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ATINER's Conference Paper Series
ARC2013-0587

The Representation of Virtual/ Real Architecture and Perspective Space

Matteo G. Romanato
Politecnico di Milano
PhD Student at DAStU
(Dipartimento di Architettura e Studi Urbani)
Italy

Athens Institute for Education and Research
8 Valaoritou Street, Kolonaki, 10671 Athens, Greece
Tel: + 30 210 3634210 Fax: + 30 210 3634209
Email: info@atiner.gr URL: www.atiner.gr
URL Conference Papers Series: www.atiner.gr/papers.htm

ISSN **2241-2891**
1/10/2013

An Introduction to ATINER's Conference Paper Series

ATINER started to publish this conference papers series in 2012. It includes only the papers submitted for publication after they were presented at one of the conferences organized by our Institute every year. The papers published in the series have not been refereed and are published as they were submitted by the author. The series serves two purposes. First, we want to disseminate the information as fast as possible. Second, by doing so, the authors can receive comments useful to revise their papers before they are considered for publication in one of ATINER's books, following our standard procedures of a blind review.

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This paper should be cited as follows:

Romanato, M.G. (2013) **"The Representation of Virtual/Real Architecture and Perspective Space"** Athens: ATINER'S Conference Paper Series, No: ARC2013-0587.

The Representation of Virtual/ Real Architecture and Perspective Space

Matteo G. Romanato
Politecnico di Milano
PhD Student at DAStU
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Abstract

The present paper reports a didactic project arranged for high school students to introduce them into the way of representing architecture with perspective and the related mechanism of space perception. Such project was then tested in three classes of an Italian school.

The project was developed in a structuralist path in which each goal was basic for further advance. One of the goals was in fact helping students to think space, objects and their relations using representations which step by step could give them a way to interpret reality.

According to the educational theories in fact the development of human intellect toward a more conscious and complex articulation, involving for example abstract thinking, takes place around the age of twelve. It was just in this period when these lessons were performed.

The main aim of this design was to assume a wider theoretical frame by linking scientific approach (visual perception) and artistic expression (perspective, architectural painting) just to go beyond the subjects sectionalism.

This interdisciplinary character involved also the didactic methods (Pc experience, drawings, urban survey, trials) in order to help students in different ways to face the sides of the question.

A good part of the class could anyway be involved in the process with different outcomes but, what is more important, every student had the opportunity to try out its specific ability or inclination perceiving the learning as a work always in progress with an high level of correlation with their space and environment.

Keywords:

Corresponding Author:

Introduction

Many of the didactic projects developed in the schools nowadays usually think of the drawing practice as a mere technique the students must acquire for their career (in case of technical drawing) or as a form of expression of personalities and sentiments (in case of artistic pictures) or even, especially for young people, as a surrogate to convey inner psychological frames. It is very difficult to propose the drawing as a mental tool to understand reality and to monitor the sensitive experience in a more aware perspective. The mechanism of vision, with its complex structure and the representation of objects, distance, geometry and space can yet be an opportunity to show the drawing as a switching place between the real and the abstract. On this assumption drawing is so a resource to give a shape to our perception, to describe the outer space, to dominate it trough a conceptual formalization. The expression of the personal contribution or the skilful knowledge (or even some unconscious process) can be rescued inside this outlook as well. It is no necessary in fact to loose these other aspects of such a stratified discipline. On this way the interdisciplinary character[1] of teaching can be considered as an academic parallel of a comprehensive attempt to map out multiple channels of interaction with boys and girls. The mission of the school education in this case should be more to open new interrelated scenarios in which every student can find his personal path to its well rounded development.

Research Context

Jean Piaget[2] claims that there is a moment in the development of a schoolchild when it can not reject anymore the concepts, the ideas or the phenomena he does not understand but makes one or more attempts to arrange them with its previous learning. This effort to manage its fund of knowledge with the new experiences is the so called passage to the formal operational stage and it happens less or more at twelve years of age. It is around this development phase that in the Italian Junior high school the teaching system should offer a specific training and qualification in drawing. Unfortunately the national directions for the learning programs according to the Italian law[3] are quite generic and speak about orthogonal and axonometric projections without mentioning other important forms of representation. This is a quite serious and misleading approach for two reasons. First of all this way of thinking the drawing does not involve a clear relationship with descriptive geometry and the reasoning and second of all it does not help students to proceed with graduality from concrete (common vision) to abstract (projections). In other words this is a clear contradiction with the above mentioned outcomes of the developmental

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[1]Klein J. T. (1990).*Interdisciplinarity: History, Theory, and Practice.* Detroit: Wayne State University.

