Looking for the More Favourable Similarity Between Graphic Images

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Abstract. The processes of a projective nature, through the construction of images, both rigorous and expressive, make it possible to translate the spatial qualities and figurative properties of the space that surrounds us on the level of design, making it possible for those who read the image, the recognition of the object of the space. The model that is created, as a conventional image of objective reality, uses a linguistic code with a precise system of rules. The work presented here, in tents, illustrates, within the code of projective transformations, that operation that transforms on the plane (or rather on a plane $\pi \equiv \pi'$) the same relations that exist between the figures in the perspective, the homology, understood as the process capable of creating an image in which the original one is recognizable in its transformed, preserves its characteristics, and from it we are able to recognize, backwards, the initial image.

Keywords: Similar homology · Affinity · Homotetic · Metaphor · Consistency

1 Introduction

In continually thinking about teaching Design, and adapting it time after time to the changing demands of the degree course in engineering, from the number of credits given, to the face-to-face lessons, to the laboratory activities, going from the first year to the second year of a course and vice versa, there always remains the unchangeable, in every declination, of the act of design as projection/transposition of the object on one plane, i.e. the possibility of expressing on a two-dimensional plane, the characteristics of an object which, in effect, is three-dimensional.

This action necessitated the knowledge of processes of a protective nature, through the building up of images, which are both rigorous and expressive, which translate the spatial qualities and the figurative properties on the plane of the design. Those phenomena of a protective nature, in fact, possess the dynamic genesis of the configurations of objects. You just need to think of a luminous projection (whether natural or artificial) or the projection of shadows, the projection of photographic or filmed images, the vision itself. These phenomena define that transforming process which forms the objects and which determines a journey in a double sense geared towards vision and thought. On the one hand singling out the form and its expression through coherent and recognizable images, on the other there is the capacity to imagine them, to plan them, to conceive and project them.

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2 The Design as Projection from the Real Thing and Projection from the Idea

The "discovery" and then the knowledgeable study of the protective properties which regulate and guide the reduction to the plane of the three-dimensional configurations of objects, followed by the learning of those theoretical formulations of representation - the Methods - which have been proposed by the "scientists-artists" of every epoch and developed into a plurality of different procedures, lead us to assume that the operation of the projection is the basis which cannot be ignored in every procedure. The objective configuration is transformed every time the object is projected from a point, properly so if it had been placed at a finite distance, improperly so instead if it is infinitely distant.

If nowadays, for whoever practices the art of design, the word "projecting" is unequivocally linked to descriptive geometry and to the methods of representation, then for artists it continues to correspond to an ability to set up on an ideal plane their own dreams and their own ideas (Carlevaris 2017). This corresponds to their own feelings and their own illusions and their aim is to be able to observe them or to have them observed through a privileged and subjective point of view which is an expression of their most intimate and personal experiences.

In particular, when the experience is of a spatial type (and this is valid also for those who project, as well as architects and engineers) the projection allows the idea of space or the memory of it to become real, and so creates continuity between the desired spatial form which the mind has thought of and the form represented, so much so that the latter becomes the only real and existing form. The graphic exercise, then, of designing a space while it is seen, even if for the first time, like that of designing a space impressed on the memory, has only to obey the laws of vision and, hence, of the projection (Migliari 2000). Designing space, or the forms of space, is translated into that creative action which tries to transfer, through a personal order of who carries out the designing, their vision of things, which otherwise would not be available.

Through the perception of the design which has become an object, or when the action of the drawing has been completed, the recognition and understanding of the objective reality is possible, i.e. the drawing becomes the artificial reality through the graphic model of it and the clearer it is the more effective it is (Cardone 2015). Thus the created model is only a conventional image of objective reality, which does not necessarily visually look like it, but it is comprehensible to whoever knows it and uses this type of language.

Just like every linguistic code, understood as a system of rules, comprehension is, in fact, entrusted to the use and knowledge of rules. In the code of projected transformations geometry offers the chance to choose the level and type of scheming to which the observed phenomenon is intended to be brought to the reality which surrounds it so as to make some of its characteristics explicit (Carlevaris et al. 2010). And surprisingly enough it is the two-dimensional structure of the representation which determines the decisive simplification and clearness of the reality.

The generating laws of the phenomena are often explicit in those models whose description, if carried out through flat sections, becomes more immediate and evident than in reality. This means that it is possible that events, objects of space, elements of

architecture, etc., which are not observed or which are difficult to observe in a direct way reveal symmetries, regular qualities, recurrences, or however laws which help to clear up doubts, only through some of their two-dimensional projections (de Rubertis 2000).

