

13 Building Performance Evaluation (BPE) and the Role of Perceived Values in Heritage Preservation – A Research Case for Italy

Carlotta Fontana

13.1 Introduction

The protection of architectural heritage and landscape is a matter of balancing transformation and preservation. It is influenced by a variety of factors far beyond the traditional fields of architecture and building design, requiring a truly multi-disciplinary approach. The projects presented in this chapter were developed at the Department of Building and Environment Science and Technology, Politecnico di Milano. They resulted in research-based consultancy for local communities, small public authorities and organizations.

13.2 Background

13.2.1 *Built environment and landscape*

In 1844, the Italian economist Carlo Cattaneo defined the landscape of Lombardy as ‘a huge repository of human labour’. This statement is far from the Arcadian notion of the ‘*bel paesaggio*’, recalling a fine landscape picture that was very popular among the foreign travelers visiting Italy. It pre-dates the multi-faceted notion of landscape which evolved in the late twentieth century. For a long time, landscape values, both in literature and in law, were mainly identified with visible aspects, in accordance with the traditional ideal of the *bel paesaggio*. At the beginning of the twenty-first century, the European Landscape Convention (2000) stated in Chapter 1, Article 1: “Landscape” means an area, as perceived by

Enhancing Building Performance, First Edition. Edited by Shauna Mallory-Hill, Wolfgang F. E. Preiser and Chris Watson.

© 2012 Blackwell Publishing Ltd. Published 2012 by Blackwell Publishing Ltd.

people, whose character is the result of the action and interaction of natural and/or human factors'. The ELC's definition gives a central role to the site inhabitants. Every intervention requires methodologies and tools to empower local communities to achieve a deeper awareness of how proposed changes will impact their own settlement over time. In Europe, the notion of 'natural landscape' has very little to do with 'wilderness'; landscape has been widely and deeply shaped by human civilization for over twenty centuries. Therefore, when considering issues relating to conservation, one finds it more useful to refer to the notion of 'built environment', taking into account the urban and rural areas together as a whole, with their varying degrees of development.

13.2.2 Built environment as a human ecosystem

Research (Marshall and Batty, 2009; Giacomini, 1981; *Science*, 2008) suggests the built environment is the peculiar ecosystem of the human species, and how the scientific approach of biological sciences can help us understand such physical phenomena as cities. Geographer Eugenio Turri (1974; 1979) noted over 30 years ago that, as biological ecosystems break down when the inhabiting organisms destroy the conditions for their own survival, so it is that the built environment breaks down when the balance between natural and human resources and the requirements of its inhabitants is upset. In not being able to direct social behaviors as well as the actions of the political and administrative entities, culture fails to play its role in mediating between people and the environment. This is a very serious problem in both industrialized and developing countries all over the world.

13.2.3 Sustainable reuse and protection of the built resources

In Italy, built heritage goes far beyond the great churches, palaces and ancient ruins. The historical city and town centers are made up of buildings which are currently used as homes, schools, offices, hospitals, factories, shops and stores. They require as much protection as innovation, in order to meet their inhabitants' ever-changing needs. The commitment to reusing and rehabilitating the old building stock characterized an important part of the Italian architectural culture since the 1960s (ANCSA, 1971; Di Battista, 2006; Fontana, 1991). Today, Agenda 21 for Sustainable Construction (CIB, 1999) indicates that maintenance, rehabilitation and reuse of the urban fabrics, as well as the protection of the built heritage, represent a fundamental strategy for sustainability in the building sector.

13.2.4 Built environment as the product of an implicit project

Human settlements are the product of human societies; they have been built up and developed by many interconnected conscious and unconscious acts over a long time, rather than by specifically designed single acts (Lynch, 1960; 1981).

