

GEOMETRY AT FINE ARTS AND DESIGN FACULTIES
European Encounter of Erasmus Partner Faculties
<http://scaffolding.fba.up.pt/>
May 7th- 9th, 2018
i2ADS – Research Institute in Art, Design and Society
Faculty of Fine Arts of the University of Porto
Junta de Freguesia do Bonfim, Porto

Geometry at FBAUP

Vasco Cardoso, Ph.D.,
Assistant Professor at the Drawing Department of the Faculty of Fine Arts of the University of Porto,
Integrated Researcher at the Research Institute in Art, Design and Society
vcardoso@fba.up.pt

Inception

It was the implementation of the Bologna Process in 2007 that motivated and justified a major reform of the presence of Geometry in the undergraduate courses – Fine Arts and Communication Design – at the Faculty of Fine Arts of the University of Porto (FBAUP). Since 2005, João Athayde e Melo, Álvaro Meireles, Lucena Sampaio and Vasco Cardoso, Invited Assistant of Geometry, under the coordination of former Department Director – Professor Mario Bismarck –, started a reorientation process of the Geometry science within FBAUP. Some mature reflections were made. Firstly, the centennial presence of Geometry in the Porto Fine Arts School was pondered. Then, a lot of consideration was devoted to the Bologna new *curricula* formulations. Also, much attention was paid to the new undergraduate candidates, namely the competences that they bring from Secondary Education. But, mostly, narrower solid bonds between Geometry and Drawing were delineated to be followed onwards. Throughout the years required for the expected adaptation to the Bologna Process, a decent amount of time was available for adjustments. The time after the first three mentioned colleagues' retirement coincided with the consolidation of the chosen path for Geometry at FBAUP. Even more, it was also the time for the next step, the search for new developments.

The discipline's academic and pedagogical profile, has always been under construction, by being shared and by receiving the contribution of the peers when presented and discussed in some scientific meetings since then:

- *II Encontro Internacional sobre Educação Artística*, 2EI_EA (II International Meeting on Arts Education, 2EI_EA), April 2012;

- *III Workshop Anual de Inovação e Partilha Pedagógica da UPorto* (III Annual Workshop on Innovation and Pedagogical Sharing of the UPorto), January 2015;

- *Jornadas Didáticas 2016*, da *Associação de Professores de Geometria e de Desenho* (Didactics Conference Days, 2016, of the Portuguese Teachers Association for Geometry and Drawing), November 2016.

Following the principle of a permanent search for continuous improvement, we now bring to this International Encounter our path, our contribution to a common growth.

Context

Geometry, Drawing, Printmaking and Arts Education are the four fields of knowledge cohesively brought together as FBAUP's Drawing Department.

Until now, the Geometry area provided Fine Arts and Communication Design undergraduate students with a subject designated as "Geometry". "Geometry" is a mandatory subject for the first year of undergraduate studies. It occurs during one semester as a set of 14 classes of 3 hours each. Nevertheless, 3 hours of complementary autonomous work must be considered and added as part of the subject's global timetable.

Fortunately, the great majority of our students acquire in their Secondary Education and further *curriculum* some basic knowledge in the discipline of "Descriptive Geometry". For that reason, we certainly benefit from working with that already built base. The two years with "Descriptive Geometry" lead the students through an atomistic approach; "Descriptive Geometry" supports the acquisition of knowledge, from the simpler and isolated case to the much more complex cases. It works by accumulating knowledge by layers, assuming an abstract and theoretical overview of a fragmented reality. In fact, it can even include every form and space, but only as a concept. In doing so, it loses the connectors to the experience of the senses, and sets a gap with the process by which the individual person constructs knowledge and competences. Furthermore, the approach to the problems does not make an effort to integrate different scales of analysis and synthesis between the whole and the parts.

