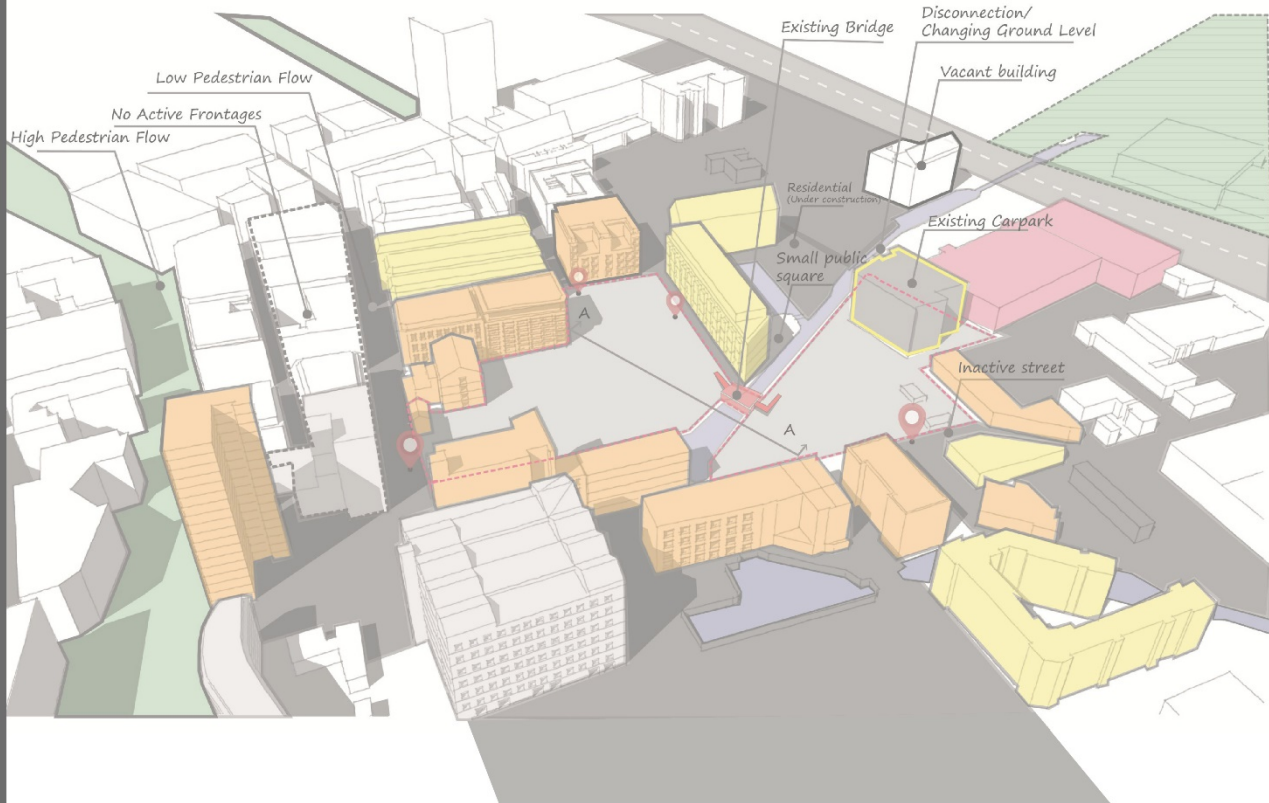




MUD-Lab Toolkit Thinking 3D

This handout aims to make you aware about the importance of thinking 3D in the design process. It attempts to develop your perception of the third dimension by giving some useful comparisons between 2D layouts and their 3D spaces in addition to a useful exercise about how to think 3D in the design process.

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To reference this MUD-Lab Toolkit please use the following:

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www.seed.manchester.ac.uk/mudlab

1-INTRODUCTION

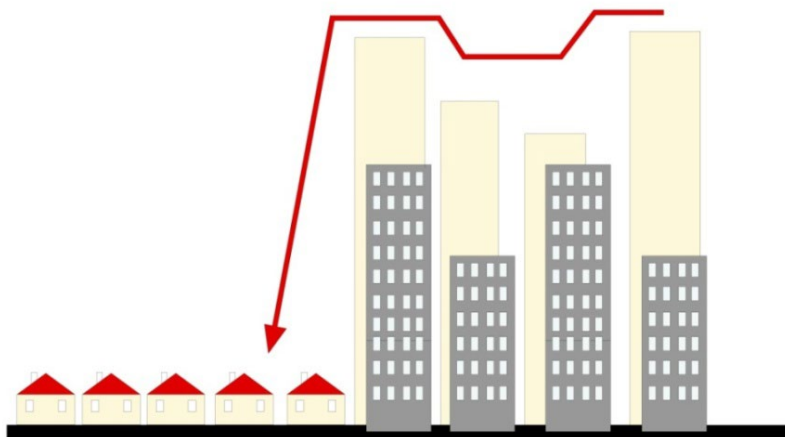
Design is unfortunately not a straightforward process. You need to combine between a considerable amount of data from your analysis stage on the one hand, and reasonable functional and aesthetic aspects on the other hand to build a robust scheme. The third dimension is an essential part in that process and it should not be left as simply a direct result of the 2D layout. You need to think about the third dimension as the actual space that people will experience. This handout focuses on the physical aspects of the third dimension. It will discuss briefly the following points:

- Why to think 3D
- How to think 3D;
- How to visualize the third dimension;
- 3D in the design process
- A practical example

2-WHY TO THINK 3D:

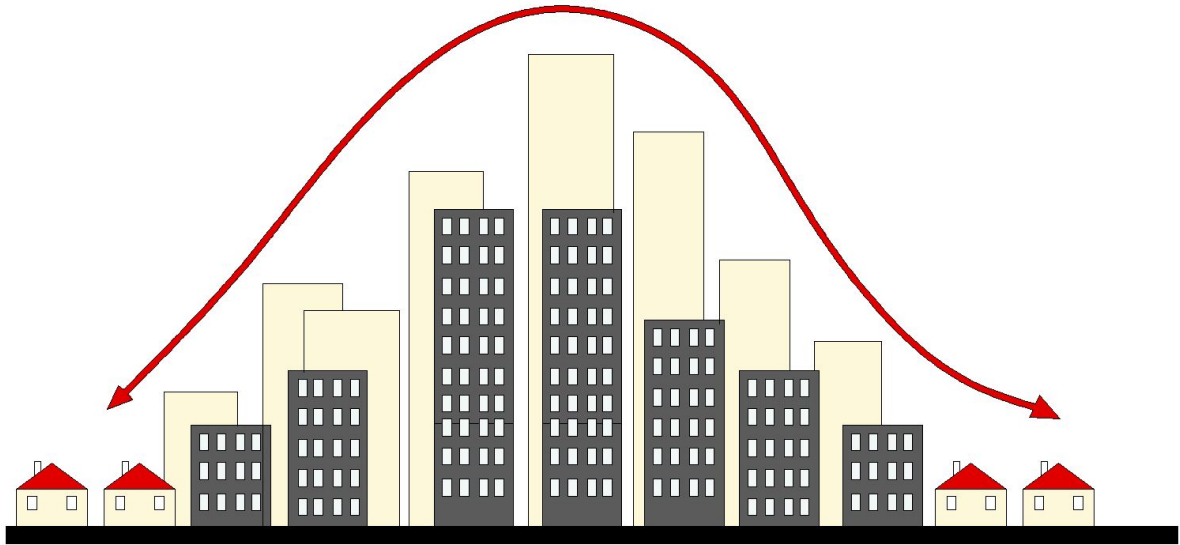
The simple answer is that the third dimension is the actual space you are creating. The 2D layout serves as an essential step to assure design functionality, but it does not work alone. The following points should raise your awareness about the importance of a thoughtful 3D design:

1-Building heights affect the whole journey within the urban space. Heights should be properly designed to produce **harmonic spaces** without the sudden uncomfortable transition from extremely high to very low buildings.