[2]Piaget J. (1985). *The Equilibration of Cognitive Structures: The Central Problem of Intellectual Development*. Chicago. University of Chicago Press.

[3]'Indicazioni nazionali per i Piani di studio personalizzati nella Scuola Secondaria di 1° grado'. Allegato al 'DLgs 19 febbraio 2004, n.59'.

psychology. Fortunately for a teacher the Italian system can also offer a wide margin of action considering the necessity to meet the student's inclination and to structure the activity on a child focused point of view. In this context it was so possible to experiment a new approach to drawing and to the experience of vision in a proper way using the key issue of perspective as an operational tool and a learning frame.

Case Study

The learning project was put to the test in three classes of a Italian junior high school in which the students (20 children on average equally divided into both sexes) were from twelve to thirteen years old. It is important to point out that these were homogeneous classes according to the Italian law and tradition. In other words there were not accelerated classes for extra-smart kids and even those with disabilities (psychological or cognitive) were kept into regular classes. All the different students were so distributed in the classes with the same percentage of clever and less clever students. The time disposable for the project was an amount of three ours per week split into a set of two plus one our. A pc class was disposable for one our with a large screen connected with the teacher's laptop for the information technology lectures. So all what the teacher types on his pc can be displayed to the class as well. The classes were also already accustomed to some intuitive perspective drawings (very simple) by the art teacher who focused her attention more on other aspects anyway and at the same time the maths and science teacher had trained them to measure and to deal with geometry (lines, shapes, intersections etc…). This was so a very useful educational background for the new experience proposed.

Class Work

The first step was to demonstrate trough a class experience the phenomenon of vision. The question proposed to the class was: 'How do we see?' and 'Can we resume this into a shape or not?'. The class had so to accept the challenge to transform its everyday sensation in a more formalized and conscious structure. They were forced to give rise to some spatial model they never wondered before: a model that had to be fit for their need to understand the phenomenon of vision. Therefore a boy was put in the middle of the class with a black round shaped cardboard in front of him to obstruct him a part of the vision of the class wall (Figure 1). He was then asked to say which part of the wall he can see and the rest of the class had to mark with some points on the wall the unseen portion. So a circle (obviously larger than the cardboard itself) was depicted on the wall to indicate the blind perimeter. Then the cardboard was brought nearer to the observer followed by another definition of the blind area: an even larger circle on the wall and a 'strange curved shape' the students could not identify clearly (the teacher told them it was an hyperbola) on the ground. Now, during a class discussion with the help of the teacher, a model was, step by step, drawn on the blackboard. So the student started to

realize it was a cone. After having accepted the optic cone, basically in the Euclidean footsteps[4], as viable model for vision mechanism (Figure 2) they were ready for the further step. After that it was possible to lead the students to a school trip just around the school when they could copy a perspective urban landscape on a transparent plexiglas board. They so realized also in real life that parallel lines (streets border, fences, sidewalks) meet all at a single point in our vision (Figure 3). This was a particularly precious experience because it offered the opportunity to focus their attention on landscape and architecture with a unusual look. It was quite easy to show them that the vanishing points depend on the position of their eye though the combination, on the same transparent support, of the change of them in relation with the movement of their point of view. Through the composition of these two outcomes: the principle of the optic cone and the empiric perspective the classes could face an interesting PC experience. The teacher prepared in fact a photogrammetric reconstruction of an architectural building depicted in a Renaissance painting. The painting was the so called *La calunnia* (in English: the defamation) by Botticelli. It shows a quite complex architectural environment with pilasters, arches, vaults and niches in the tradition of the Italian Renaissance[5]. The teacher built a 3d model of that architecture by a CAD solid modeller in a virtual space and then drew the construction lines, marked the position of the point of view (the painter's eye according to which the perspective was painted) and put an image of the painting in the place of the picture plane (Figure 4). So the student were invited to verify if the construction lines (assimilable to the visual rays) starting form the points on the 3d architecture and ending on the viewer point intersect the picture plane in correspondence with the image point of the painting. They did not do it by watching it but just by coming to the teacher's desk and using his laptop one by one. They got in fact inside the virtual space and got some familiarity with the program with two or three simple commands. Then they were put in condition to operate with a certain autonomy to verify the effectiveness of the model. Meanwhile all the class could follow each mate on the large screen. Finally it was possible to define properly the classic rules of perspective on a more conscious background. So a class project could start from a participative cooperation among all the boys and the girls of course again with a decisive support by the teacher (to overcome understandable difficulties). The class group could start to drawn a perspective scheme of one known building trying to put into practice all the knowledge and the suggestion they collected in the previous path as a final collective product of their experiences. (Figure 5)

Figure 1. *Class Experience*

[4]Edwin Burton H. (May 1945). 'The optics of Euclid, translation by Edwin Burton Harris, Dartmouth college, Hanover, New Hampshire '. *Journal of the optic society of America, volume 35, number 5.*

[5]Camerata F. (2006). *La prospettiva del Rinascimento. Arte, architettura, scienza.* Milano. Mondadori Electa.