Arriving at the first year of their undergraduate studies, it has been determined to provide the students with knowledge, and to develop the capabilities, necessary to be able to see, and to see through, and with, Drawing . Consequently, Geometry at FBAUP

has been structured to participate in that assignment, making use of its own field of knowledge.

We believe that it is important to learn to see, to learn when to see, what to see, from where to see and how to see. To do so, it is necessary to establish a strategy. Thus, Drawing is also *cosa mentale*.

To draw is to solve a problem and for that you define a problem solving strategy. The Drawing Department offers two models aimed at fulfilling that task, and they are models because they are meant to draw the reality, and not to be the reality. From Drawing the student receives a perceptive and expressive model. And Geometry gives the students a scientific model for understanding space, form and light.

To learn how to draw tangible things and spaces is to learn to coordinate all the several models whereby one can analyse and synthetize real spaces and forms, in a continuous depuration of knowledge.

Geometrical Model

Geometry teaches the Drawing *Grammar* to solve space, form and light; Geometry is the *scaffolding* to Drawing, keeping Lino Cabezas's (1995) expression close to mind. Here at FBAUP three programmatic and methodological pillars are used by Geometry to achieve its goals. In the first place, and following Alberto Carneiro, we highlight the entire body as the entity that draws. As it moves, installs, selects, includes or excludes, sees and draws, the body is drawing. Secondly, from Mário Bismarck we learned to strengthen "the eulogy of error" as working method, as an honest precaution, as a careful plan to achieve knowledge. That reinforcement connects directly with Gaspard Monge, who emphasised determination for the need of *épures*. The drawing process of depuration is synonymous of a pursuit for an increasing intelligibility. Last but not least, Geometry at FBAUP follows a holistic approach to problems. If it is clear that our students start drawing from the first class onwards, then it must be underlined that they always do it with complex and difficult problems related with the representation of space and form. Making use of this help, driven by the Drawing *Grammar*, the problems are decomposed to be partially analysed, with simultaneous coordination of the various scales involved. Instead of an atomistic teaching adding the fragments, we propose holistic and multiscale tactics – from space and volume to surface, line and, lastly, the point.

Implementation

The curricular subject of Geometry has fixed classes of 3 hours *per* week and 3 hours more for students' autonomous complementary work. Classes have 1 hour for lecturing and theoretical debate, after the students have previously approached the study materials at home. They can study at the library or from a selection of texts uploaded on the Moodle platform. The remaining two hours are used for problem solving, *i.e.*, to draw.

It is important to mention that students select two spaces in order to develop a learning process, driven by Drawing and Geometry: a complex problem and a large scale. Students must choose one of their homes' uses compartments to be discovered in the class. For their complementary work, the students must select one public space of the city. This second space will be the core of each student's project of representation to be developed individually and autonomously. The project will be progressing while the syllabus is ongoing.

There are two main structural lines organizing the discipline's contents. On the one hand, we have the inevitable physical embodiment of the space, on the other hand, the construction of the geometric models for drawing.

Since the beginning, the observer's position in space determines the system of representation to be known. From that decision the Construction of the Perspective and the Construction of the Axonometries start to be learned under a historical and contextualized view. On Linear Perspective, we teach the construction that emulates vision – *Costruzione legittima*, followed by the constructions that create virtual realities in order to put the effect into action – *Costruzione abbreviata e Costruzione con i punti di distanza*. And, lastly, we teach the construction which works from understanding the synthetic features of the forms, their morphology and their geometry – *Costruzione con i punti di concorso*. Regarding the Axonometries, we focus on the origins of their usefulness and of their aims. We use the orthogonal ones to draw objects, and the obliques for spaces.

A second way of integrating the mentioned structural lines is based on the homological relation between reality and its representation, and even between two different representations of the same object. The Desargues Theorem is at the root of graphic representation.

There is a third way of integrating the two lines previously referred to and it deals with the relation between the observed space and the paper where one draws. Framing and scaling are the major topics of that relation, which determine several of the posterior drawing decisions. The relation defines the limits of the constructions, considering the phenomenon of haptic perception. To that end, Leonardo's Paradox, regarding Linear Perspective, and the Pohlke Theorem, in the case of the oblique axonometries, are explored.

