Chapter 12

Projective Visualization:
A Widespread Design Tool

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ABSTRACT

We will basically deal with three issues. Firstly, talking about visualization in relation to Design seems to be matter of the present era while talking about projection mostly pushes our feelings back to the past, despite even advanced digital visualizations are projection-based, or better, they are projective visualizations. Secondarily, these projective visualizations are not only mere supports to show design results but, mainly, they are irreplaceable thinking-and-operational tools for design development. Third, given their semantic wideness, these visualizations work as very customized tools in the various branches of Architectural, Engineering, or Product Design and so forth, as we also discussed in a cycle of seminars on The Visual Language of Technique Between Science and Art organized by the author during the celebrations of the 150th anniversary of Politecnico di Milano (Cocchiarella, 2015). Last, in order to connect the abovementioned issues we will remark the combined power of Geometry and Graphics, friendly called The Ghost and The Ghost-Buster and their roles over time.

INTRODUCTION: VISUALIZATION VS PROJECTION

In order to understand the deep relationship between visualization and projection a quick look at the history could offer a helpful start. Since the pre-projective graphs in the caves, indeed, a strong aim at outlining recognizable figures arises. We are not mentioning symbols and abstract signs here, but visually recognizable profiles of animals, human beings, natural elements, landscapes, and so forth. In other words, all those intentionally realistic figures that tend to show, as better as possible, the world as it was in that pre-historical time. Well, aiming at graphically replacing by visual analogy the visual perception, we can somehow consider them as unconsciously implicit projective representations, since the vision itself is based on a projective process, as Euclid would have later on demonstrated in the treatise Optiks (III century BC). In this way, we can recognize projective evidences in all our visual experiences, either looking at the real space, or looking at projective or at pseudo-projective images, and even at all those.

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non-projective forms of representation like symbols, schemes, diagrams, and any type of writing that we excluded a few lines before. All the languages that use visual signs, in fact, need light to appear, more precisely, from a purely sensory point of view, they need light rays reflected by graphic signs to be intercepted by our pupillary hole, working as a collector, and to reach the retina onto the internal surface of our ocular bulb. This travel and its final destination establishes the geometric principle of projection/section, where the first is related to the linear travel of light, the latter to the impact of the light rays on the sensory cells of the retina. As we know, this impact sensitizes the cells generating visual stimuli and the following generation of images in the brain. Of course we understand that no one can work without the other: in fact, without a projection no impacts are possible, as well as without a sectioning surface, the travel of light could never stop and therefore no image could be generated. Together with this, we can also understand the importance of the light collector, that is, of the pupillary hole in the eye as well as of the hole in a stenoscope, of the lens in a photo camera or in a video camera, or of a geometrical point in the projective theory, in a nutshell, of the center of projection (Pirenne, 1970).

Trying to rationalize, we see that a projective process characterizes our subjective visual perception of the so-called objective world. Moving now on this world from a projective point of view, according to our purposes, we propose the following subdivisions. First of all we recognize real spaces and objects of our everyday life. They are non-projective, it means that they have been naturally generated by geological or chemical phenomena, or artificially built based on metrical instructions. Their geometry is consistent with the geometry of the Universe, locally considered Euclidean. Their shapes are non-distorted and normally measurable, apart from some special cases, which belong to the next category. Secondarily we have analogue representations of spaces and objects. They can be either non-projective representations, which are not realized following specific projective rules (like diagrams and schemes), or projective representations realized according to Projective and Descriptive Geometry (like perspectives, axonometric and orthogonal views) (Evans, 1995). Although they can represent real spaces and objects, they cannot be directly measured without taking into account some specific procedures. Indeed, these representations normally consist of images, or sets of images, showing three-dimensional situations on a bi-dimensional plane, namely the picture plane, that is, paper, canvas, and so forth. Therefore, strong distortions occur in these images, and that is the price we pay for constricting spaces into planes. As automatic projective representations, photographs and movies show similar structures, apart from the additional distortions produced by the lenses, while stenoscopic images realized by means of a camera without lens, are even more closely similar to perspective, in spite of the unavoidable effects of the diffraction of light. Very special cases in this group are drawn or painted anamorphoses, perspective sculptural reliefs, holograms, and the perspectival spaces. Just to mention one of the most well known among the latter, it is mandatory to recall the Palazzo Spada’s Gallery by Francesco Borromini. It is a three-dimensional perspective, characterized by a short conic vault appearing as a long cylindrical ceiling. The walls and the ground are also set as the faces of a truncate pyramid around their horizontal axis. The result is a space, namely a gallery, becoming gradually restricted walking from the front to the back entrance, and vice versa. In what is this space different from a normal real space? Based on the abovementioned notes, it is a real artificial object, but it has been built according to the geometrical rules of perspective and extended beyond the canvas. Consequently, it is a three-dimensional object working as a three-dimensional perspective, therefore there are only few points of view from which it can be correctly perceived, appearing as a normal gallery, while observed from any other position, it necessarily appears distorted. Third, we have digital representations, displaying all the abovementioned typologies of images, either the projective or the non-projective ones (McCullough, Mitchell, & Purcell, 1990). Moreover,
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