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Original article

The preservation of the chromatic image of historical cities as a cultural value. The old city of Valencia (Spain)

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ABSTRACT

Understanding the physical and material characteristics of our historical cities is essential for the preservation of their hereditary and cultural values. Beyond the historical logic of the urban scene and its functional nature, the city is sensed through the spaces, which it creates and configures. The spaces of the historical city represent the soul of its history and the final result of its development. Through the architectural configuration of these spaces, we can visualize the historical and vital logic that underlies the city, the heritage of the people and cultures that make it up. The *Study for the Recovery of Urban Spaces in Valencia Historical Center* is an interdisciplinary project of intervention in patrimonial architecture, aiming to recover the original image of spaces in the historical city center. This is a project started in 1995 and ended in 2013, which is formed by a series of activities in which both, the Polytechnic University of Valencia as a research institution and the public administrations involved in the processes of regeneration and restoration of the historic center, take part. The aim of the project has been the start-up of a dynamic restoration process of the city's historic urban centre and its landscape value. By combining scientific studies, tasks of awareness and sensitization of population, it aims to determine the formal and chromatic characteristics of original spaces that create the architecture of the city.

1. Introduction

In each particular historical city, the landscape of the physical environment and the cityscape are intimately and inseparably interrelated. This is due to the use of materials taken from the immediate environment that constitute the physical basis of the buildings [1]. The culture, at last, is the agreement of the human adaptation to each physical environment, and generates unique and inimitable urban scenes. This distinguishing specificity among cities can also be extrapolated within the districts of a singular historical city. The different districts belonged to disparate periods and where lived by heterogeneous social classes with the consequence of a distinct chromatic and visual image. A rich spatial variety that reflects the history of the inhabitants and which has to be preserved as a cultural value linked to the history of the city itself.

This logical articulation between architectural form, material and color is a common feature to all the Mediterranean coastal cities, in which similar material conditions coincide with an intense network of cultural and commercials exchanges, which led to a similar way of building and a similar way of understanding the city [2]. The findings of this article are based, in addition to the research projects described above, in a series of studies about the historical centers of the Spanish East: *Burriana* (Castellón, 1999); *Sant Mateu* (Castellón, 2000); *Cartagena* (2004); *Ontiyent* (Valencia, 2007); y *Segorbe* (Valencia, 2007). The set of activities developed in the city of Valencia since 1993 is proposed as a valid methodology to be applied in most of the cities of coastal nations, in order to preserve a common cultural identity, which is threatened by intense urbanization processes, often lacking of programs that preserve the original image of urban spaces.

2. The historic center of Valencia

The aim of the project, initiated in 1995 and developed over nearly twenty years has been the start-up of a dynamic restoration of the historic centre of Valencia, highly dilapidated since the *Turia River Flood* in 1957. Since then, a gradual abandonment and deterioration of the old town, one of the largest in Europe with 1,7 km^2 began. The consequences of this natural disaster were devastating to the historical city, creating a process that began with the depopulation due to the inability to adapt streets and old buildings to the new residential needs, a progressive loss of tertiary activities that aggravated the process of depopulation,

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and an ageing population structure. The population figures of Valencia historical city over recent decades are a clear example of the degradation process described above.

Most of the residents that remained, apart from the areas in which the administration and parts of the financial entities settled, was increasingly aging and was economically unable to face the maintenance tasks of the housing areas. Those underwent a progressive and unstoppable deterioration. Spacious mural surfaces of the historical center were characterized by a deplorable state of conservation: walls totally faded or with the color layer so eroded that it was possible to see the previous layer under the current one; walls with different layers of paint, all of them chipped, that showed with clear evidence the different colorations that the building had undergone over time; chips in the chromatic finish due to the incompatibility between the paint treatment and the wall; chipped mortars with important cracks due to the age that leaved the brick unprotected; and bulges and flaking of waterproof paints which had been incorrectly used in subsequent restorations. All this, added to a profound ignorance about the interaction between traditional building techniques and new materials used in the restoration process, derived in a profound deterioration of the urban image of the historical city, losing the coherence between the original urban space and the formal and chromatic characteristics of the buildings that composed it, resulting in a loss of the city's cultural identity (Fig. 1).