Sudden transition in building heights creates unbalanced space

On the other hand, a **gradual change** in building heights may provide more comfortable spaces. It also gives a more balanced skyline.



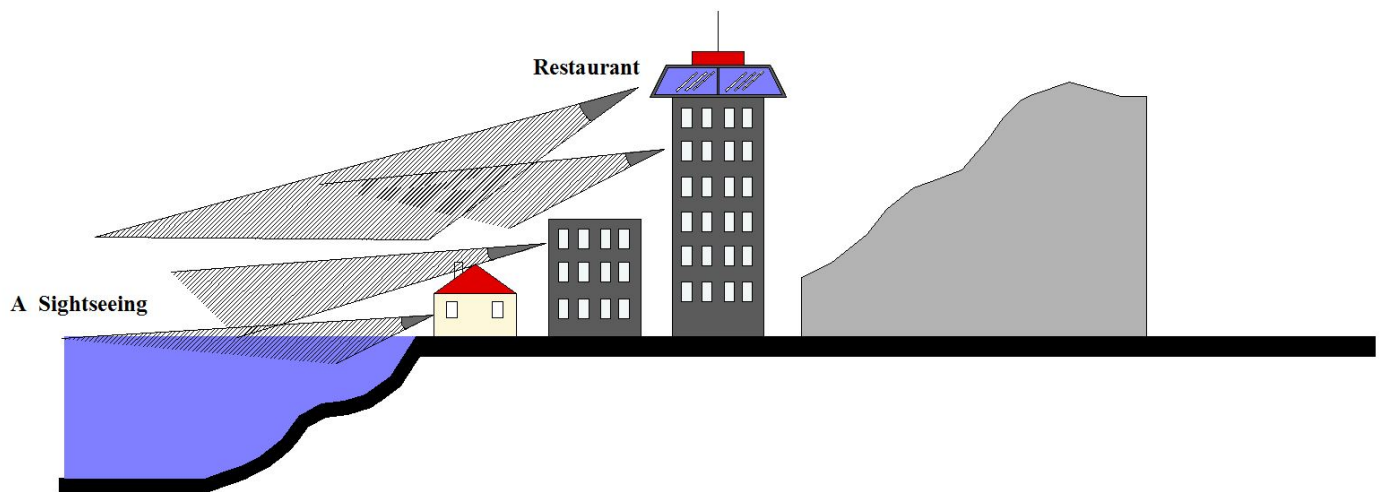
A gradual change in building heights creates a more balanced space

2- **High buildings** may represent **uncomfortable objects** for pedestrians and the surrounding environment, so they should be designed carefully. A stepped design can represent a solution. Other solutions include surrounding towers with tall trees.



Design solutions for high buildings for a more pedestrian-friendly space

3-Surveillance is an extremely important element in urban design. Surveillance is important to create safe places and to provide a good view for people. This adds value to your design. The arrangement of buildings in the figure below allows more surveillance and a good view to the sightseeing. A restaurant was suggested at the top of the tower for a panoramic view.

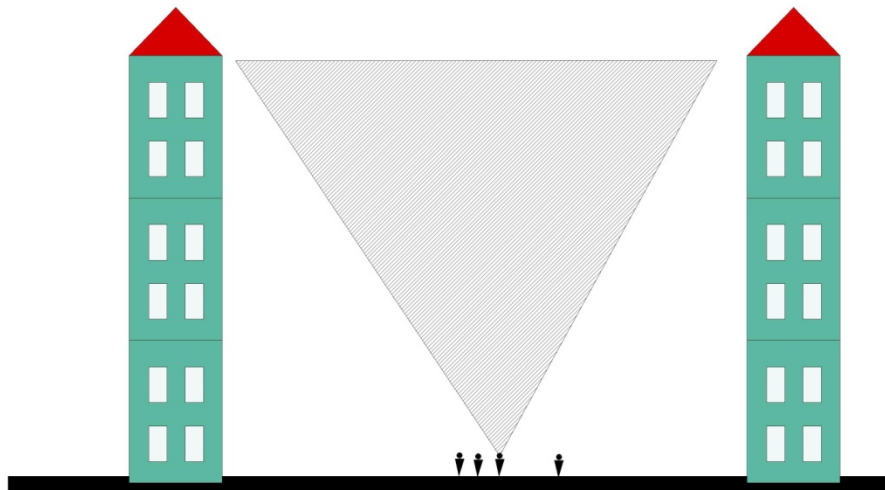
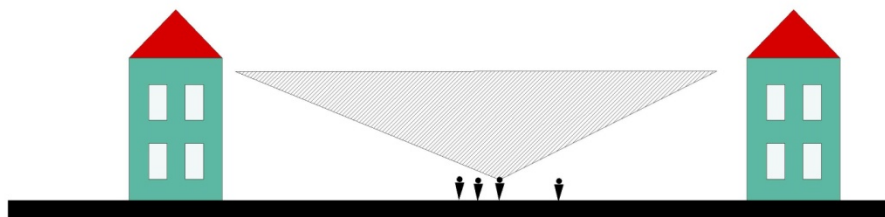
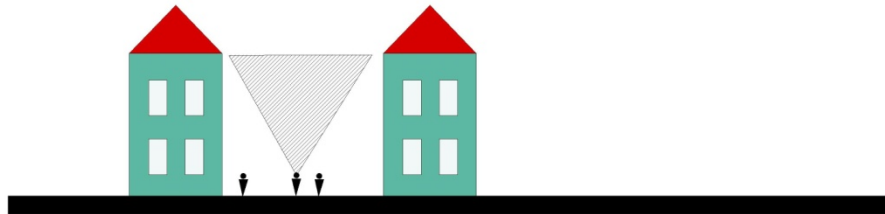