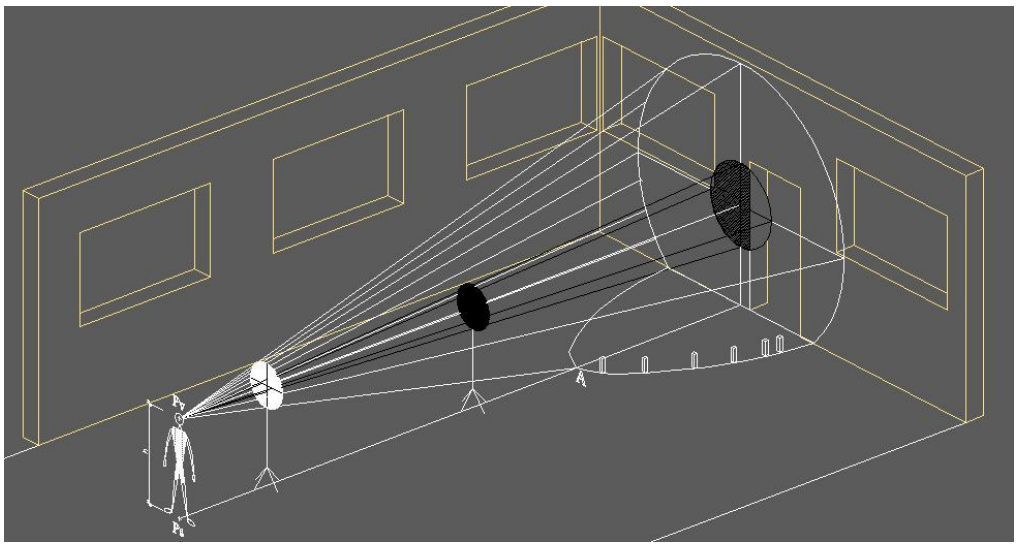


Figure 2. *The Optic Cone*

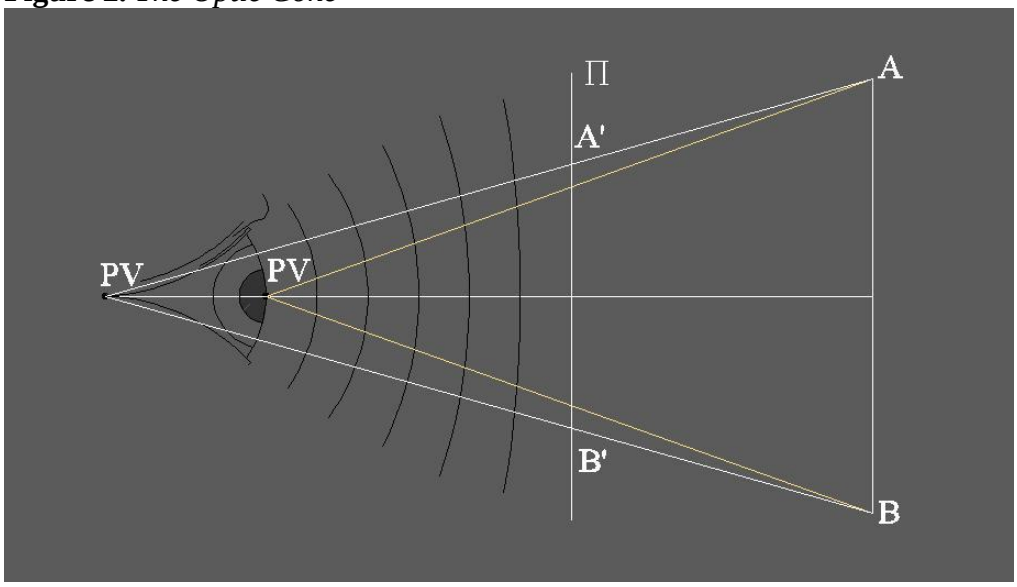


Figure 3. *Urban Landscape*