Considering the projection, therefore, as a generating operation of every form of representation, it is the succession of the projecting operations which lead to the construction of the forms and the modification of the configuration. In the process of representation and, in particular, in the representation of space, the geometrical transformations are essentially of a protective type.

Points, straight lines and planes, fundamental geometric beings which lead to the essence of every form/image can be deduced and related to each other through an infinite number of projecting operations. Through the geometric language the beings acquire a relational value which allows us to investigate them in their reciprocal relationships, to analyze them in their due degree of belonging to a visual system, of recognizing them in their new and unedited image in which, through their projection, they are re-organized (Fig. 1).

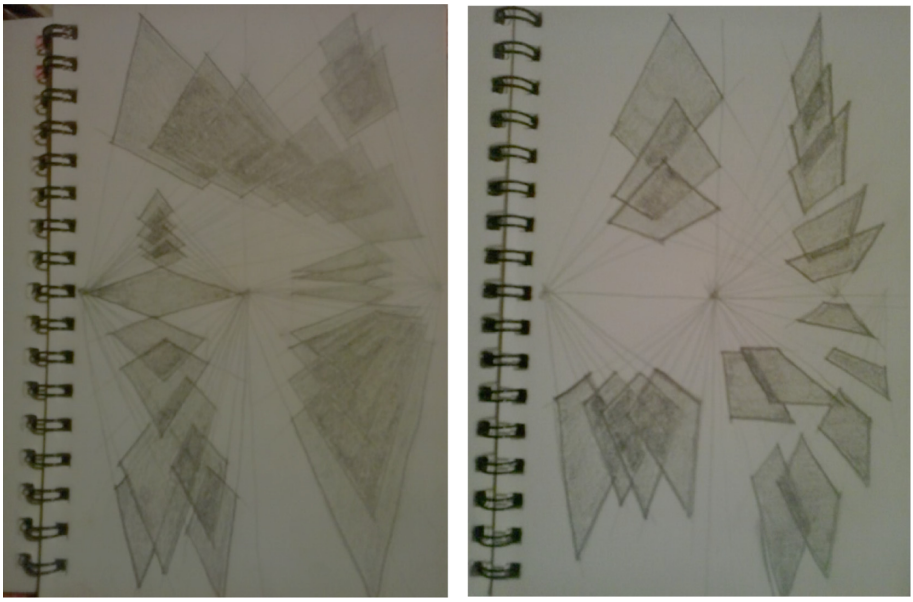


Fig. 1. Graphic deductions of projective figures.

3 The Recognizable Transformation

If a figure from a central projection is projected on a plane, another figure is obtained on the plane which in visual terms can be recognized as more or less similar to the starting-out figure, while in geometric terms it is affirmed that it corresponds in a bi-unambiguous way to the former, i.e. to every element of the former image there

corresponds one, and only one element, of the latter and it is possible to go back to one from the other and vice versa without any errors or ambiguities (Gay 2004). The correspondence which is created - and which takes its name from the perspective - is valid between the images of the flat figures. To understand this relationship better you only need to think of exposing it to natural light or to an artificial luminous source (like a candle or a light bulb) of a sheet of paper. It will be projected on the floor or on a wall or on the top of a table, etc. and its shadow, on this plane, will determine a corresponding image, which is more or less similar to the original according to the reciprocal position of the sheet of paper with respect to the source of the light and the plane (Fig. 4).

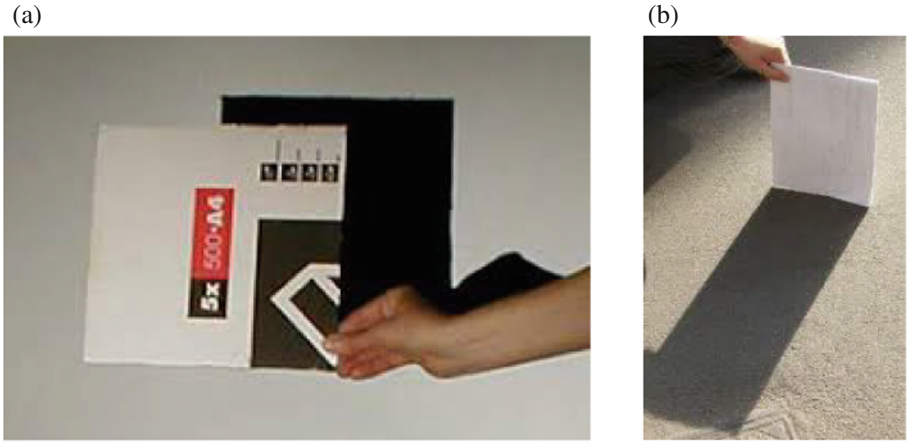


Fig. 2. The image-shadow of a sheet of paper exposed to a luminous source can be observed where it is arranged (a) in a position parallel to a plane and (b) perpendicularly to it.