Designing building heights with surveillance in mind

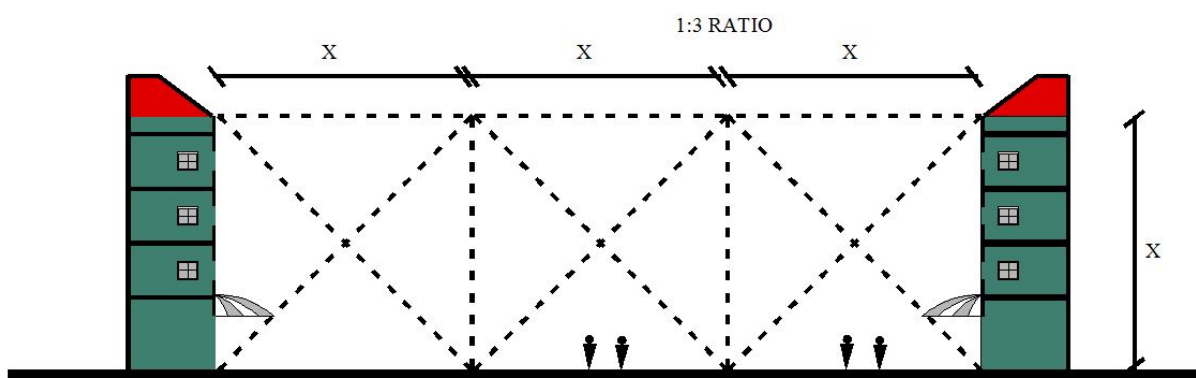
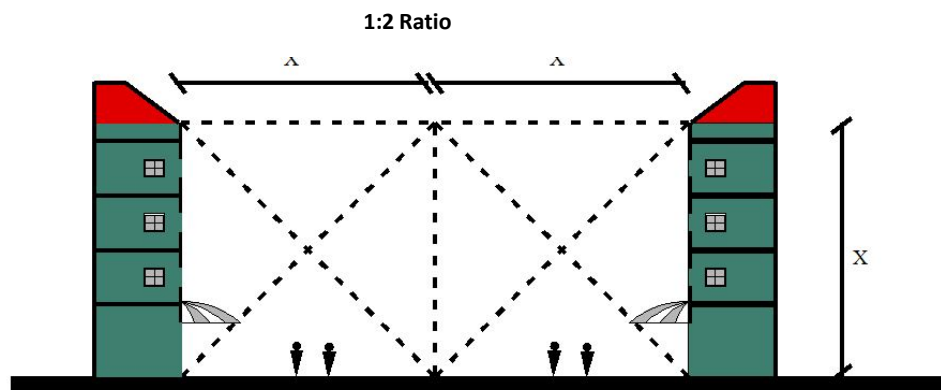
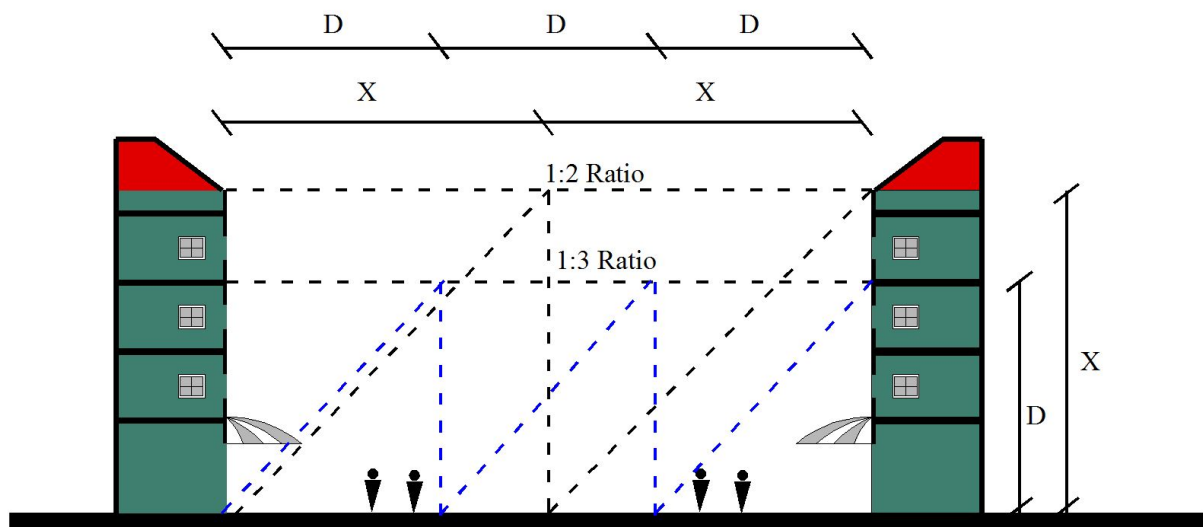
4- Enclosure creates a scale that is comfortable to people and encourage walking. Height to width ratio determines the level of enclosure in a space. Have a look at the figure below and note how different building heights and widths create enclosure.

Pedestrians first perceive enclosure at 1:4 ratio of building height to path width. This is usually in the countryside areas in which population density is low. In denser areas ratios are between 1:3 and 1:2. **Both 1:3 and 1:2 ratios create an appropriate sense of enclosure.**

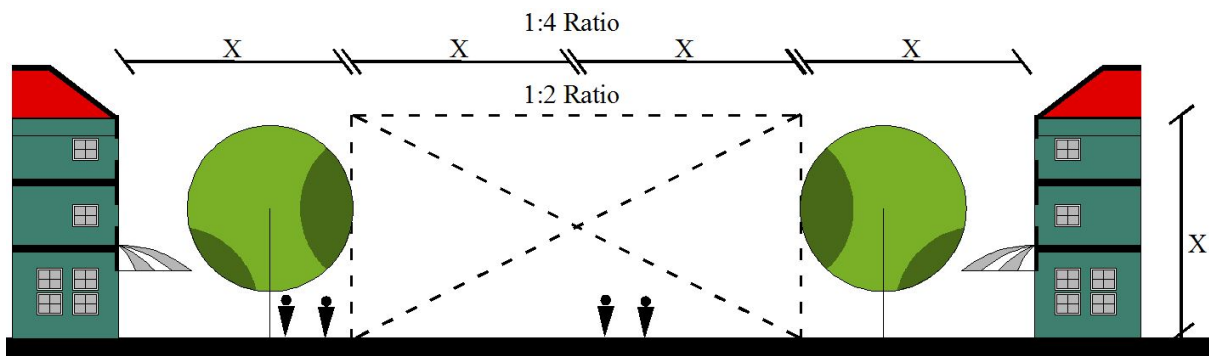
In some cases where buildings are already there, you can add street trees to create a similar sense of enclosure. The figure below shows a space with a 1:4 ratio which gives a weak sense of enclosure. A 1:2 ratio is achieved after adding trees.



Different ratios of height to width creates different sense of enclosure

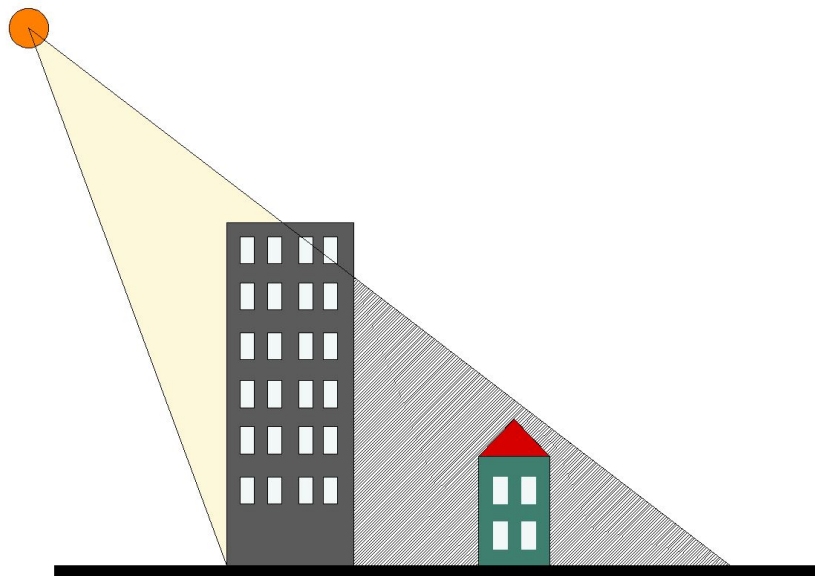


1:2 and 1:3 ratios give a good sense of enclosure



Trees may represent a design solution to create enclosure. In this example a 1:4 ratio was changed to 1:2 ratio using street trees.

5-Building heights are important when it comes to negative/positive **shadows**. Tall buildings may block sunlight from reaching shorter buildings surrounding. This might be useful in areas with extremely hot weather where architecture and urban design work together to decrease buildings temperature. However, this should be considered carefully in areas where sunlight is an advantage and buildings should be arranged in a way that guarantees as much sunshine as possible.



High buildings may block sunlight and affect the surrounding areas

6-An **un-thoughtful 3D** design can negatively affect your **thoughtful 2D** layout. Have a look at the 2D layout below and compare it to its actual 3D space. The 2D layout has an interesting design with a good distribution of green spaces and yards. The design looks natural with dynamic routes and different types of spaces. However, the 3D space is **dull**. The green areas in 2D layout **cannot be observed** from the street. The design of the **facades**, the lack of **trees**, the **ratios** of the buildings, the **repeated** building design, the high **fences**, and the ground **patterns** and **colors** all contribute to the dull environment revealed in the 3D space. Remember, this is the actual space people will experience, not the 2D layout.



A space with a good 2D layout and a bad 3D design

7-Creativity needs 3D thinking: your design is not necessarily a direct result of your 2D layout. Look at the examples below. A direct extrude to the left block is the plain shape in the top picture. However, the urban space in the figure below it is obviously not a direct extrude. It is a thoughtful organization of floors. This design aimed to create terraces to open up the courtyard and maximize the view to the waterfront. These are all based on robust and convincing analysis.