In this context, since 1995, a series of scientific activities were initiated and developed aimed to determine the original chromatic characteristics of each one of the five neighborhoods that make up the historical city. The culmination has been the development of a *Color Shade Card* for each one and a general Color Shade Card for the whole city, which has acquired the character of binding regulations in restoration processes. A study aimed to determine the material-constructive features of plasters and mortar renderings in facades has been developed, in order to ensure the structural sustainability of interventions. It has been implemented in a number of pilot interventions with the aim of both, evaluating the viability of the chromatic and structural proposals, and implementing a number of focal points distributed throughout the whole historical center [3]. These focal points act as dissemination and awareness elements for the population and the technicians involved in the processes of restoration, such as architects, developers and builders.

3. Scientific studies: description of works

The set of studies has focused on the analysis and developing performance determinations in small-scale residential buildings. The issue here is not a program of interventions aimed at the recovery of the great patrimonial architecture, but we are working in the field of restoration of the urban scene itself, giving preference to residential buildings which are the most common in the urban structure and image of the city.

3.1. Color analysis and preparation of color plans: applied methodology

A total of approximately 1200 samples of façade coverings (mortars and plasters) have been extracted in the whole of Valencia's historical center for subsequent analysis, sorted by type, age of construction and the formal characteristics of the wall to which they belonged (background wall, or ornamentation).

In the first phase, the color of the superficial coats of paint was studied *in situ* and 'color chromatic' maps were made from instrument readings. These maps identified qualities like Hue, Value and Chroma. The instruments used were an adapted contact color meter and a spectrophotometer. In a second phase, the study has been broadened with chemical analysis to determine the exact composition of the original materials – construction materials and mortars, as well as the pigments used in the mortars and the resulting colors. This process of analysis and classification of the samples has led to a third phase of the study. The samples of pigments were prepared for an optical photographic study with a binocular magnifier for a physical/chemical analysis and determination of components. The analytical instruments and techniques used were: a scanning electron microscope (for the morphological study of the samples), and X-ray diffraction, or scanning electron microscope/energy dispersive using X-ray (SEM/EDX) for mineralogical analysis of samples (Fig. 2).

The studies result in a description of the basic construction technology, which was common to all analyzed historical buildings, with minor variations. Up to the mid-19th century, it was usual to employ non-hydraulic mortars (lime mortar and gypsum plaster) and, to a lesser extent, hydraulic mortars (pozzolanic and hydraulic lime mortars). The set of developed analysis about the historical center of Valencia give us the following relative values about the predominance of one or another construction technique in historical buildings:

In all cases, the predominant aggregate was the siliceous, existing limestone and dolomite aggregates in smaller quantities, and being characterized the gypsum plaster by a higher binder/aggregate ratio than the lime mortars [4]. This solution is usual in the material traditions of all cultures of the Mediterranean arc, is characterized by a high adaptability to the environment, and what interests us most here, by the close connection with the territory proposing a color treatment technology based on the use of oxides as natural inking mechanism for mortars (Fig. 3).

The colored lime mortar used natural pigments, soil and oxides, which were extracted from the hinterland close to the city and thus created a link between the images of the city and the territory. This is the origin of how certain pigments has a city identification: the ocher of Sienna or the yellow of Naples were created from the natural conditions of the site, generating a two-way relationship that came to assimilate city and territory in the collective stereotypical image. It is precisely the loss of this close interrelation between the material from the immediate surroundings and the traditional structural solutions which has generated both the progressive material deterioration of the Mediterranean historical centers, and the loss of identity and the chromatic and visual artificial uniformity that derive from the indiscriminate use of modern materials. The present study stresses this aspect, proposing not only the recovery of the traditional material characteristics through the use of contemporary structural techniques, but also the link between these material characteristics with the chromatic variables of architectural form and the establishment of implementation criteria aimed to preserve the historical spatial differences of the different areas of the historical city (Fig. 4).

3.2. Typological analysis

The material and structural progressive deterioration is the consequence of the abandonment of traditional techniques and the incompatibility between the original walls and some contemporary finishing treatments. Together with this material incongruence, we should add the indiscriminate application of unitary and undifferentiated color solutions, disassociated from the color compositional criteria usual in each period and architectural typology.

One of the main contributions of the work we have developed has been the elaboration of color compositional criteria, based on the relationship between color and architectural typology.

In other color studies for ancient cities, there is not a study of the intimate connection between chromatic rendering and architectural typology, something that we have demonstrated by a