Fig. 3. The image-shadow of a wooden grid which is only a few millimetres thick can be observed and this makes it comparable to a plane.

Fig. 4. The image-shadow of different figures of paper used for didactic and recreational purposes.

The relationships which exist between the images in the perspective depend exclusively on the figures and their characteristics and neither on the position on the planes which the figures belong to nor on the position of the beings in space. As exemplified in the previous images, in fact, if the sheet of paper has four sides, its corresponding image will continue to have four sides. If the vertexes of the four-sided object follow one another in an ABCD order, then in the corresponding image the same succession comes about. This also happens if the grid has a 3 × 3 mesh, as its corresponding image will continue to have the same matrix, and so on…

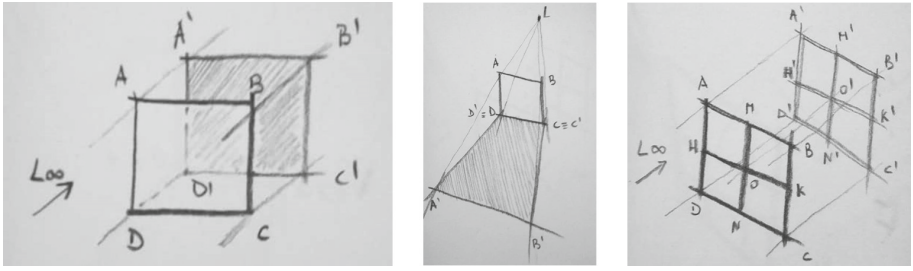


Fig. 5. Identification of the geometric-projective relations between the images in Figs. 2 and 3.

In the code of the projecting transformations, it is essential that the graphic construction is the operation which transfers onto the plane (or better still onto a plane $\pi \equiv \pi$') the same relationships which exist between the figures in the perspective. It takes the name of a homologous form and can be understood as a procedure which is capable of creating an image in which the starting image is recognizable in its transformed one, it keeps its characteristics, and from it is possible to recognize, in a backwards manner, the initial image (Fig. 5).

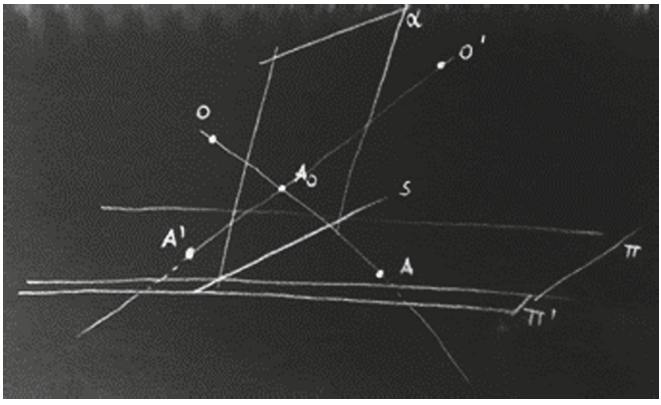
3.1 The Reference in Space

In the current praxis of Representation and, in particular in the drawing of space, the advantage which is obtained from using the homologous principle is notable. The principle alludes, in any case, to all the Methods of Representation (from Monge's Method, to Axonometry, to Perspective) and it speeds up both the drawing done by hand and the digital drawing.

In fact only two rules define the homologous form on the plane, but to understand the efficiency of the principle it is necessary to single out the geometric-spatial reference which helps bring it about.

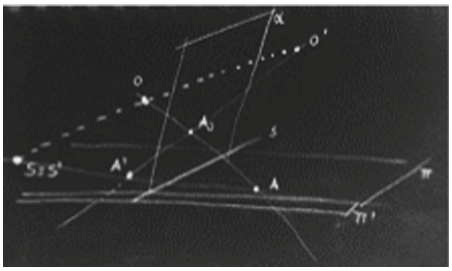
Let's consider a α plane and two points external to it which are indicated by the letters O and O'. From each of them we project respectively a generic point A_0 which belongs to the α plane. Thus we build up two distinct perspectivities. If we introduce another plane, π, which intersects α in the straight line *s*, the projecting ray coming from O and which contains A_0 will single out on π a point A which corresponds to in the perspectivity of centre O, the corresponding planes α and π, axis the straight line *s*.