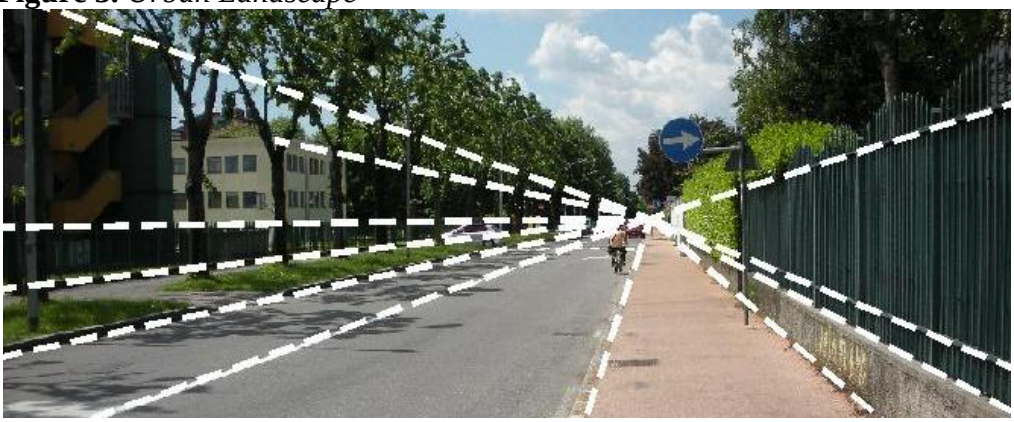


Figure 4. *Virtual Model with Perspective*

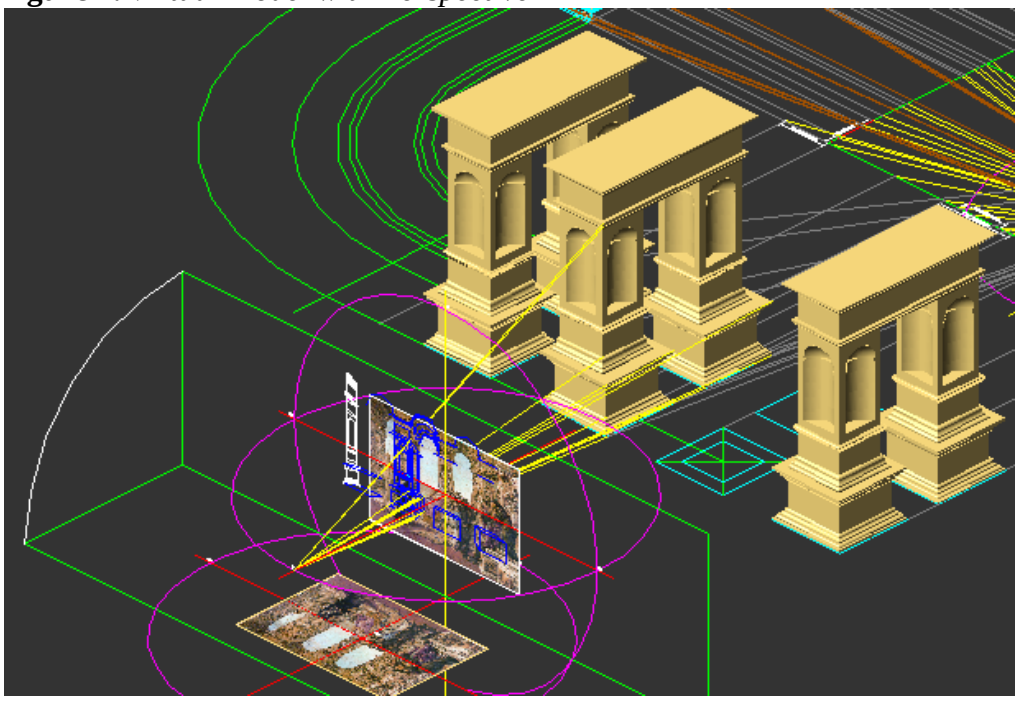
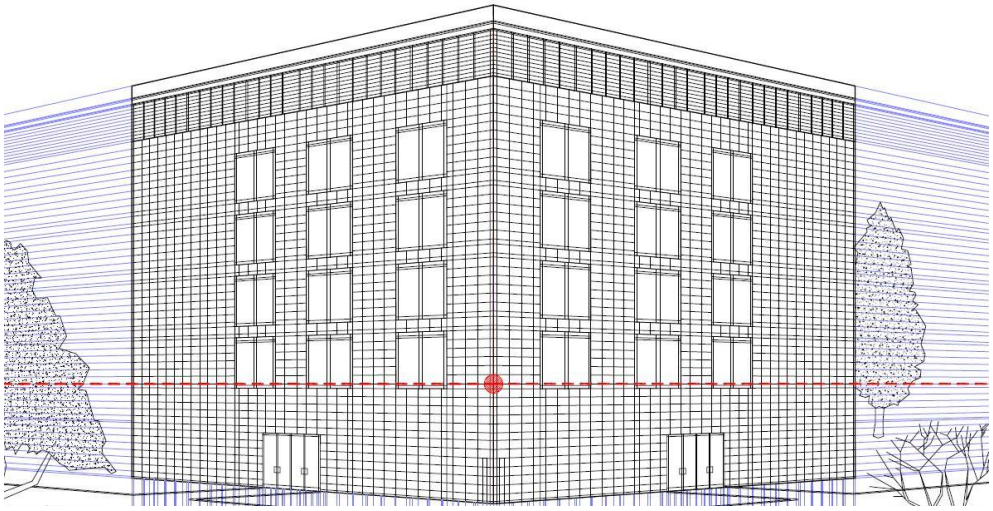


