above quoted experiences put the emphasis on community involvement and social impact, to the capability of heritage reuse to answer needs. The emphasis seems to be on adaptation more than on the results in terms of heritage conservation. To be clear, coevolutionary heritage programs, as seen above, seem to be very interested in nonmaterial issues, but at the very end, they deal with the physical reality of heritage sites, and cannot avoid taking some more "brick and mortar" responsibilities for conservation and reuse. This is a perspective for the future: the lesson to be learnt is that there is a space for the implementation of the same coevolutionary attitude both in the program phase, fostering the involvement of people and communities, and in the design phase, fostering investigation and the development of tailored solutions.

Conclusions

To wrap-up, the definition of a design methodology based on coevolutionary thinking could be very consistent with the aims of architectural heritage preservation.

The reasoning path presented above leads to underscore the link between program and design, as a precondition to place the design exercise into the conditions of a real-task. This means that a more comprehensive meaning of planned conservation, oriented to program and mindful of community involvement, has been posted in the background of our reasoning (Van Balen and Vandesande 2015; Vandesande et al. 2018).

In reality, practices of programming based on coevolution are not only timely, but also very proficient to build sustainability and resilience.

Furthermore, the attitude to elaborate and develop the program enables to describe coevolutionary design methodology not only as a good way to problem solving, but also as a good way of setting, or to say better fine-tuning the problems.

The key activity of such fine-tuning of the program requirements is investigation and the production of knowledge.

In theoretical terms, the proposed methodology can be described as a ternary coevolution between problems, solutions, and knowledge (Fig. 12.1).

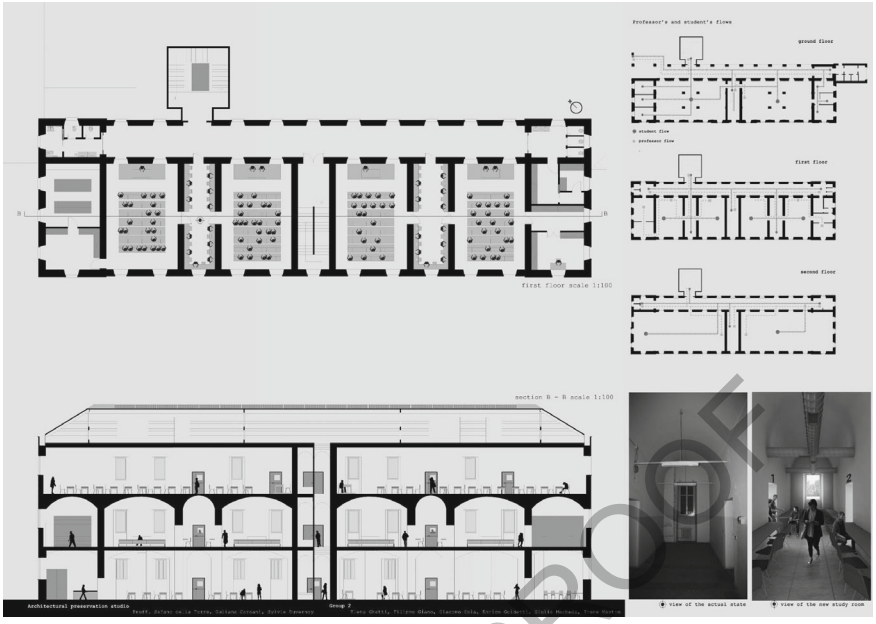

Fig. 12.1 S. Martino Psychiatric Hospital, Como. Architectural preservation studio. Professors. Stefano Della Torre, Giuliana Cardani, Sylvie Duvernoy. Students: Elena Ghetti, Filippo Giano, Giacomo Gola, Enrico Guidetti, Giulia Macheda, Irene Mastro. Politecnico di Milano, 2023

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