THE PLANNING STUDIO EXPERIENCE

By: Jason Karian

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Chapter 1: Introduction to Planning Studio

At West Chester University, students have the incredible and unique opportunity to have the planning studio classes offered in the Geography and Planning department. These classes put students into the real world, with each different class dealing with unique projects and scenarios that enables students to collaborate with real world professionals. The products created in these classes are then implemented into the real world, be it accurately modeling and predicting future tree growth in an urban forestry model, or developing an economic center along different traffic corridors for a municipality. In this planning studio, students were tasked with collaborating and creating 3D models for the city of Malaga, Spain, to assist the city in their current urban renewal projects in the El Eijdo district as well as environmental and historical modeling of Castle Gibralfaro. The students are also creating a website for Malaga to use for displaying their upcoming and current projects, give opportunity to the community for inputting their opinions on the projects, and for the ability for professionals and citizens to download and upload their own data to the website for future analysis.

Chapter 2: The project site(s)

2.1: Malaga, Spain

Malaga is located in the Andalucía section of Spain and situated right on the coast of the Alboran Sea, part of the Mediterranean Sea. Madrid, the capital of Spain, is 260 miles away and is connected through a high speed rail system, taking 3 hours to reach the destination. Some other important and popular cities in Spain are Granada, which is close at 55 miles from the heart of Malaga, and Barcelona is on another coast, totaling 478 miles away. It's also located close to

Gibraltar, where a ferry can be used to travel to the coast of Africa. Located in the northern part of the boundary is the Montes de Malaga, part of the Parque Natural Montes de Malaga, a national park used for a slew of outdoor activities, including hiking and serene nature locations located in the mountain range. The climate of Malaga is part of the Mediterranean climate: usually hot and sunny summers and rainy, winters. During the winter, Malaga annually receives only 20.7 inches of rain. With an average temperature between 53ºF and 78°F during winter and summer months, respectively. Because of the city's location just off the coast, there is usually a cool breeze coming from the sea, keeping the temperature at comfortable for the residents. The sea also stays relatively cool throughout the year, averaging 65ºF temperature (World Climate Guide, 2019).

Malaga is quickly becoming a tourist destination, with 1.3 million tourist visiting the city in 2017, a 9% increase compared to 2016, making it the fastest growing tourist location in Spain (Dollimore, 2018). Because of Malaga's unique location and access to the Mediterranean Sea, the Montes de Malaga, as well as its relative closeness to other tourist destinations, they city has a lot to offer to their visitors. The downtown has a lot to offer too, thanks to the cities commitment to making Malaga a smart city. One of the features of the city is the completely walkable streets for residents and visitors with minimal vehicle traffic flowing through the downtown. Many shops line the main streets and alleyways, offering food services, trinkets, as well as countless other services for visitors and residents alike.
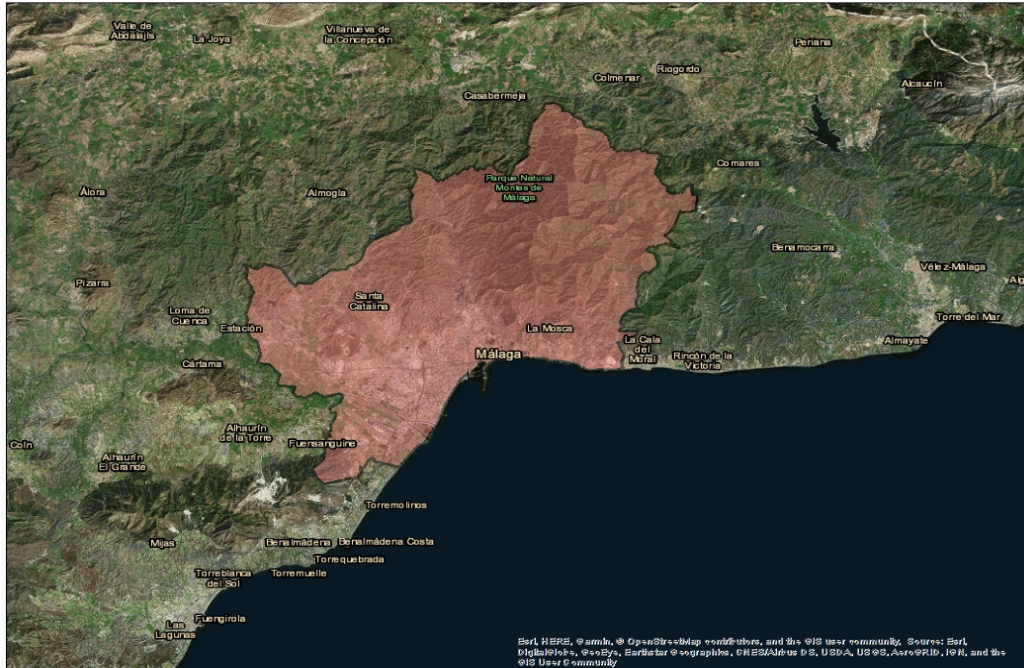
Figure 2.1. Malaga's boundary, on the southern coast of Spain.