As Christopher Alexander (1979) wrote: ‘Architects are responsible for no more than perhaps 5 percent of all the buildings in the world. Most buildings ... which give the world its form ... come from the work of thousands of housewives, the officials in the building department, local bankers, carpenters, public works departments, gardeners, painters, city councils, families ...’. This concept generates the idea of an ‘implicit project’ that continuously modifies the built environment and that can be conceptualized as a complex systemic entity where processes of emergence occur (Goldstein, 1999). Emergence can be investigated through multi-disciplinary theories and methodologies based on Systems Theory (Broadbent, 1973; Collen, 2008; Minati, 2008).

13.3 A performance-based approach for sustainable reuse

The goals of preserving and protecting architectural heritage, and upgrading of old building stock to meet current environmental requirements, often appear to be in conflict. To effectively reduce pollution and energy consumption in re-use/rehabilitation projects, all technical characteristics of the old buildings should be taken into account as ‘vestigial performances’. They should not get eroded in the rehabilitation project, but fed into the information/analysis design phase. Most heritage buildings provide better environmental performance than newer ones. They are durable, have thick masonry walls and windows allowing direct control of natural ventilation and daylight, and they were often built with local materials. Sustainable re-use requires as little demolition of the existing fabric as possible, thus making it easier also to preserve heritage values. This approach advocates a mutual adaptation of old buildings and new uses, on a carefully balanced basis. Multi-disciplinary tools, such as those derived from post-occupancy evaluation and building performance assessment (Preiser, Rabinowitz, and White, 1988; Preiser and Vischer, 2005), link together technical and functional aspects with behavioral, psychological, and social issues. Well-established research in the field of environment-behavior (Zeisel, 2006) provides consistent methodological frameworks and techniques. In the quest to operationalize the principles of the European Landscape Convention, these instruments appear very useful in shaping bottom-up strategies and empowering the inhabitants.

13.4 Counseling for communities: a performance-based approach at different scales

13.4.1 *Balancing building rehabilitation and architectural values*

The goal of balancing conservation issues and technical/functional innovation requirements entails the evaluation of how users perceive both issues. Building elements should be modified by taking into account both their technical performance and the users’ perception of their meaning and of their

immaterial value. In the following two examples, the issue of historic preservation was critical in both cases, and integrated evaluation was used to support the briefing for rehabilitation. Both cases are part of a project on educational buildings in Milan and its hinterland conducted at Politecnico di Milano that began in 2003 (Fianchini, 2007; Fianchini et al., 2008).

The first case is an elementary school complex consisting of two buildings, one constructed in the 1920s, the other in the 1950s. The older one is listed on the register for historic preservation and is very important within the neighborhood. The study was requested by the school headperson.

The second case concerns the School of Architecture of the Politecnico di Milano, which also includes two buildings. The older one has a concrete structure and shell. It was designed by Giò Ponti and built in 1962. The newer one was completed in 1985, designed by Vittoriano Viganò, a renowned architect and past professor in the same School. It has an imposing steel frame and glazed façade, and its architectural value has been established through literature and critical assessment. In both cases, the overall technical and functional survey and diagnostic assessment followed a well-established schedule, outlined in Box 13.1.

In the Ponti-Viganò complex, two types of questionnaires were used to carry out the users' perception survey: an 'extensive questionnaire', which was mostly derived from post-occupancy evaluation literature (Preiser et al., 1988), and the shorter Building Use Studies' (BUS) occupant questionnaire. The elementary school provided very poor fire-safety, thermal and acoustical performance, as well as inadequate spatial conditions. A new functional layout was designed to reduce the waste of space and energy mainly through change in use. This was done to upgrade performance with minimal construction and without eroding the physical condition of the building and its identity as cultural heritage. This quality ranked high in the perception of teachers, parents and staff, and different solutions were simulated to improve the indoor energy and comfort performance. The choice among options aimed to balance levels of improvement and façade preservation. The budget did not allow the restoration of the old windows, and they were replaced with new ones; roof insulation and shutter boxes were provided. The external walls were not modified. In the Ponti-Viganò complex, two different questionnaires were used. The short Building Use Studies questionnaire, a much less time-consuming tool, proved very effective in identifying critical issues requiring further technical assessment, and it also underpinned the general appreciation of the design by the users. The second one, called the 'extensive questionnaire', indicated precisely the less appreciated issues and places, allowing to fine tune design decisions for the brief. The architectural and cultural values were appreciated differently by the various types of occupants: very much by the Dean, fairly well by the professors, and almost not at all by technical staff and students. Many technical and functional problems were identified. In fact, soon after completion both buildings proved rather uncomfortable because of poor thermal insulation, failing weather-tightness of roofing and windows,