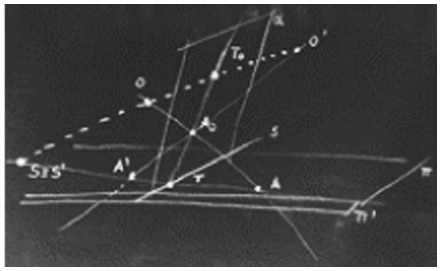
A second perspectivity is generated if we imagine a plane π' which is superimposed on π. The projecting ray coming from O' and A_0 will single out on π' a point A' corresponding to A_0 in the perspectivity of centre O', the corresponding planes α and π', an axis of the perspectivity straight line *s*. The straight line *s* is common to the planes α, π and π' and is defined a jointed straight line, all made up of jointed points.



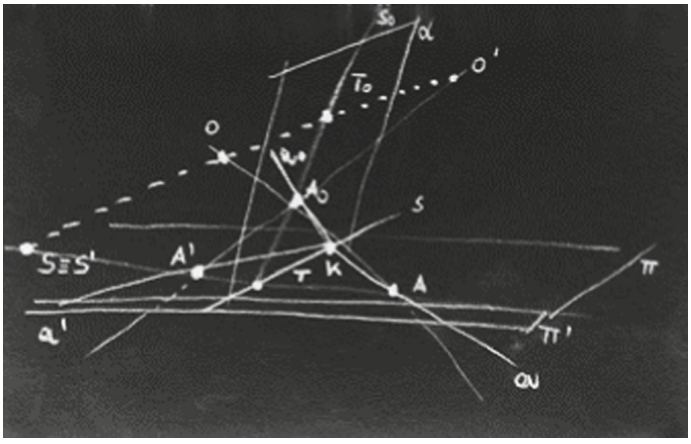
We can show the geometric product of these two perspectiveties on which the plane α is related to the superimposed planes π and π' once through the centre O and another time through the centre O'. Showing the product of two perspectives is equivalent to projecting the point O from O' and the point O' from O and obtaining on π' the point S' and on π the point S.

$S \equiv S'$ is a joint-point and is aligned with the points A e A'. O-O' individualizes on α the point T_0 to which - added to A_0 - there is determined the jointed point T. Through T, A_0 and T_0 there passes a straight line s_0 which corresponds both to the straight line S and A on π and to the straight line for S' e A' on π'.





The product which is arrived at between the two perspectives determines, on the plane, a corresponding one called homology in which the jointed point S ≡ S' is characterized, as the centre of the homology and the jointed straight line s as on the axis of the homology. The points A and A' are called corresponding or homologous and have the characteristic of being aligned with the centre of the homology. Besides carrying for point A_0 a generic straight line a_0 it characterizes on the axis s a jointed point K. K-A on π will correspond or be homologous to the straight line K-A' on π'. Therefore it is possible to affirm that in a homology, corresponding or homologous straight lines intersect on the axis of the homology.



Here are synthetically the two rules of homology:

- Corresponding points (or homologous ones) are aligned with the centre of the homology.
- Corresponding straight lines (or homologous ones) meet up on the axis of the homology.

Once the reference in the space through which it is possible to effect the product of the two perspectives and determine a homology has been singled out, you can graphically work exclusively on the plane of the design and synthesize the corresponding homology

by assigning the centre of the homology, the axis of the homology and at least a couple of the corresponding elements (either a couple of homologous points or a couple of homologous straight lines) (Fig. 6).