2.2: El Ejido

El Ejido is one of the many historic districts in Malaga. Located near the geographic center of the city, El Ejido was important for the city in history because of its use as a meadow for the cattle that supplied the milk and meat for the city during its Muslim occupation 1000 years ago (Garrido, R. 2010). However, during the time of the Black Plague, the area was quarantined and used as a mass burial site for those who died from the plague. Today, its home to an important part of the community: the University of Malaga. Founded in 1972, the university is known for scientific development and innovation on the southern coast of Spain. However, this major part of the district is moving into the Teatinos district to join with the newer campus of the university that initially comprised the School of Medicine, the School of Humanities, and the School of Science (University of Malaga, 2019). Now, with the musical

school and Dance Theater still on the El Ejido campus, the community hopes to find a use that will fit in with the surrounding uses.

2.3: Castle Gibralfaro

Castle Gibralfaro, located on top of Monte Gibralfaro, is a major historical location that overlooks the mayor's office. Built in 929 AD during the Muslim occupation, it was built on top of a preexisting buildings and lighthouse. Later in the 14th century, the castle was enlarged, with Yusef 1, the Sultan of Granada, adding its famed double walls in case of a siege. When Christian monarchs sieged the city, it took three months for the occupying Muslims to surrender because of the location and how difficult it was to safely cross into the castle itself (Andalucía.com, 2019). Today, it's a very popular tourist attraction for all visitors of Andalucía, as it draws hundreds of guest a day. Tourist are allowed to explore the inside of the castle, housing the ramparts, beautiful natural features, and a breathtaking view of the city of Malaga. To get to the very top of the mountain, tourist are either driven up by bus or by their own personal vehicle up the mountain and dropped off in the parking lot, or take a scenic walk up the mountain with a paved path, offering a few stops to rest and take in the view of Malaga.

Chapter 3: GIS Methods

3.1: Introduction to Methods

This section focuses on the process of creating 3D models for the City of Malaga. This follows the process of collecting the online data from different sources, importing it into many different GIS programs, like ArcGIS Pro, CityEngine, and ArcGIS Online, then meeting and showing our preliminary data as well as discussing the future of our two study sites of El Eijdo and Castle Gibralfaro with the planners in Malaga, and finally creating a realistic representation

of both study sites in ArcGIS Pro and 3 different scenarios within CityEngine. With the completed models, we will be able to share them with the City of Malaga as well as the community to get instant feedback on the upcoming plans using ArcGIS Hub.

3.2: Data Collection

First, we had to collect data online in order to figure out what we can do in the surrounding area. The data was obtained online through different websites from Spain, and allocated onto ArcPro into a File Geodatabase. Since the projects required the download almost 100 different types of data, the data had be divided into separate groups, depending on what was being represented. The class decided on creating 12 different groups to separate the data into: Transportation, Recreation, Population, Cultural, Legislative, Environmental, Crime, Boundaries, Housing, Health, Services, and Employment. As the ArcGIS Pro team leader, I assigned of the ArcGIS Pro 6 group members two groups each of data to upload onto the web on ArcGIS Online (AGOL). To properly show the accurate location of the downloaded data, the ArcGIS Pro group had to change to projection of the coordinate system into the projection *ETRS 1989 ETRS – TM30*, because the data we received would only be shown in the said projection. We also found the data for building footprints of our two project sites in Malaga: the El Eijdo district which is temporarily housing part of the University of Malaga, and Castle Gibralfaro which is a major historical attraction in Malaga. In CityEngine, the models were downloaded in the *Get Map Data* option, and downloaded from the OpenStreetMap (OSM) world dataset. These features were found in 2D, but exported as multipatch features from CityEngine to not only extrude them out as 3D models, but to texture each individual side of the building, called the building face, as well. The height values associated with extruding the buildings to their correct