A simple block that has the potential to be more interesting (based on Black & Sonbli, 2019)



The block has been altered to a stepped design, creating terraces that overlook the waterfront.

3-HOW TO THINK 3D

In addition to considering the principles discussed in the previous section, it is important to train yourself to think about the 3rd dimension. One useful method is using **Google earth** and **Google Street View** to compare 2D layouts and their 3D spaces. Every line you draw affects the 3D space. See how straight lines and curved lines appear in 3d in the pictures below.

Straight lines
in 2D



Straight lines
in 3D



A curve in 2D



A curve in 3D



Straight lines and curves in 2D and 3D

It is important to carefully observe the different element in a space which you feel dull/interesting and compare how these elements contribute to the space character. The pictures below is a comparison between there similar parallel streets from the same neighborhood. See how some elements have big effects in changing the street environment and attractiveness.

Trees, bushes, front t yards, low fences, ornaments and a green end (rather than a dark, unclear far end) are elements that created a more attractive path in this example. You should consider including these elements in your 2D layout as you know now their power.



See how some elements can have a strong effect in changing the space

Similarly, in the example below the 3D space includes many elements which create a sense of enclosure and organize the path. Draw these elements in 2D or use Google earth to see the main 2D lines that created such a place.

3D



2D



Every single line you draw in 2D will have effects on 3D. So think about your layout lines carefully

This way of training is practical, easy and affordable. It is simply a training technique to observe the space surrounding you.

3D IN THE DESIGN PROCESS

You should be thinking about the third dimension while designing the 2D layout. It is a **back and forth process** from 2D to 3D and from 3D to 2D **based on your analysis** and your **concept plan**.

After finishing the draft version of your scheme, drag it to SketchUp and extrude the blocks.



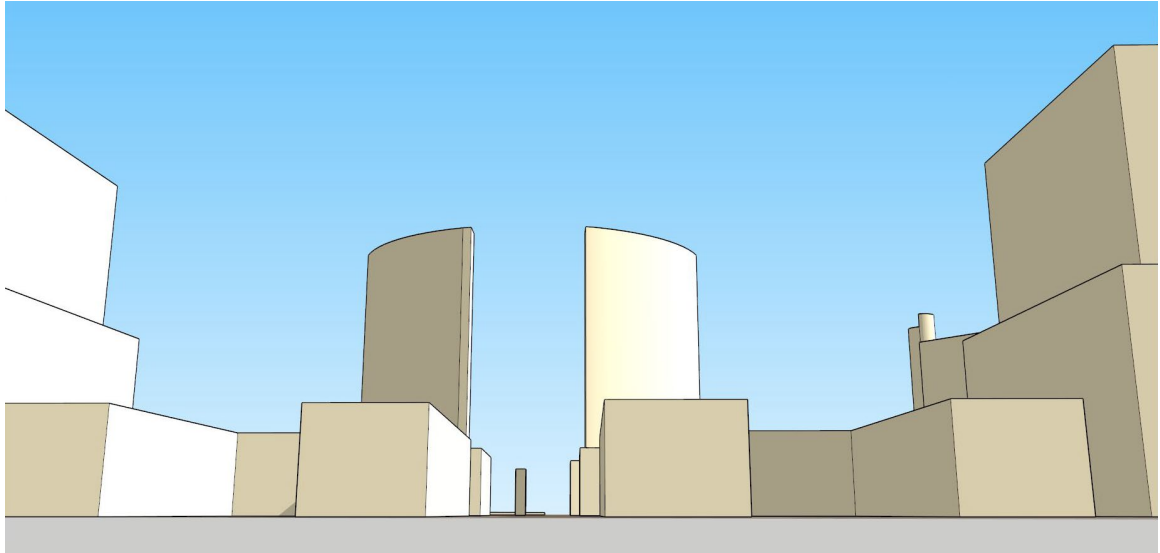
A hand sketched draft 2D design

Explore the 3D design from different views and modify it according to the urban design principles discussed before and the analysis stage you already did.



Scan your 2D layout and drag it to SketchUp and explore its 3D space

You may select a view from a key area and suggest detailing or modification by printing it out, adding a layer of tracing paper and sketching on it.

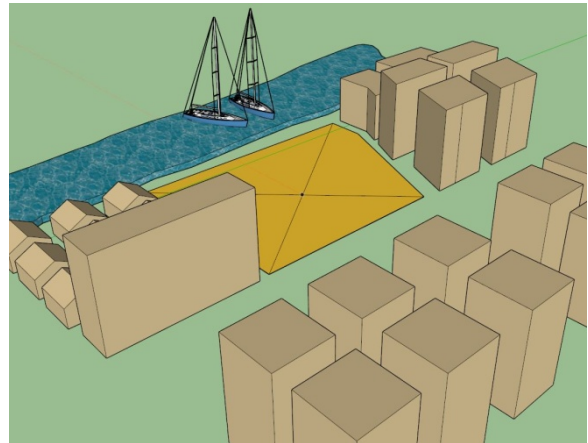
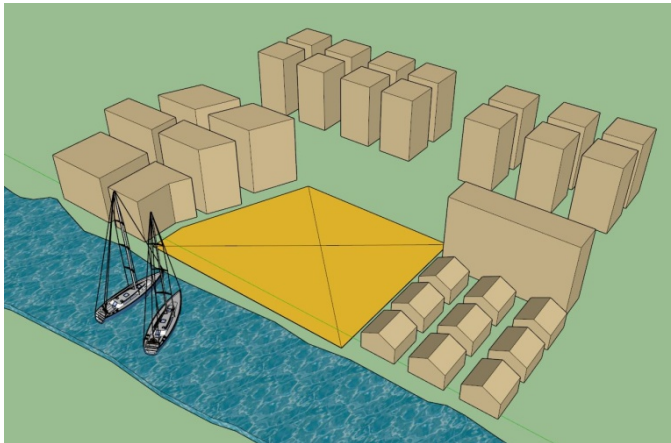


Sketch over a selected shot to show the space environment

Refer to **Serial Vision** handout for more design intervention using hand sketching and SketchUp.

EXAMPLE:

There is no magic recipe to learning. Every project has its own context which affects the way we approach it. Skills come from practice and experience. Keeping this in mind, in this section we will present a simple virtual example about thinking 3D. We are going to suggest a design on the yellow plot below.

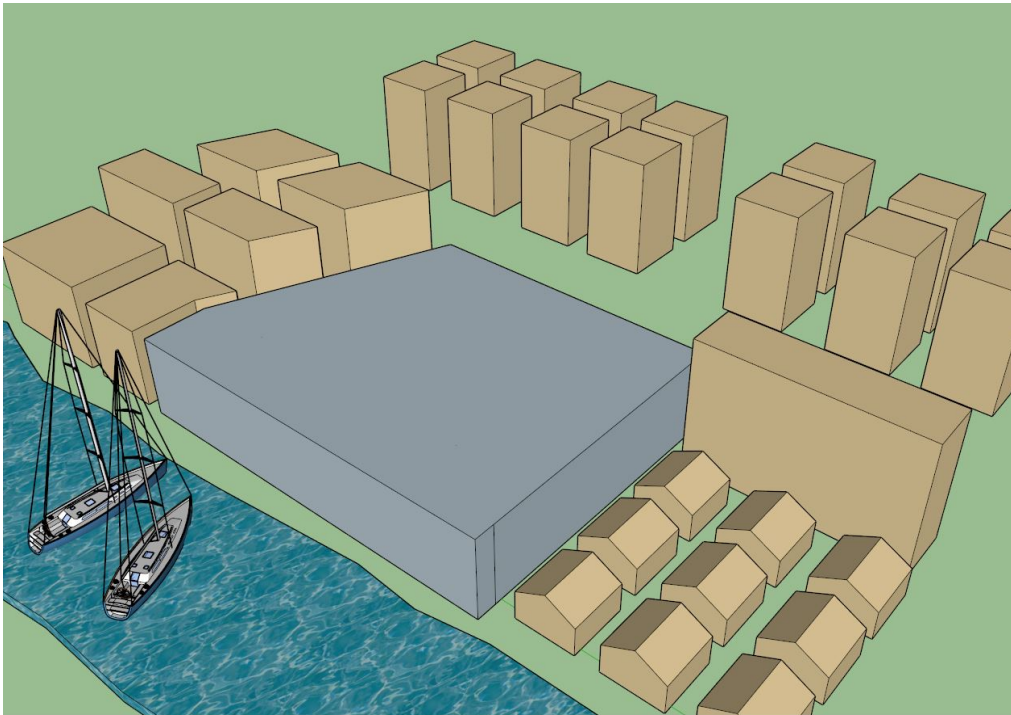


We are going to assume that thorough analysis of the place context has already been conducted and the following points frame the concept plan:

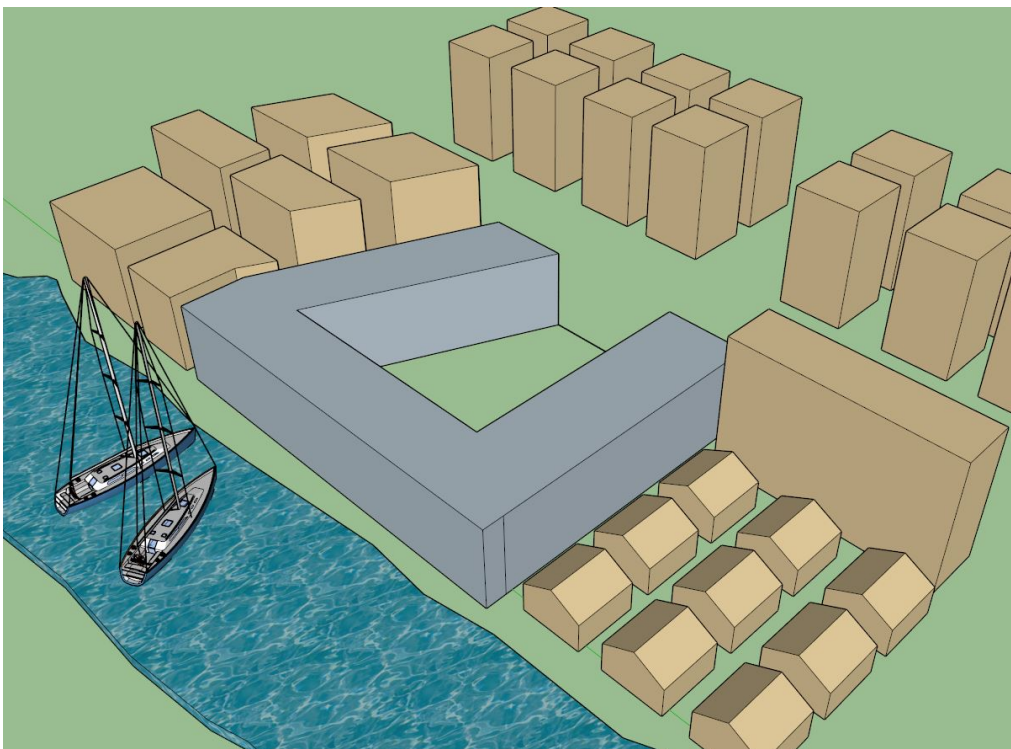
- A Lynch style mental map was done and the analysis suggests that the area lacks legibility. The space needs a landmark to for legibility purpose
- The sea cannot be seen from the adjacent paths in the area because existing buildings form a barrier that blocks view. Our design should tackle this problem.
- Existing buildings are high by the main street, and lower by the coast.
- The area needs a mixed-use development to attract different groups and investors (market, hotel, cafe, offices).
- The surrounding area is crowded and there is a considerable lack of open public spaces. So our design should create an interesting yard for the area.
- Underground car park is permitted and encouraged by the council.
- The area noticeably lacks greeneries (high trees and bushes), so our design should provide plenty of trees.
- The area is surrounded by mountains, and traditional houses are spread over the mountains which characterizes the countryside.
- The sea is an attractive sightseeing and we need to provide as much overviews as possible.

Look at the pictures below and see how the design developed and how it responds to the points above identified by the analysis stage.

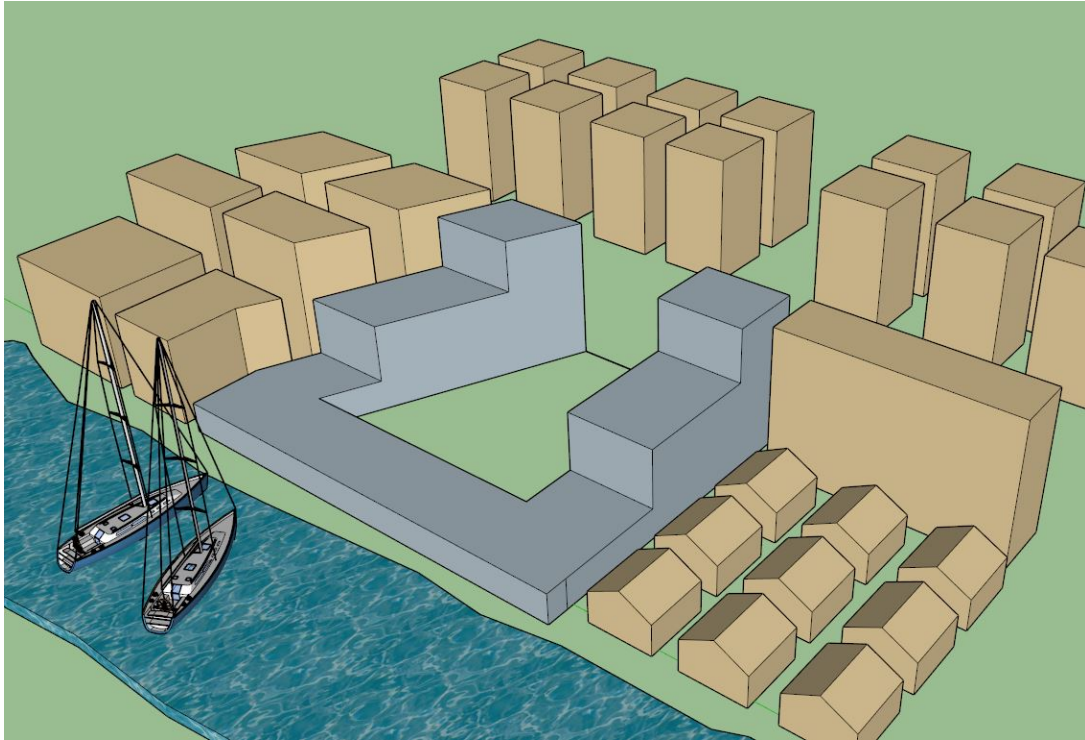
1-Extruding the whole plot to the roof level of an adjacent building. This, of course is, not a sensible design but it indicates the size of the mass.