Box 13.1 Outline of technical and functional survey and assessment at the building scale

- **Anagraphical**

(information on the building about location, age, general measurements, owner and management)

- **Technical**

Factors:

Building technological system: description of structure, walls, roofing, windows, services (water and drainage, heating, lighting, air-conditioning, electric power, IT); internal and external fixtures and finishes; for each element of the technological system:

- decay and faults
- safety and comfort performances (thermal, acoustic, natural light and ventilation)
- compliance to building codes and regulations

Data collection methods:

- as-built drawings
- direct survey and physical measurements
- site walkthrough
- interviews with organization and facility managers
- energy consumption audit

Assessment against:

building pathology technical literature, building and sanitation codes and regulations (safety, fire, etc.)

- **Functional**

Factors:

- quality of access and circulation
- room size and configuration
- equipment accommodation
- spatial relationship and circulation patterns
- functional facilities
- flexibility and adaptability to organizational changes
- privacy
- users' perception of safety and comfort
- compliance to building codes and regulations

Data collection methods:

- as-built drawings
- direct survey and physical measurements

- site walkthrough and direct observation
- photos, audio and video recordings
- interviews with organization and facility managers
- interviews and questionnaires to different users' groups

Assessment against:

design guidelines, state-of-the-art literature, building and sanitation codes and regulations (safety, fire, etc.), users' answer to interviews and questionnaires.

bad acoustics, and unsatisfactory use of space. An interesting and challenging question stems from the consideration that Architecture students, in their twenties, do not recognize as architectural and cultural values the same features that their teachers, in their forties to sixties, do. This fact, which regards functional performance as well as aesthetics, concerns both the fast-changing appreciation of architectural style by different generations, and the more general gap between the architect's expressive intention and the users' perception and interests. It should also be noted that the cultural and architectural character of the elementary school building, an older but ordinary building, designed in the early 1920s by an unknown municipal architect, was well recognized and appreciated by all users. Once more, this suggests that the familiar and comforting image of traditional architecture is in itself very much appreciated.

In the Ponti-Viganò complex, all elements and spaces were assessed against both technical performance and architectural appreciation criteria, and the careful physical preservation that was undertaken implied two considerations: first, the complex represents an important example of Italian architecture of the 1960s and 1970s, and it has an established historic and cultural value; second, the complex represents a very good training aid for students, providing everyday evidence of the consequences of when not taking into account the three Vitruvian qualities of *venustas*, *firmitas* and *utilitas* equally in architectural design. Technical improvements were provided whenever construction would not conspicuously modify elements. Functional improvements were achieved through change in use of spaces that could not be modified and increasing flexibility wherever possible. For instance, the installation of removable furnishing and electric/IT fittings was provided for in the inner courtyard, that is used by both students and teachers as an outdoor open-space temporary classroom in good weather. A number of elements, such as the spiral staircase were not modified (see Figure 13.1). This was done whenever the architectural value could compensate for situations of discomfort/non-compliance, provided that there was a functional alternative somewhere else within the complex.

