

# GeoDesign

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## ABSTRACT

This paper presents the design, realization and evaluation of a Map Design course conducted using an open source GIS (QGIS) to students of the bachelor in Visual Communication. The specific challenge was integrating teachers from Social Science and Humanities (SSH) and Science, Technology, Engineering and Mathematics (STEM) disciplines and integrate rigorous cartographic methodologies for map production with visual aspects. It was successfully addressed with an hybridization approach that discuss themes from the two disciplines point of view and a goal-oriented course organization that produce as an output real map products. The general evaluation of this new course by students and teachers was positive. Despite the main criticism was related to the complexity of the used tools with respect to the course duration, the quality of the outputs demonstrated a very good capacity of students in learning and fusing of STEM and SSH concepts.

## INTRODUCTION

According to Encyclopaedia Britannica (2017) cartography is defined as "the art and science of graphically representing a geographical area, usually on a flat surface such as a map or chart. It may involve the superimposition of political, cultural, or other non geographical divisions onto the representation of a geographical area." It is clear from this definition that the process of map making to communicate information is an overlapping of two different sectors: the art component that is the visual communication from the so called *Social Science and Humanities* (SSH) disciplines and the science part that is the geomatics from the so called *Science, Technology, Engineering and Mathematics* (STEM). This is nothing new, in fact long time ago Board (1967) already individuated a communication paradigm for maps that included the analysis by the *Map Readers* as an essential part in the process of the development of a satisfactory product. The fusion of well-defined cartographic standards and technology with creativity and science of communication is therefore an essential well-known aspect for an excellent map composition. Nevertheless, this collaboration of disciplines was only unilaterally addressed at mapping courses at SUPSI, by engineers that "explored" the graphical aspects and by "designers" that explored the cartographic rules. For the first time, in SUPSI a real collaboration of the two disciplines taking advantage of the competences of teachers of the *Visual Communication* and *Civil Engineer* bachelor SUPSI courses was experimented in February 2018. The students of *Visual Communication* had the opportunity to participate in a five-days full-time course on *Map Design* with specialists from the two different fields. This educational experiment intended to investigate the aptitude and predisposition of SSH students in assimilating STEM approaches and rules in their creation process.

## METHODOLOGY

In February 2018, SUPSI held a five-days full-time *Map Design* course for the third-year students of the Bachelor SUPSI in Visual Communication, in Lugano. The general scope was to provide students with

the foundational knowledge of visual-information design and technological tools to develop maps with communication purposes and scientific rigor.

### Crossing open geospatial technology and information design in education

The *Map Design* course was an attempt (the first in SUPSI) to use open geospatial technology in a trans-disciplinary setting. During the preparation of the course, several questions arose. Among these, there were: how to frame the course in the program of the school? How to present the course to students? What is the right approach to balance technical and design components? How to evaluate the final results? The following paragraphs present the strategy followed in answering those questions.

The course has been included in the bachelor program interlinking it with the course of *Graphic and Brand* in which the student works on the set-up of graphic and typographic forms and elements in relation to the visual field to organize the space of the composition. The idea is to teach students how to produce a map in *Map Design* course and then how to organize the back of the map with contents and information in an integrated concept in the following *Graphic and Brand* course. In line with Open Geoscience principles the main tool selected for the course practicals is the open source software QGIS (QGIS Development Team, 2018), which is a Geographical Information System (GIS) that permits to analyze and edit spatial information and to compose and export graphical maps.

To present the course to students and make it appealing it has been conceived as a laboratory where the final goal is the realization of a product. To this end, a collaboration with Ticino Turismo (TT), that is the local cantonal tourism agency, has been set. TT was identified as the client that is looking for a renewal of the main touristic map leaflet to present the Ticino territory and its attractions. A creative brief was prepared to present the product and guide the work.

To balance visual and technical aspects an hybridization approach was pursued: scientific methods are addresses through the lens of design and design became a means to express scientific methods. As a result, different topics are presented from both geomatics and graphical point of view so that the similarities and differences of the disciplinary approaches can be understood and opportunely weighted. For example, for geomatics the choice of map projection is driven by the control of errors due to deformations in the representation of the space while for the designer it is a way for emphasizing different aspects of data content. Similarly, the selected scale of representation for geomatics is of primary importance for the determination of the map accuracy, therefore used data precision should be compatible with the selected scale; conversely for designer, the scale is of primary importance for the hierarchical organization of the elements that visually fit within a physical space dimension.

A presentation of final work with the implemented concepts and strategy will be evaluated to grade students: innovation, visual aspect, geographical rigor, communication impact and fit of client requirements are being adopted as main evaluation criteria.

### Course structure and content

The course was structured in strategical, theoretical, methodological and practical parts executed by groups of 4 students. The program is structured in four different parts described in the next paragraphs.

In the first hour the **strategical part** was conducted presenting the creative project brief to introduce the indications of the expected product that was: the printed map dimensions are 50x70 cm; the target are foreign tourists that want to understand Ticino geography and find major attractions and transports; the client want to present Ticino as a varied territory offering tourists a multitude of attractions and activities to satisfy their needs; the map must not be too stylized and must represent the territory morphology; the map will be distributed by touristic operators and info points. To close the course introduction the client strategy for the next four years was presented to better frame the client strategic context.

The **theoretical part** took place on the first-day-morning. The introduction consisted of a lesson of the historical design and usage of the map, from the abstract maps made in the Middle Age to the recent implementation of maps for urban planning with reference to literature works (Anceschi, 1992; Bertin, 1983; Ferrauto, 2012; Weber, 2017). Initially the designer presented how the communication with maps has evolved with time following the available media and historical toughs, later students were exposed with technicalities of geographical reference systems, projections, scales, accuracy, generalization and map elements. In this part the SSH component had the priority to gradually expose students to the STEM aspects.