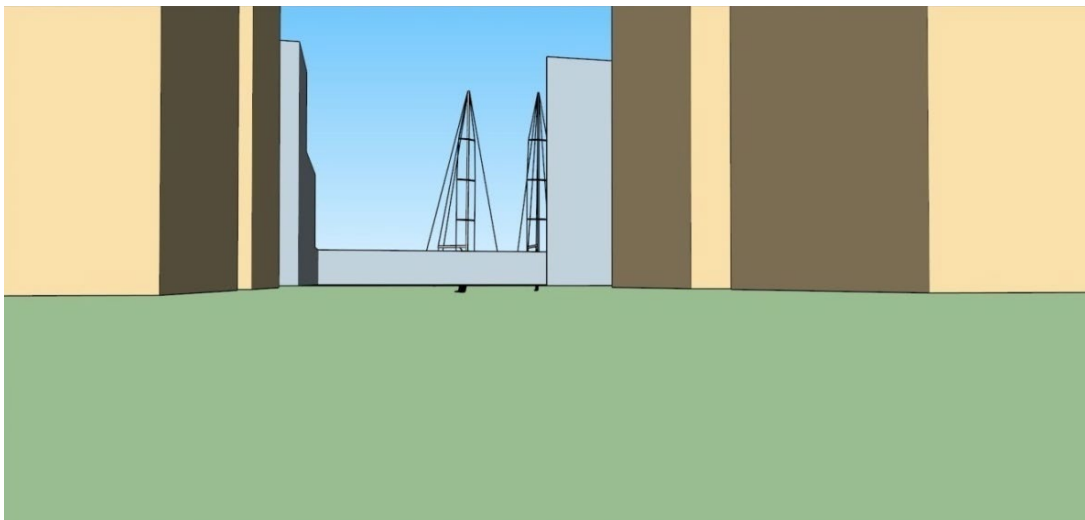
2-Creating a yard as suggested above.



3-Creating a stepped building which works in harmony with the surrounding buildings. High by the main street, low by the sea. A Stepped design provides roofs at different levels which are great for planting trees and can be excellent terraces for cafes and hotel rooms.

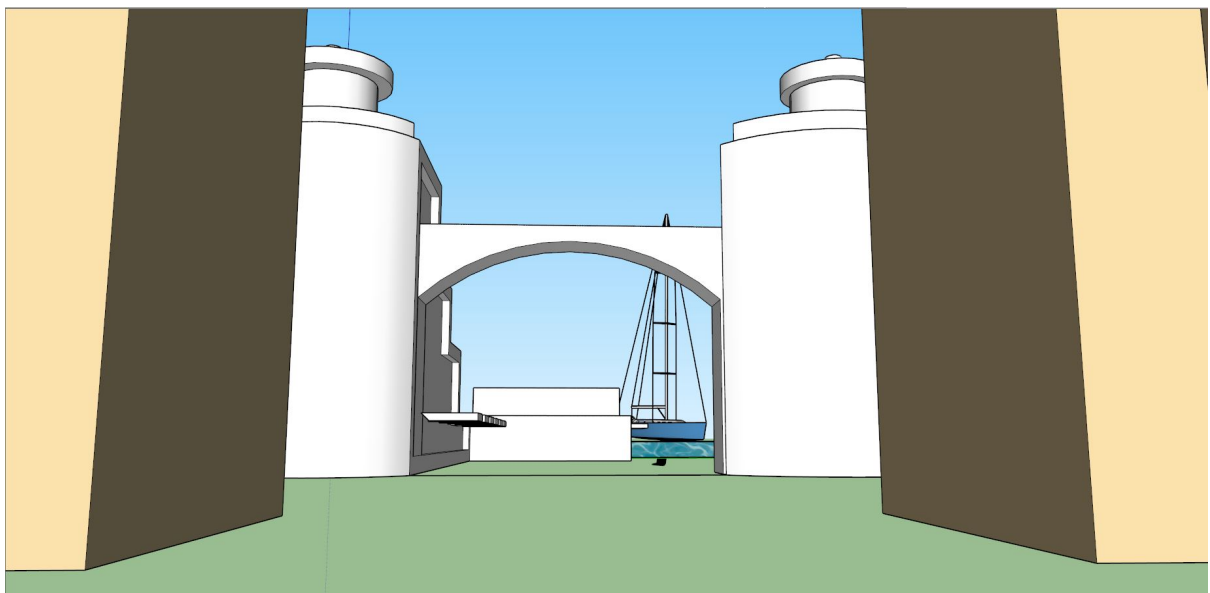
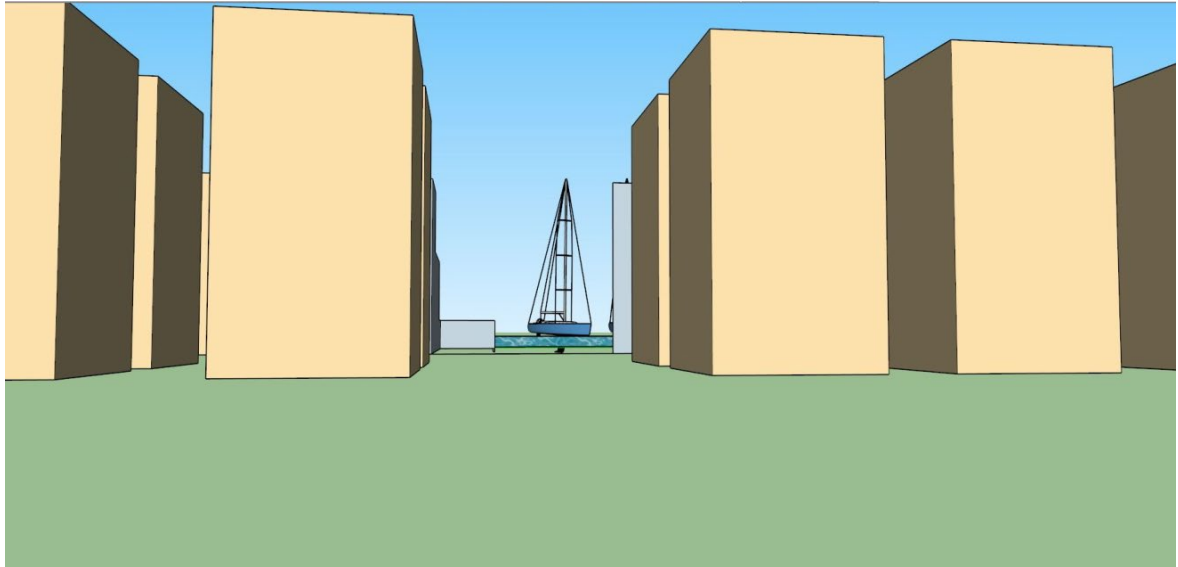


4-A shot from the street shows that our building, while now provides a yard, still represents a barrier that blocks views to the sea. The sea still cannot be seen.

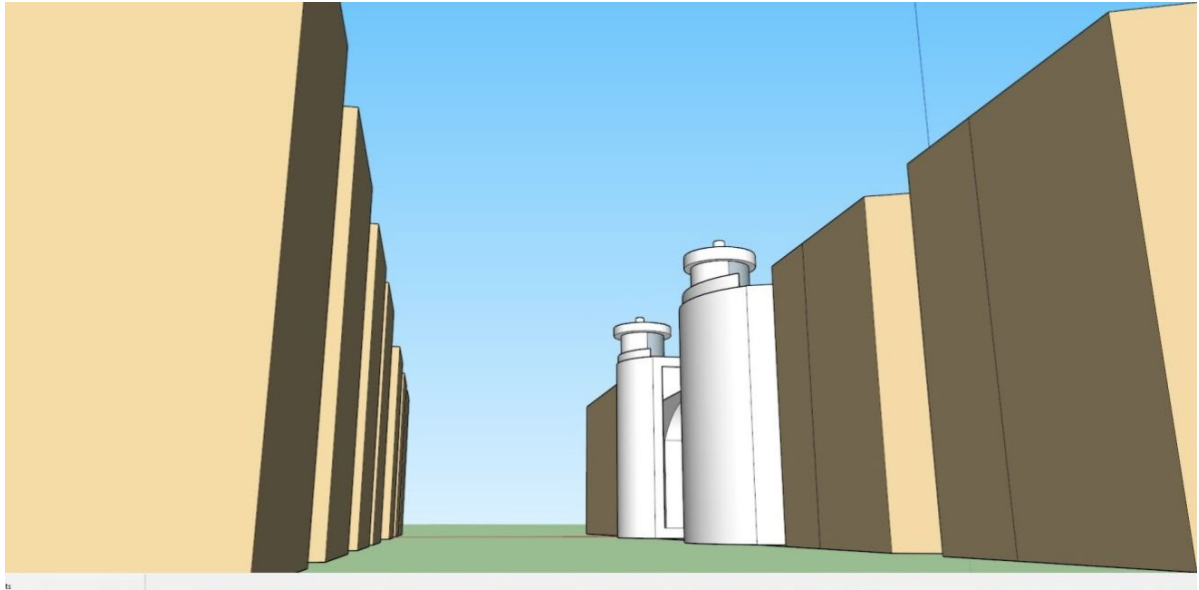


5-This can be solved by changing the design a bit and opening a gap to allow overlooking the sea.