height were done by adding a new field in called *Height(M)*, and ran the field calculator command on this attribute. In field calculator, you can create a mathematical equation to add different attributes into a single attribute to represent the accumulation of data. In order for *Height(M)* to accurately show the building height, there were two things needed: OSM's building story data *(bldng__lvl* in the attribute table*),* and the standard building story for OSM. In the OSM data, they represent each individual story as 3.7 meters; just above 12 feet. With this data, I was able to create a code that would extrude the 2D building footprints into a 3D model that has accurate building heights of the El Eijdo and Castle Gibralfaro project sites. The code was written as followed:

$$Height(M) = !bldng\_\_lvl! * 3.7$$

Figure 3.1. 3D Model of the El Eijdo Area. The University of Malaga is highlighted in blue.

3.3: Uploading the data online

Second, the data had to be projected online. In order to put our data online, the groups had to reproject the data from the *ETRS 1989 ETRS – TM30* projection into ESRI's standard web projection for online data: *WGS 1984 Web Mercator Auxiliary Sphere*. With this projection, we were able to upload the 12 different data groups into AGOL. To have the data separated into their different groups, the Transportation group, for example, was given a unique tag to classify

the data as "transportation". Once online, we created online web maps with the grouped data in order to share with our ArcGIS Hub; a website that allows us to collaborate with professionals and the community on some of the ongoing projects in the El Eijdo and Castle Gibralfaro area, as well as allow access to our data for different research projects in the future for the aforementioned groups. The maps were created and published onto the Hub, as well as the individual data points, lines, and polygons.
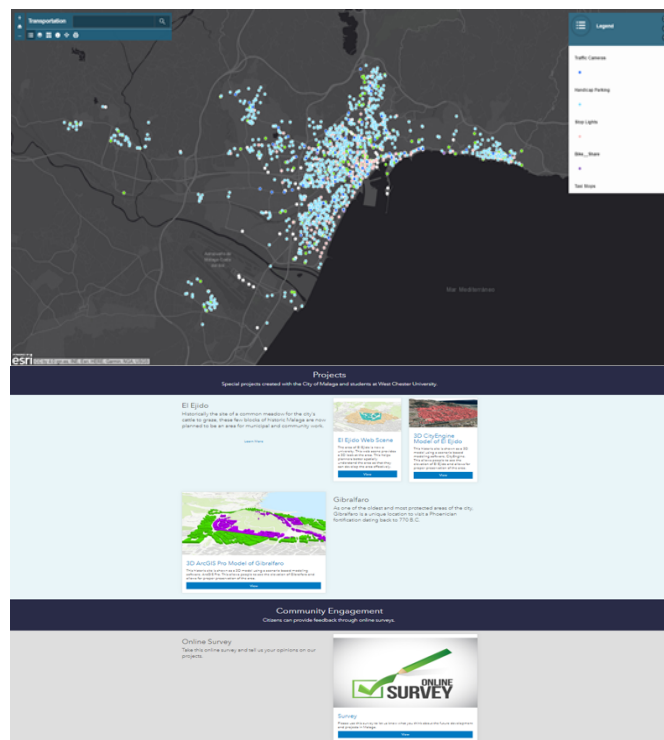

(Above) Figure 3.2.1. Online Transportation Map for the City of Malaga. Includes Handicap parking spots and bike share locations.
(Below) Figure 3.2.1. Part of the open data Hub for Malaga. Includes a survey for the citizens of Malaga.

3.4: Meeting with Malaga

The third part of this process was meeting with the city of Malaga. Even though GIS is a powerful way to show and analyze data, the most important part of any GIS project is sitting down with your client in order to figure out exactly what deliverables they want. We traveled to Malaga in order to meet with the planning officials of Malaga to discuss the future plans they