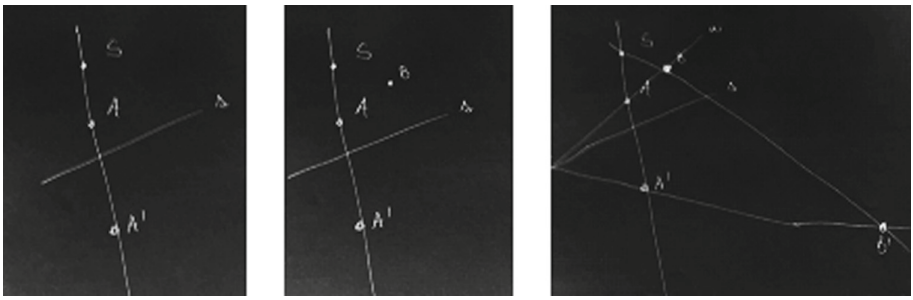


Fig. 6. Let there be assigned a homology to the plane through the centre S, the axis and the couple of homologous points A and A'. Consider a point B and determine its homologous B'. To proceed to singling out a homologous point, let us exploit the property of the homology through which the corresponding points are aligned with the centre and therefore trace the straight line joining B and S. On this straight line you will definitely find B', a homology of B. The other rule of homology is that according to which corresponding straight lines meet on the axis and allow us to reason in this way. If we unite the points A and B, we single out a straight line which meets the axis in the jointed point K. Then we can unite K with A' and single out the straight line *a*' corresponding to *a*. On a' you will definitely find B'. In fact the searched for point is singled out by the intersecting of the joining of S-B with the straight line *a*'.

3.2 Related Images: The Cases of Homology

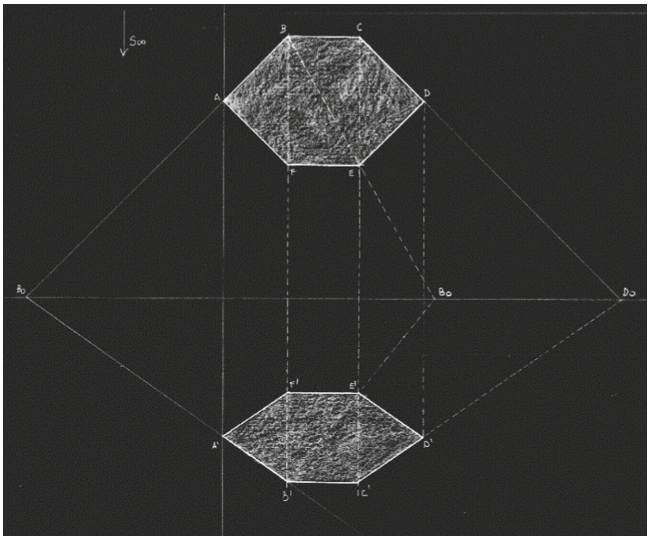
In the preceding examples we have always considered a homology in which the centre is a true and proper point and the axis is a true and proper straight line. However if we consider that the centre can also be an improper point and that the axis can also be an improper straight line, then the homology is declined in most cases and the homologous figures, in their various combinations, will be the above-mentioned similar figures, homothetic figures, metaphorical or coherent figures.

3.2.1 Similar Homology or Affinity

Let's consider a homology on the plane in which the centre is an improper point Soo and the axis is a proper straight line *s*. We can speak of similar homology or affinity and, in particular, if the direction of the centre is perpendicular to the axis, the affinity will become perpendicular. If, instead, it is not perpendicular to the axis, the affinity will become slanting.

The reference in space from which the principle is generated is given by a double perspective in which both the centre O and the centre O' are both improper points.

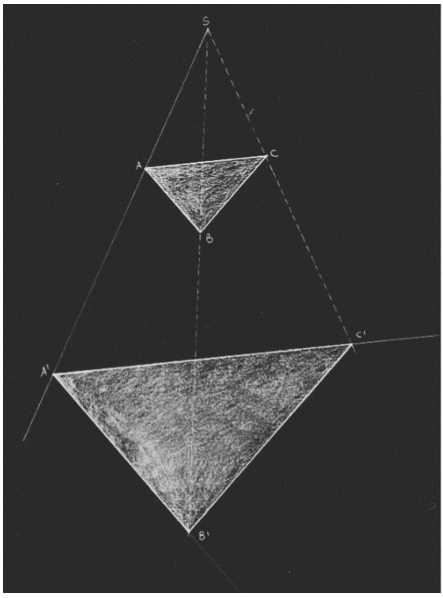
Or from a double perspective in which the centres O and O' are aligned along a parallel straight line with the superimposed π and π'.