While acquiring knowledge and skills in the class, the student has the opportunity to reinforce them, during his/her autonomous work related to his/her project of representation. Thus, the cycle closes. Provided with autonomy, the student will have to draw, s/he will have to solve a problem and must define a problem-solving strategy. By that time, s/he should be able to learn to see, to learn when to see, what to see, from where to see and how to see. At last, the first-year student is gaining the awareness that drawing is also *cosa mentale*.

Future initiatives

Aiming at expanding Geometry's contribution to the Fine Arts, two new curricular subjects will be available for graduate students next year, hopefully boosting future lines of research.

The Interdisciplinary Subject "Territory Representations, its Drawings and Images" intends to be a crucible for exploration of transversal pedagogical-scientific practices, driven by the Drawing Department, the Geography Department and the Civil Engineering Department of the University of Porto. It will be opened to all graduate students. Nevertheless, the Interdisciplinary Subject's main foundations on Arts and Humanities will have to be evidently reflected in the knowledge to be attained.

In its transverse graphic dimension, Geometry will base some of the relationships among Drawing, Topography and Cartography. Project practice will be the chosen pedagogical and didactic method. The determination is to produce an integrating result from Art, Science and Technique bringing up creative innovations. This way, the students must develop a project of representation and graphic expression of a territory, including the contributions of the invited speakers, who will address us on their perspective about territory.

The second new curricular subject is “Interdisciplinary Approaches to Geometry”, a partnership between the Drawing Department and the Mathematics Department of the University of Porto. Although it was planned to serve students from Art Education, it is also open to teachers, trainers and other interested professionals.

It will be oriented towards research on education focusing on trying to identify and explore the common approaches that either Drawing or Mathematics can conduct to solve a problem. Geometry is the common ground that we believe is prolific to find and explore those partnerships.

Research practices will be the adopted methodology base, stimulating active pedagogies and enabling the follow up of the defined training process. Under that methodology, students must formalize research proposals on possible integrated approaches to Geometry and to establish communication strategies to assure its transmission and educational application.

- BISMARCK, Mário (2010), *Pentimento, ou fazer e feito, ou o desenho "abs-ceno", ou, talvez, o elogio do erro: sumário pormenorizado da lição*. FBAUP: Porto.
- CABEZAS, Lino (1995), “El andamiaje de la representación”, *in* MOLINA, J.J.G. (coord), *Las Lecciones des Dibujo*. Cátedra: Madrid, pp. 217-339.
- CABEZAS, Lino Gelabert e ORTEGA, Luis F (2001), *Análisis gráfico y representación geométrica*. Editions Universitat de Barcelona: Barcelona.
- CARNEIRO, Alberto (1995), *Campo Sujeito e Representação no Ensino e na Prática do Desenho/Projecto*. FAUP Publicações: Porto.
- COMAR, Philippe (1992), *La perspective en jeu: les dessous de l'image*. Gallimard: Paris.
- KEMP, Martin (1990), *The science of art: optical themes in Western art from Brunelleschi to Seurat*. Yale University Press: New Haven.
- PESSEGUEIRO, Abreu (1996), “Dois exemplos para a iniciação à perspectiva”, *in* Boletim da APROGED, nº 1, pp. 15-17. APROGED: Porto.
- VIEIRA, Joaquim (2007), “O desenho da Geometria é a geometria do Desenho”, *in* Boletim da APROGED, nº 26, março de 2007, pp. 15-21. APROGED: Porto.
- WRIGHT, Lawrence (1983), *Perspective in Perspective*. Routledge & Kegan Paul: London
- XAVIER, João Pedro (1997), *Perspectiva, perspectiva acelerada e contraperspectiva*. FAUP Publicações: Porto.