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have with the two sites. During the meeting, we discussed what ideas we had for the two sites as well as what their plans were. We found out that their plans for Gibralfaro was to keep on preserving the castle and their walls, because of the historical and environmental significance the castle and mountain brings to the city of Malaga, as well as Mount Gibralfaro. For El Eijdo, part of their plan was to keep the current infrastructure of the area to save time and money compared to completely demolishing and renovating the project site. They also showed us many different maps with data they collected, like the green space areas, solar panel locations, and pedestrian streets / sidewalks.
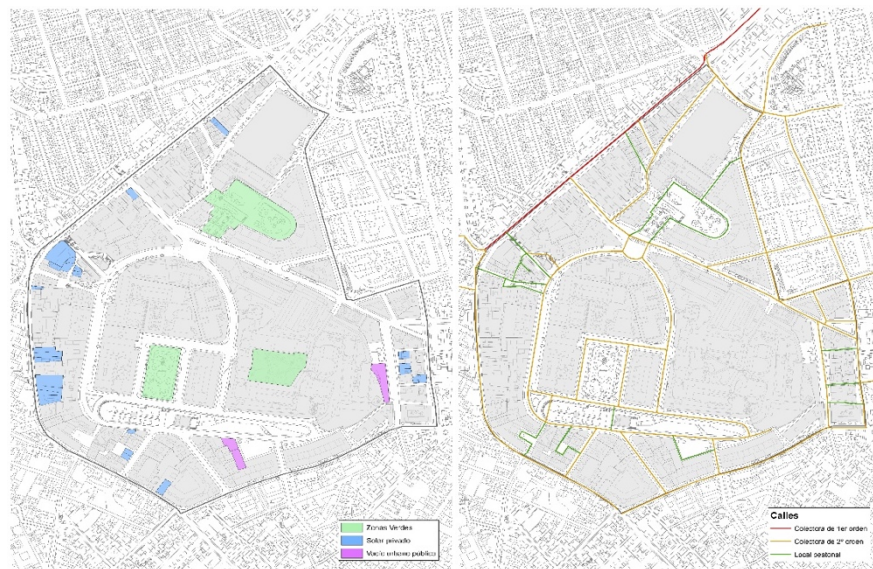
(Left) Figure 3.3.1. Green Space, Solar Panels, and Public Urban Space in the El Eijdo district.
(Right) Figure 3.3.2. Pedestrian walkways in the El Eijdo district.

The current plan they want to do is to create a residential area for the citizens of El Eijdo, while also offering commercial business in some of the existing buildings as well. With features like the green space, connectivity to the public transportation system, and even the possibility to power the buildings with solar power, the planners wanted to create an area that promotes a healthy lifestyle for all residents residing in the El Eijdo district. The planners were focused on the urban renewal of the area, even though the University has been established around 47 years

ago. By reinventing the universities buildings into different uses, the area will not be changed, preserving most of the community character, rather than inputting a use that conflicts with the community. From there, we went out to the El Eijdo project site to take pictures of the existing buildings in order to create our 3D models. With the pictures taken, we can import them into ArcGIS Pro and use the multipatch texture tool to physically texture the models with the building pictures. We also traveled to the Gibralfaro historic site in order to collect texture pictures as well as explore the project to site to get the extent of some of the plans for the future of the mountain and castle.

3.5: Creating the 3D models

Finally, after returning from Malaga, the ArcPro group was assigned to create the 3D model of both the El Eijdo district as well as the historic Gibralfaro area. In ArcGIS Pro, the El Eijdo area was split between 6 different sections for texturing because this data was vital in the creation of our ArcGIS Hub, as well as the models will be used in one of the three CityEngine Planning Scenarios. Each of the 6 sections was given its own ArcGIS Pro Project, because ArcGIS Pro doesn't allow users to make multiple edits from multiple computers in one project. The textures pictures taken from the El Eijdo and Gibralfaro sites were then applied to their models, creating a realistic 3D representation of our study areas. After the 3D models were made in ArcGIS Pro, they were exported as .DAE files into CityEngine for scenario based modeling. Scenario 1, shows the current use and models of the buildings which are shown today. The second scenario, Scenario 2, shows the uses and building type based of the Malaga plan, with the residential uses colored in red and the commercial uses colored in green. The final scenario, scenario 3, consist of the same models as in scenario's 1 and 2, however this scenario is based off of our idea of what to put there from data pulled from ArcGIS Business Analyst. With the

surrounding businesses known, we were able to model what we think would help reinvigorate

the surrounding community. Again, we used red as residential uses, green as commercial uses,

however the other color, blue, is an institutional use, for example use as a museum or learning