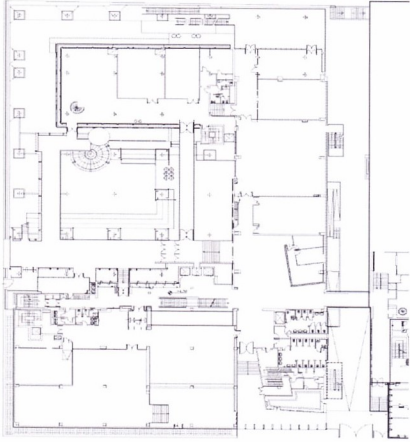
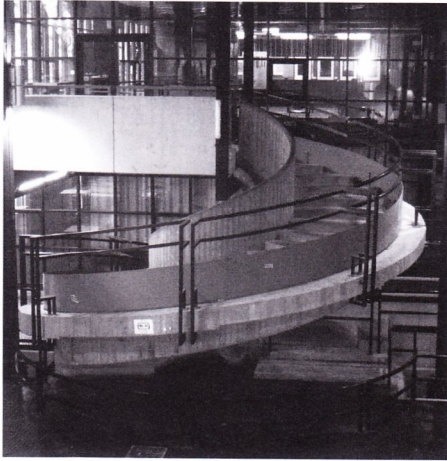
SCHEDA		022
Elemento tecnico		
Scala elicoidale in cemento armato		
Descrizione		
Scala elicoidale realizzata in gradini di massello prefabbricati in graniglia di cemento martellinata sulle parti a vista, su struttura in cemento armato gettato in opera		
Quantità		
1 scala tra piano interrato e la quota zero		
Localizzazione in pianta	Fotografia	
 <p>Pianta piano terra</p>		
Problematiche riscontrate		
<ul style="list-style-type: none"> - rampa priva di segnale a pavimento, di materiale diverso, indicante l' inizio e la fine della rampa (cfr. DM 236/89 Art. 4.1.10, 8.1.10) - parapetto con correnti attraversabili da sfera di 10 cm (cfr. 20 febbraio 1989, n.6, Allegato Art. 8.1.10) - parapetto facilmente scavalcabile per la presenza di elementi orizzontali fissi in grado di offrire punti di appoggio 		

Figure 13.1 Data sheet of the spiral staircase in the Viganò building.

13.4.2 The small town scale: users' behavior and risk indicators

Years ago, some ten buildings collapsed in different parts of Italy due to illegal structural changes by owners. The Politecnico di Milano was asked to help local administrations carry out a diagnostic survey of residential buildings regarding safety risk (Regione Lombardia, 2000). Most of the residential building stock belongs to private owners, who are usually unwilling to provide information about their estate. Therefore, a risk-indicator self-assessment tool was devised to pinpoint warning signs that might prompt owners to ask for expert advice. Later on, a quick survey-and-assessment tool was commissioned, aimed at collecting preliminary information about hidden risks in the building

stock (Di Di Battista and Fontana, 1999). The tool was expected to be used by municipalities as part of their risk prevention and management programs (Fontana and Cattanei, 2006). In this case, all types of buildings were considered, such as schools, libraries and town halls. The previously tested self assessment approach was applied to private residential building stock. A few significant indicators were identified, pointing out the buildings that were more likely to suffer or cause damage. Other indicators helped to evaluate the effect of flood or earthquake on a building. The indicators referred to building characteristics, such as construction type, age, size and layout. Three kinds of factors were considered: the technical factor addressed the condition of structure and services; the functional factor dealt with the organization of the activities inside the building; the human factor focused on the type of users and their behavior, especially on items that might represent a risk in everyday situations or that could become a danger in emergency situations. Analyzing users' behavior is crucial to this objective. For instance, functional checklists aim at pointing out ways to use the space that represent safety risks, such as storing detergents or placing a switch control panel in the wrong place. Some checklists can be used as a self-assessment tool by the occupants themselves, thus safeguarding privacy about sensitive issues. These refer mainly to the common practice of disregarding building regulations, which endangers both the occupants and the community. For instance, it is often the case that the self-assessment checklist for safety conditions asks owners whether the compliance certificates for building codes, fire regulations and the like are available or not. They often have no certification, so the score for the building is negative. Guidelines and checklists direct the investigation of selected indicators for significant elements in order to make the tool easily manageable for small municipalities and by occupants. The proposal of self-conducted assessment of private property was intended to stimulate owners' and tenants' awareness about potentially dangerous consequences of the ways to use and manage their buildings, and the risk characteristics of older urban fabrics.