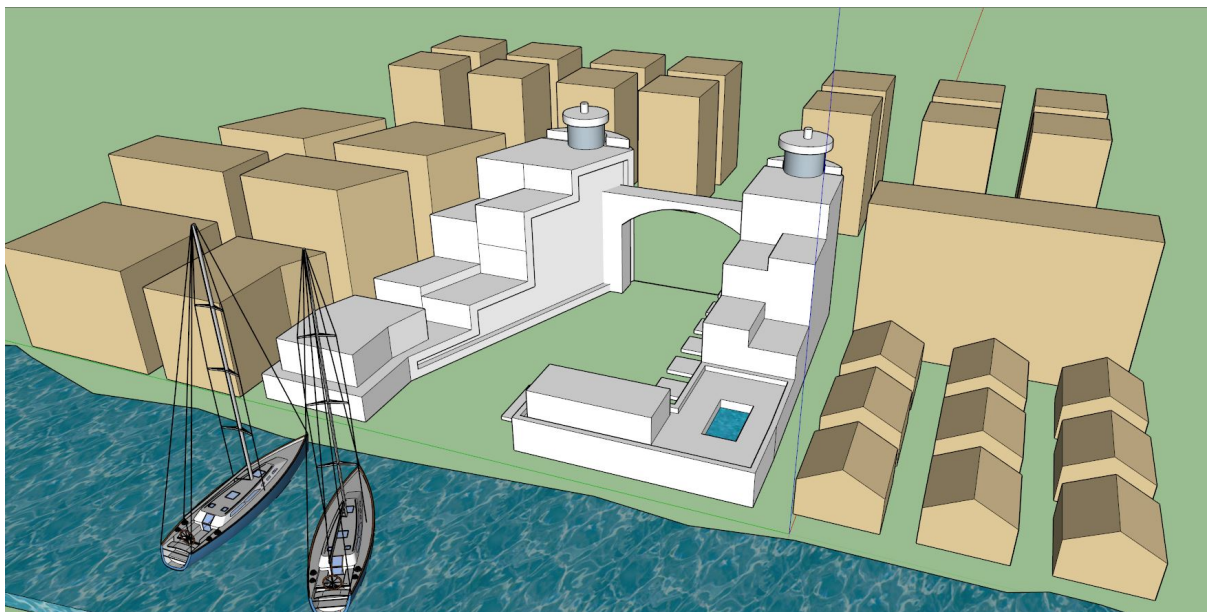
6-The gate can be enhanced by an arch design. The two blocks by the main street were given a distinct cylindrical design to form a landmark. An additional floor was added to the opposite block to compensate mass loss (caused when creating the gap) and to make the inner yard looks more active. This will be a cafe/restaurant.



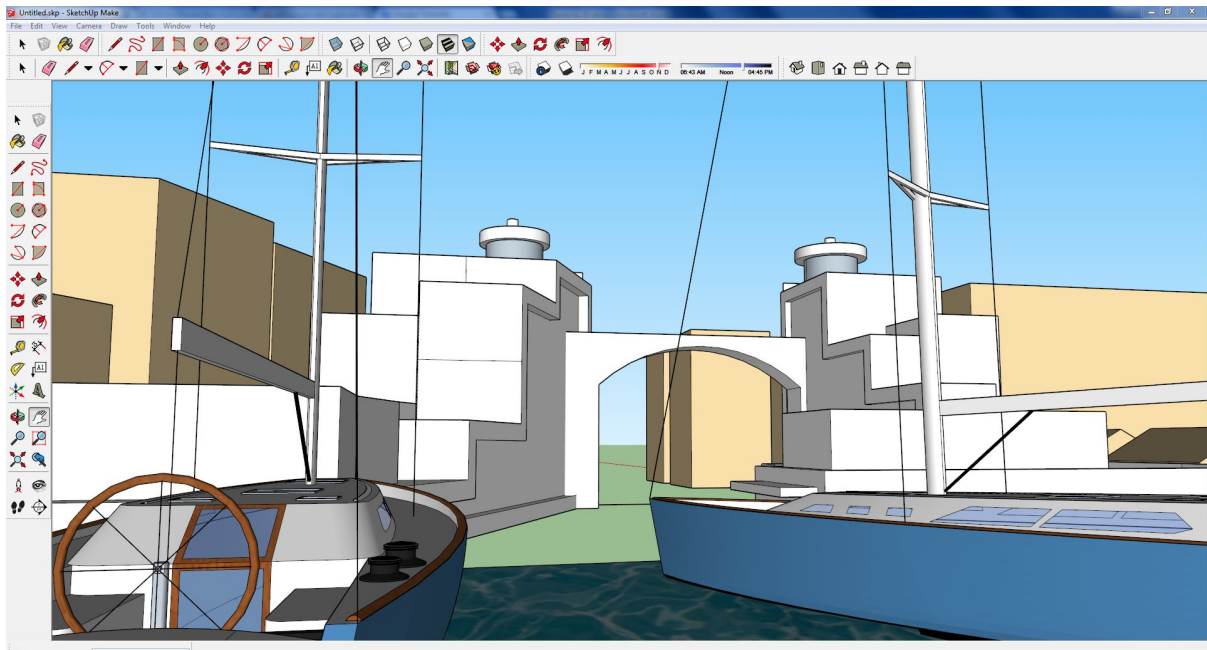
7-A shot from the street to see how the cylindrical design works in creating a landmark.



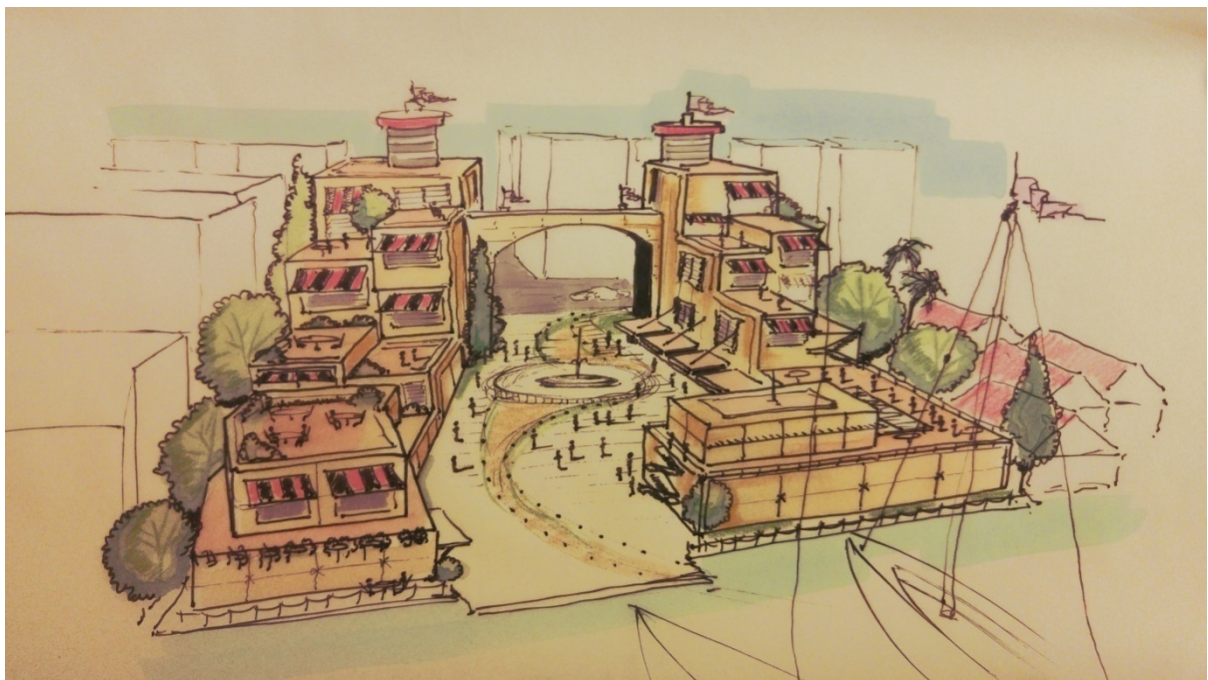
8-Roofs were manipulated further to give more dynamic spaces and more levels.