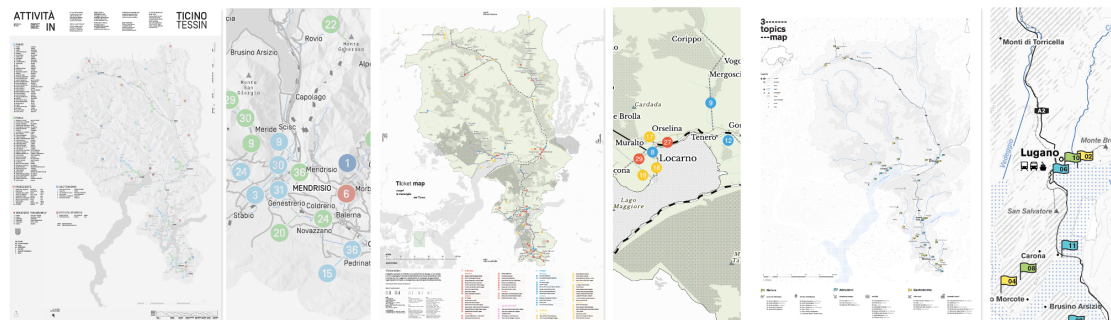
The **methodological part** was conducted on the first-day-afternoon and the second-day-morning by introducing QGIS open source software. Students executed a guided tutorial derived from (Hale, R. and

Kraemer, C., 2016) that permitted to take confidence with the software and offered the opportunity to introduce GIS concepts (e.g.: layer types, navigation, styling, semantic and spatial analyses, editing and re-projection). After this introduction, students were exposed to QGIS cartographic design tools in terms of spatial representations options and particularly to layer styling and labeling. The *Map Design* book (Graser and Peterson, 2016) offered an excellent plethora of good graphical examples to show how GIS technical tools can be creatively used to produce great visual results.

The **practical part** was executed from the second-day-afternoon to the fifth-day-morning. Students designed and realized the maps with the support of the teachers by using Open Data only. Several vector layers from Open Street Maps (OSM Contributors, 2018) and a digital terrain model from the HeliDEM project (Biagi et al., 2011) was provided to students to realize the final product. On the third-day-afternoon, students presented their concepts and visual design. On the last day, students presented the final product and an overview of the applied design and technical processes. To pass the course, within one week after the course completion, students had to provide a working QGIS project with all required files to reproduce the presented map.

## DISCUSSIONS AND RESULTS

During the five-day course, students learned about GIS and developed a map to meet client expectations. The three groups realized three different maps illustrated in Figure 1 which are respectively named: "*Activities map*", "*Ticket map*" and "*3 topics map*".



**Figure 1.** Results of the Map Design course: from left to right "*Activities map*", "*Ticket map*" and "*3 topics map*"

Every map presents an ordered visual hierarchy of several layers that clearly communicate information in line with the project brief. The fonts and the colors used are highly readable. They were selected by considering visually impaired people. From a technical point of view, several GIS techniques have been used and geographical layers has been appropriately represented. Although, styling and labeling were the tasks that required most of the effort, students spent a sensible portion of time also in data manipulation. Query filters, field calculator and spatial selection were extensively used to arrange the spatial elements to be represented. Additionally, styling was in some cases arranged by using variables set in layers attributes, this was particularly used to scale fonts and to offset labels. Elevation models was also elaborated to extract contours and in one case further processed for smoothing using advanced tools.

The course was evaluated by students with a questionnaire that uses a rating scale from 1 to 4: 1 to indicate complete disagreement and 4 to indicate complete agreement with the prosed sentence. The general the appreciation of the course shows an average rate of 2.5 (with a standard deviation  $\sigma = 1$ ), the organization of the course received an average score of 2.7 ( $\sigma = 0.9$ ) and the training and knowledge transfer activities was evaluated 3.1 ( $\sigma = 0.8$ ). The most positive answers were related to the training activities with the highest rate for willingness of teachers in supporting and helping within and outside the course hours that received an evaluation of 3.8 ( $\sigma = 0.4$ ). The less appreciated aspect was related to the organization of the course and in particularly on the the fact that student previous knowledge/skills allow him to fully understand the course topics (rate 1.9 and  $\sigma = 0.9$ )

In consideration of feedback received during the course and the analyses of the student course evaluation questionnaire, the authors strongly believe that the course had an very positive impact on students. Although some adaptations are required, it is clear that while the course was in general

138 appreciated the points of criticism rose from a non familiarity with technical terminology and a STEM  
139 software. This is easily understandable from a student perspective, and especially if the duration of the  
140 course and the requested outputs are considered. Nevertheless, from a teacher perspective this is not a  
141 surprise, in fact, this is exactly the challenge that educators wanted the students to be exposed at. The  
142 good artistic and technical quality of final products demonstrated the capacity of the students to overpass  
143 those barriers despite their opposite feeling. Finally, it should be considered that the course dos not aim at  
144 providing high GIS expertise, but rather expose SSH students to STEM approaches and offer the basic  
145 tools to understand the opportunities that GIS may provide in map production with cartographic respects.  
146 While in the initial realization of the product students see the GIS as a complication with respect to already  
147 known graphical design software, in the following review phases the modification process was highly  
148 efficient thanks to the use of parameterization of styles. Additionally, the parametrization of the styles  
149 offers to the creative designer the opportunity to experiment the effectiveness of different aesthetic choices  
150 in the cartographic communication. One of the produced map has been selected by Ticino Turismo to be  
151 further elaborated, finalized and distributed to tourists.

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