13.4.3 'Sustainable landscape' versus 'bel paesaggio'

The consultancy work developed for Monferrato Casalese, a semi-rural region in Southern Piedmont near Alessandria, started in 2005 at the request of a group of inhabitants who wished to promote environmental and landscape protection (see Figure 13.2). At the end of 2010, the 'client group' included a dozen municipalities, as well as local cultural associations such as the Osservatorio del Paesaggio (www.odpm.it) that belongs to the European network of Landscape Observatories. This region does not represent a famous international tourist attraction, such as Tuscany. Nevertheless, it offers a very pleasant countryside with nice little towns scattered on hilltops. It retains a delicate balance between valuable site resources, such as the Po River, brooks, woods, fields, vineyards and orchards. These could be carefully maintained and enhanced to promote sustainable local development. However, they are in constant danger of being swept away by land depletion and overexploitation.



Figure 13.2 A view of Monferrato Casalese.

The Politecnico consultancy, uses a research-based approach to support different projects, such as organizing and connecting local information systems on the built resources, foreshadowing scenarios related to institutional development projects, and providing local communities and associations with tools to support their case in negotiating with developers and central authorities. The main objective is to promote information among the inhabitants about short and long term consequences of interventions, especially those affecting the environmental aspects that concern the notions of 'landscape' and 'landscape protection'. People only protect the things that they take ownership of. For this reason, three main questions were identified for Monferrato Casalese:

1. How do inhabitants perceive landscape quality and recognize landscape value?
2. How do inhabitants modify their environment to meet their everyday needs, and how much do such changes affect the recognized and shared landscape value?
3. How do inhabitants perceive the proposal of interventions that heavily modify the landscape, while providing some obvious advantages, such as a new highway junction or a big department store?

Descriptive and diagnostic studies in different towns and their surroundings were carried out through interviews and questionnaires, and direct observation of behavior and physical traces. Many open meetings were organized with inhabitants and local authorities, which resulted in better knowledge about problems, such as ways of reducing the impact of commercial buildings along country roads, or how to connect the many small village fairs in a network in order to promote sustainable local tourism. In six towns, questionnaire-based research was conducted in junior high schools under psychological and anthropological supervision (Jaccod et al., 2007). The purpose was to investigate how both pupils (aged 11–14) and teachers perceive landscape value. The questionnaire, following Lynch (1960), focused on reactions to photographs of buildings and views of the surroundings. It also contained open questions, such as: ‘Where would you take a friend visiting your town for the first time, to show him/her a nice place? Why?’; ‘Please choose a picture of a place you like, and one of a place you don’t like, and tell why.’ An early finding to emerge from the research was that, along with more obvious environmental qualities such as physical comfort and low pollution, all inhabitants emphasized the importance of ‘visual delight.’ This quality is perceived as a complex of pleasant sensations, mainly conveyed through visible qualities that are related to green open spaces, quietness, harmony and familiarity of buildings and places. It appears to point out the change in social perception from the idealistic notion of *bel paesaggio* to a more materialistic notion of overall well-being, which is also closer to environmental consciousness.

13.5 Conclusions

The built environment represents a social ecosystem, requiring a systemic approach. It should be investigated and operated by a wide range of multi-disciplinary methodologies and tools, such as those from environment-behavior research. Performance-based analysis can help understand the conflicting interventions that modify the human ecological system, and promote feedback from people to places and vice versa. It also supports broad-based citizen participation as being a more effective and democratic in managing the decisions that shape the built environment. Improving public domain knowledge and awareness empowers local communities, thus representing a non-authoritarian way to achieve protection for the human species’ environment.

Acknowledgements

Thanks to Maria Fianchini, who directed the POEs of the educational buildings, for providing documents and contribution to paragraph 13.3.1. Thanks to Adrian Leaman, director of Building Use Studies Ltd., London, for providing the educational licence of the BUS users’ questionnaire.