A shot from the coast to see how the development looks now



9-And finally a colored sketch to add details and show the suggested environment. Trees, people and shades are added. The shades have the same colors of the roofs of the surrounding houses. Note how the yard floor is given curvy lines (paths) to contrast the straight lines of the building. Bushes are distributed on the terraces and trees with gradual heights are planted around the development.



Now go back and forth from 3D to 2D to draw the layout. The first proposal is done!

5- PRESENTING THE 3RD DIMENSION

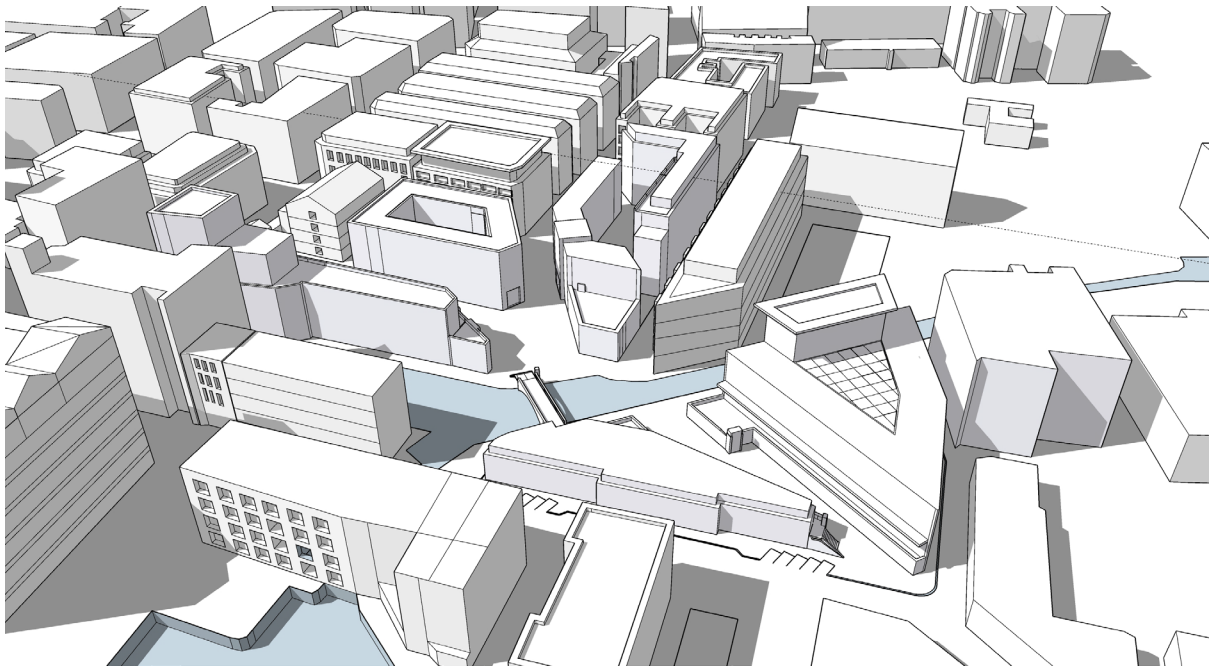
There are many ways to present your 3D design including Sketching, 3D physical models (from Styrofoam, wood or cardboard), SketchUp, CAD and Twinmotion.

Sketching is obviously a useful way to present the third dimension especially when showing details or the urban character. Please refer to Sketching Techniques handout to learn about hand sketching.



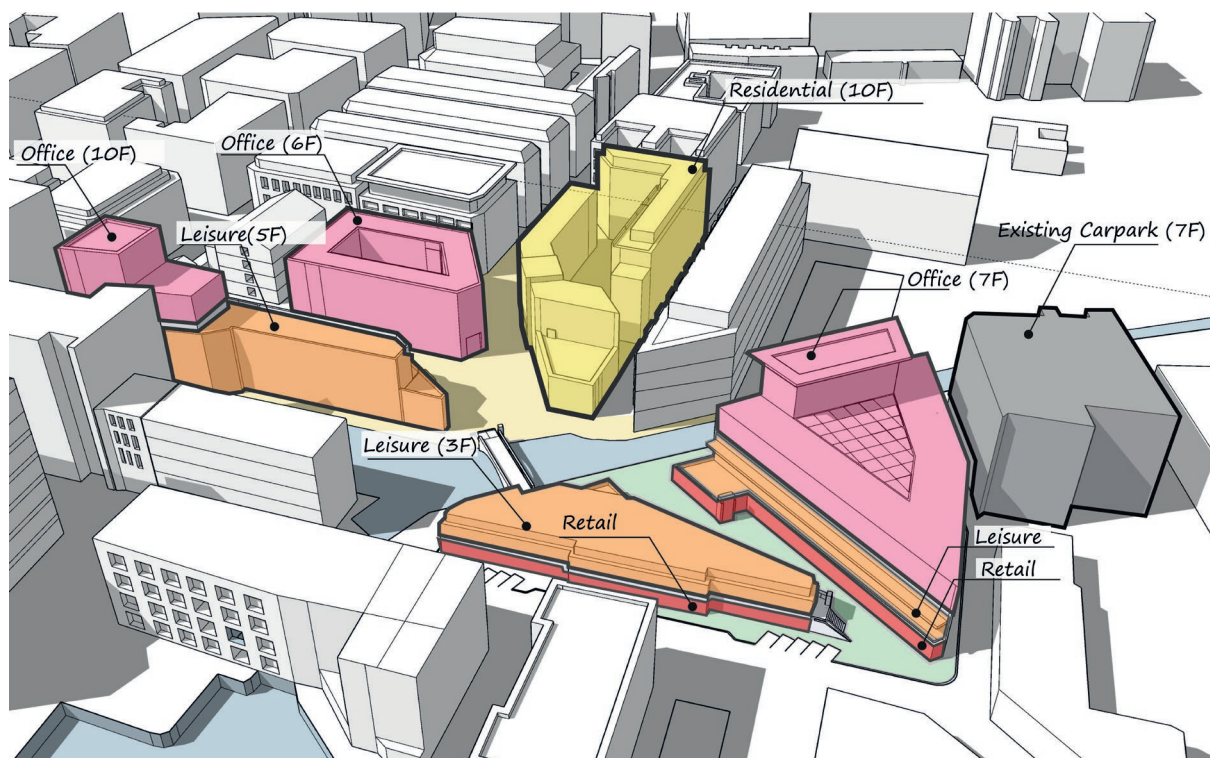
Sketching to present your 3D design (Black & Sonbli, 2019)

SketchUp is a great tool for exploring the 3rd dimension of your design and to explore alternatives. It is extremely flexible when it comes to changing building heights or the shape of



SketchUp to present your 3D design and explore alternatives

Take your plain SketchUp illustration to Ai and trace over it to highlight buildings and spaces and add annotations:



Twinmotion is an excellent software to present your final 3D work. It is a rendering software that use your SketchUp model as a base layer and make it more realistic. Please refer to Twinmotion handbook for detailed explanation on how to use it.