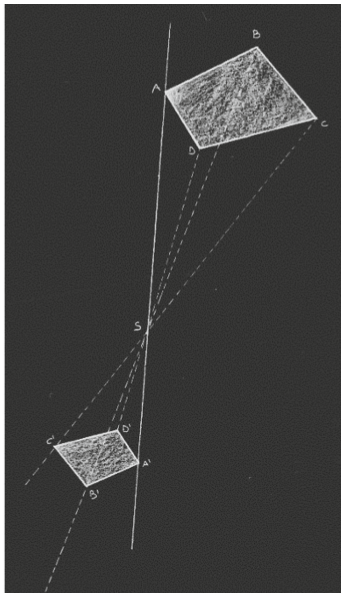


3.2.2 Homotetic

Let's consider a homology on the plane in which the centre is a proper point S and the axis an improper straight line s_∞. It is called homothetic.

The reference in space from which the principle is generated is given by a double perspective on which the plane α is parallel to the superimposed planes π and π'.

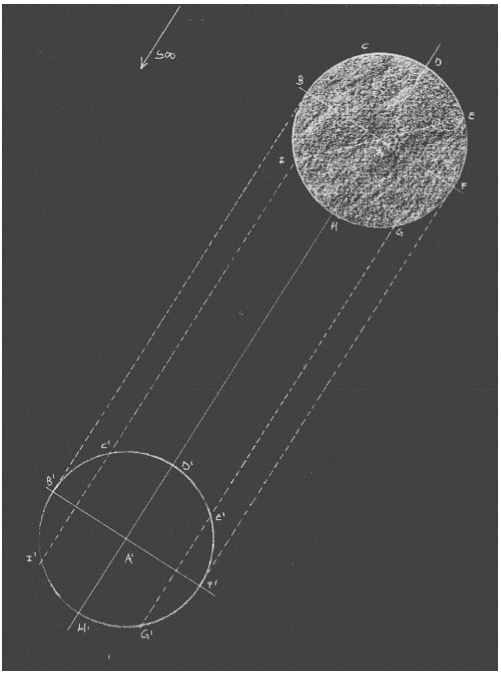




3.2.3 Metaphor or Consistency

Let's consider a homology on the plane in which the centre is an improper point S_∞ and the axis an improper straight line s_∞. The homology is called metaphoric or consistent.

The reference in space from which this principle is generated is given a double perspective in which both the centre O and the centre O' are improper points or are aligned along a straight line parallel to the superimposed planes π and π' while the plane α is parallel to the superimposed planes π and π'.



4 Conclusions

The acquisition of this principle and its application to the graphic exercise involve a form of training which is essential to the perceptive and creative capacity of relating two or more images and gets used to the "recognizable transformation", both that it is understood as a procedure to create a new form to start out from an initial image, and that it is understood as a capacity to go back to the real form given to an image. In the graphic exercise of building one or more homologies on the plane, there is, in fact, contained the attitude to the recognizing sensitivity of the forms, "that intuition which helps you communicate with the model, lets you judge it, guides you towards its habits, its ideas, its character, and allows you to obtain, not in a banal way or by chance, a reproduction […] anything whatsoever, […], although the most familiar and most favourable similarity, the intimate similarity" (Prinet and Dilasser 1966).

The cases of homology make up true and proper levels of "more favourable similarity" between the forms, as Nadar says, who was the pioneer of photography with which a new form to represent is affirmed which goes hand-in-hand with the means of the recent past. From the immediate level of the metaphor, to the intermediate one of homothetic, to the advanced one of consistency, until the most complex one of the so-called generic homology, the exercise of recognizing in the visual instance finds its essential foundation only through the graphic exercise, i.e. that operation that allows us to approach things (present or absent), so as to find a way to establish a relationship between the objects, to project them, to create a more favourable similarity, through discretion, attention, caution and respect for what the objects communicate.

References

Cardone, V.: Modelli grafici dell'architettura e del territorio. Terza edizione a cura di Salvatore Barba. Maggioli editore, Santarcangelo di Romagna (2015)

Carlevaris, L.: La ricerca nell'ambito della geometria descrittiva. Gangemi Editore, Roma (2017)

Carlevaris, L., De Carlo, L., Migliari, R.: Attualità della geometria descrittiva. Gangemi Editore, Roma (2010)

de Rubertis, R.: Geometria e percezione. Proiezione e Immagine. In: Dell'Aquila, M., De Rosa, A. (eds.) La logica della Rappresentazione, pp. 169–190. Arte Tipografica, Napoli (2000)

Gay, F.: Tra forma e figura: tre seminari sulla rappresentazione. Cafoscarina, Venezia (2004)

Migliari, R.: Fondamenti della rappresentazione geometrica e informatica dell'architettura. Edizioni Kappa, Roma (2000)

Prinet, J., Dilasser, A.: Nadar. Armand Colin, Parigi (1966)