References

- Alexander, C. (1979) *The Timeless Way of Building*, New York: Oxford University Press.
- ANCSA – Associazione Nazionale Centri Storico-Artistici (1971) *Una nuova politica per i Centri storici*, Bergamo.
- Broadbent, G. (1973) *Design in Architecture*, New York: John Wiley & Sons, Inc.
- Building Use Studies Methodology (1999), CIB.
- Agenda 21 on Sustainable Construction*, CIB Report Publication 237. Available at www.usablebuildings.co.uk (accessed August 1, 2010).
- Collen, A. (2008) 'Emergence of architectural phenomena in the human habitation of space'. In: *Processes of Emergence of Systems and Systemic Properties. Towards a general theory of emergence* (eds G. Minati, E. Pessa and M. Abram). Singapore: World Scientific Publishing.
- Di Battista, V. (2006) *Ambiente Costruito*, Firenze: Alinea.
- Di Battista, V. and Fontana, C. (1999) Architectural management in Italy: a few topical subjects. In: Proceedings of the CIB W96 1998 International Symposium, *Developing the Practice of Architectural Management*, Venice. pp.23–31.
- European Landscape Convention (2000) Available at www.coe.int/t/dg4/cultureheritage (accessed August 1, 2010).
- Fianchini, M. (2007) 'Fitness for purpose: a performance evaluation methodology for the management of university buildings', *Facilities*, 25 (3/4). pp.137–146. Emerald Group Publishing Limited.
- Fianchini, M., Ferazza, S., Galimberti, E. and Tondini, A., (2008) 'Increasing Sustainability in Cultural Heritage: a Case Study of School Buildings', in CIB W070 2008, *International Conference in Facilities Management, Healthy and Creative Facilities*, Heriott Watt University Edinburgh 2008, pp.33–40.
- Fontana, C. (1991) *Recuperare – le parole e le cose*, Firenze: Alinea.
- Fontana, C. and Cattanei, A. (2006) 'Physical and Functional Vulnerability Assessment of Historical Urban Fabrics'. In: *Proceedings of CIB W70 Trondheim International Symposium Changing User Demands on Buildings*, 12–14 June 2006, NTNU – Norwegian University of Science and Technology, Trondheim.
- Giacomini, V. (1981) 'Rome considered as an ecological system', *Nature and Resources*, 17 (1), 13–19.
- Goldstein, G. (1999) 'Emergence as a Construct: History and Issues', *Emergence: Complexity and Organization*, 1 (1), 49–72.
- Jaccod, C., Mela, A. and Novascone, R. (2007) 'Il paesaggio come bene comune: un'esperienza di ricerca nel Monferrato', Research Report Draft, Politecnico di Torino.
- Lynch, K. (1960) *The Image of the City*, Cambridge, MA: MIT Press.
- Lynch, K. (1981) *Good City Form*, Cambridge, MA: MIT Press.
- Marshall, S. and Batty, M. (2009) 'From Darwinism to Planning – Through Geddes and Back'. *Town and Country Planning*, Nov. 2009, p.464.
- Minati, G. (2008) *New Approaches for Modelling Emergence of Collective Phenomena – The Meta-Structures Project*, Monza: Polimetrica.
- Preiser, W.F.E., Rabinowitz, H.Z. and White, E.T. (1988) *Post-Occupancy Evaluation*, New York: Van Nostrand Reinhold.
- Preiser, W.F.E. and Vischer, J.C. (eds) (2005) *Assessing Building Performance*, Oxford: Elsevier.

- Regione Lombardia (2000) *Prevenzione di rischi di crollo nei fabbricati residenziali*, 'I quaderni della protezione civile', no.5, Milano.
- Science (2008) Monographic Issue '*The City*', 319 (5864).
- Turri, E. (1974) *Antropologia del paesaggio*, Torino: Edizioni di Comunità.
- Turri, E. (1979) *Semiologia del paesaggio italiano*, Milano: Longanesi.
- Zeisel, J. (2006) *Inquiry by Design*, New York: W.W. Norton & Company.