center.
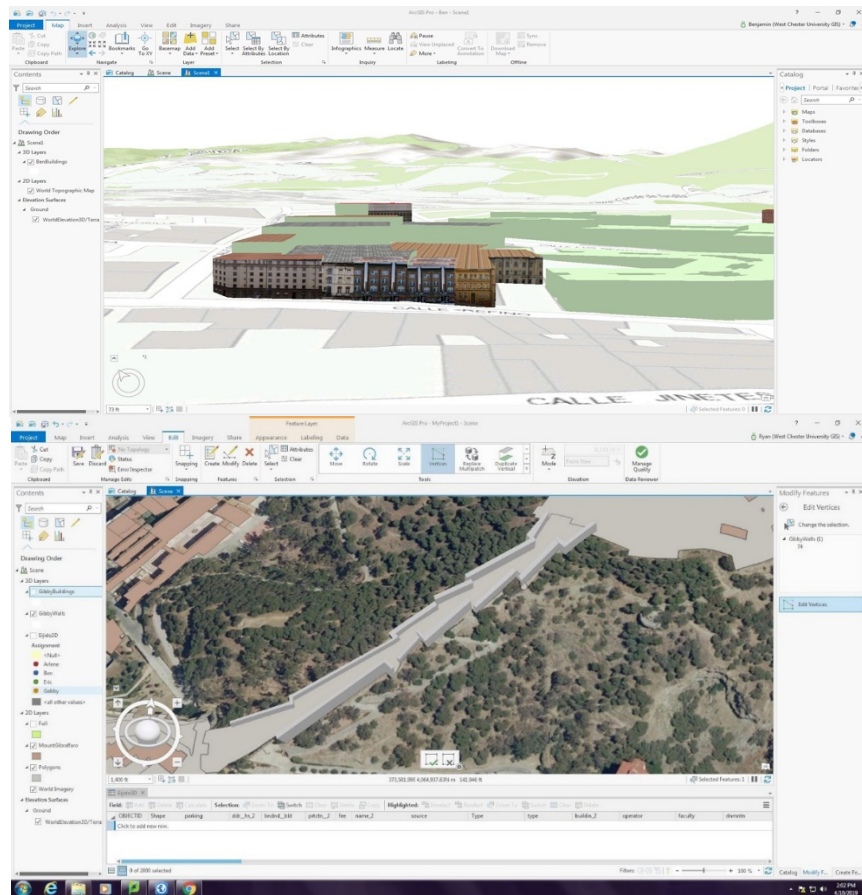
(Above) Figure 3.4.1. El Ejido district buildings being textured, to accurately represent the building and use that is present.
(Below) Figure 3.4.2. 3D Model of Castle Gibarlfaro's wall.

Chapter 4: Products

4.1: El Ejido and Gibralfaro Products

In El Eijdo, the students created a 3D model that is not only shareable to the planners, but

also for the community as a whole. This model is textured with some of the pictures taken from

the project site, as well as building façade textures from online. When the students finished their separate sections, the models were merged into one complete project. From there, two things happened to the model. First, it was uploaded online to AGOL for our open data hub for the community and planners to use and download for their own projects and analysis. Second, the CityEngine team imported the models to add into three different scenarios. The team is still currently finishing up the final product, however we know for scenario 2 the students are creating a smart, urban downtown area for the district that uses the existing infrastructure as residential uses.

Figure 4.1. El Ejido district textured with building facades.

The Castle Gibralfaro model will be used to mainly show the extent of the walls, as well as leaving the option open for analysis of the structure by the planners. Because of the walls immense file size, the students are unable to upload the models onto AGOL through ArcGIS Pro, however the students were successful in uploading the model through CityEngine. With this, anyone can download that data and input it into any of their projects. The students hope that this model will be used in environmental and historical preservation purposes for years to come.

Figure 4.2. Castle Gibralfaro walls with the allocated textures.

4.2: The Malaga Data Hub

As of now, the Hub is being utilized to create a platform for the city of Malaga to use to engage with their stakeholders and citizens. Displayed on the front page is our 3D models, including our 3D web scene of El Ejido. Further below the website has the data separated into the 12 categories, for ease of finding specific data. The website also host the sustainable development goals of the United Nations (UN), a goal that Malaga is focusing on as they plan their smart city. Because of these goals by the UN, the students wanted to follow along with the creation of a UN's smart city for the future of the citizens. The website also features transportation maps and recreation areas, for citizens to find out where a bus stop may be, or even find the nearest volleyball court.

Figure 4.3. U.N. Sustainability Goals for future development across Europe.

Chapter 5: Conclusion

In the end, we created projects and models that are shareable and useable to not only future students and researchers during the planning studio class, but something for professionals across the world can use in the future. The class also taught invaluable leadership skills for the team leaders, the ability to problem solve in real life scenarios, as well as learn to network with clients from the United States or abroad. The 3D models created by the students will be publically shared with the planners and community to help visualize future development that will impact the city. The data hub created will be the final product shared with the planners of Malaga. With this collaboration ending, we are hoping to keep the connections we made and discussions we had to continue for future projects and partnership.

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