Chapter 6
Shape and Geometry in the Integrated Digital Survey

Leonardo Paris
Sapienza University of Rome, Italy

ABSTRACT

The study of the shape in the architectural survey is the principal goal of the surveyor. Any shape is based on stringent geometric rules that the current digital methods of data acquisition don’t detect directly. The basic element in the integrated digital survey is today the point that must to be processed, automatically or manually, to generate a 3D mathematic model. In this chapter the author wants to highlight how these data are important not only for metric information but also to characterize the quality of the shape through the digital photographic techniques. The description of some practical examples proves that in both phases of the survey, acquisition and processing, it is important to know the relations between the shape of the object and the instrumental characteristics in the different methods.

INTRODUCTION

The growth of the digital technologies applied to the architectural survey has changed the procedures of the elaboration of interpretative models based now not only on traditional graphical models, never exceeded.

The definition of model refers here to the word specific of the Descriptive Geometry brought forward from the second half of the last century by Orseolo Fasolo of the Faculty of Architecture in Rome, then taken up and expanded from 80s by Riccardo Migliari (Migliari, 2003).

In the activity of the architects, engineers and designers the models are continually used to interact with the real space, giving body to the project, referring first of all to the geometric model, that is a synthesis exclusively mental. The geometric model must necessarily be represented for to be understood and investigated. Also the representation is done of models. There are basically three types: graphic (analogical or digital) on two-dimensional support, 3d digital model or plastic model. The latter have the characteristic to represent directly the third dimension bypassing the projective procedures that are the basis of the classic methods of representation.

In the architectural survey one of the main objectives is to find the geometric model that forms the architecture in a sort of the reverse process of
the project in which, as we shall see, the shape and geometry are the fundamental elements also in order to changes induced, in the recent years, by the digital revolution.

**BACKGROUND**

Until twenty years ago the architectural survey was a well codified discipline from a methodological point of view. Some phases characterized the activity of survey: a first phase of analysis and understanding of the object to be detected, a subsequent measurement phase, a final phase of representation.

Any manual before to describe the methods and techniques that characterize the scientific discipline emphasizes a fundamental fact: the survey is knowledge, analysis, selection, decomposition of an objective reality; is first of all a cultural product and, as such, strongly influenced by the historical context.

In the so-called short century a decisive impetus to the objectification of the survey stems first of all from the renewal of the cultural contest and from the gradual overcoming of the nineteenth-century academic vision. Another aspect, equally crucial, is related to the technological evolution of the instruments of measure, so the distinction, already known to the Greeks and Romans, between direct survey and instrumental survey, progressively increases. One might argue about the term *instrumental*, given that even in direct survey we use tools, some of which are high-tech, such as laser distancemeter and laser levels or aligners.

Even the traditional level, the plumb line, the wheels metrics are instruments. So it is more appropriate to distinguish between direct and indirect survey: in the first case the measures are taken on the field for the contact, in the second case are calculated indirectly with procedures related the so-called topographic method.

The photogrammetry is a typical method of indirect survey; discipline born in the late ‘800 and widely used throughout the ‘900 developed on two parallel paths: the first, stereo-photogrammetric mode based on topographical procedures, and the second derived from the principles of the inverse perspective (straightening).

The evolution of the theodolite in total station on one side and the analogical photogrammetry in analytical on the other have resulted in a strong specialization with a sectoralisation of the proceedings but without overcome a crucial concept: the measure is ever more objective, while it remains necessarily prerogative of the surveyor the choice of what to measure and how to discretize the object.

In the technological evolution of the ‘900, however, remains a constant: the survey operation, even in its specialization, remains a unitary process, undivided, in which the measurement is an integral part of the model.

The digital age, starting with the 80s of the last century, has opened new scenarios so, within a few decades, all levels of interventions are involved with different weights: the prior investigations, the documentation, the planning of rehabilitation activities, the restoration and conservation, up to the stage of scientific dissemination and use by the community.

As regards the survey and the representation, the innovations related to the digital technology are mainly two: the digital complete conversion of the analytical photogrammetry and the development of the 3D modeling from simple wireframe model to the current models, numerical or mathematical, that describe surfaces of the architecture in continuous mode.

The first aspect is digital conversion of the photogrammetry. In the 80s it was a discipline very specialized and expensive; now it’s a technique of indirect survey much more handy, economical, easy to apply and highly effective, especially because during the elaboration of the 3D model it is possible to add to the pure metric data numerous other information that only photography it can return them, for example the more minute textures of the walls, stratigraphic differences, the state of
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