Figure 5. *Perspective Scheme of Building*

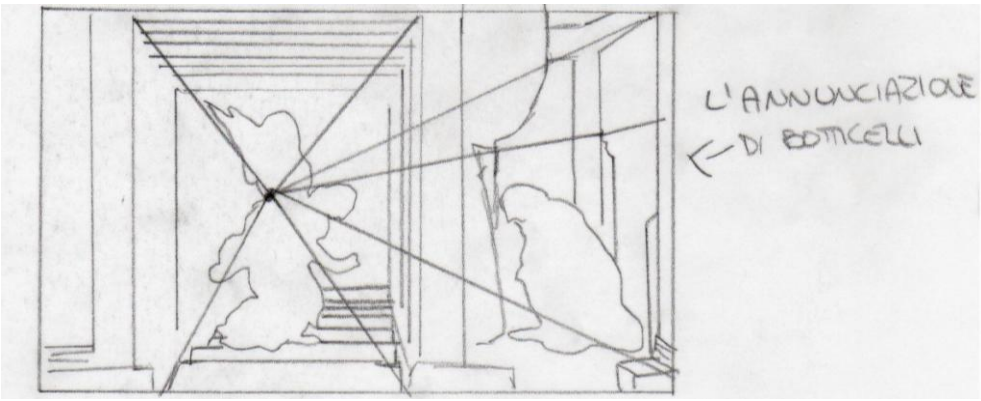


Results

The major outcome of this didactic experience was definitely a more conscious approach to perspective not only as an artistic product or as a beautiful image but also as the closest way to show things as people actually see them. They were in fact asked for a written composition in which they could describe, with their own words, what they think about perspective and drawing. Most of them wrote that perspective was far more involving for a lot of reasons but, above all, because it was the form of representation nearest to

their everyday experience. After this path it was also possible for the students to analyze the images they often find on their books (painting, pictures of photos) as a form of translation of threedimensional reality into a bidimensional support through specific tools and rules. This was testified by some works of analysis the student made choosing the main elements of representations by highlighting details through transparent papers superimposed on the original pictures (Figure 6). Another important result was the collaborative environment[1] they could keep around an experience that involved them very much so that they asked for more pc experiences and more field trips, both occasions to interact with same age mates as well as with the teacher.

Figure 6. *Analysis by a Student*



Comments

The importance of the results can be found in an evolution of cognitive structures in an abstract sense. The key element was in fact that the frame of vision, in a certain sense captured by the students and tamed by perspective rules, can be used to perform some representation of building, space and landscape. From a physical formalization of the optic cone the students interpolated it with the visual position of the vanishing points in reality and recognized that the surface representing the perspective was a plane that intersected the visual rays drawing the concurrent lines. This is the base in fact to pass from an empiric perspective (which sees the image as a self concluded plane) to the actual perspective picture plane that resumes in itself the complex threedimensional phenomenon by an implicit process of formalization and abstraction. It was anyway a process in which abstract concepts such as the vanishing point (which is at infinite actually and can not be brought back directly to the sensitive experience of an adolescent) or the converging parallel

[1]Falchikov N. (2001). *Learning Together: Peer Tutoring in Higher Education*. London. Routledge.

lines were abducted, suggested, imagined, envisaged through interdisciplinary relations, long class discussions and trials.

Conclusions

Geometry, graphics and representation can involve urban landscape, science and arts showing how they can contain, explain and joint together all these sides of human experience with their figurative significance. In other words the final result was the applicability of the representation of architecture and architectural environment as a valid source to open mind to a more conscious and analytic consideration of space and a tool to develop the abstract thinking and the formalization of experiences through representation.