

Introduction

This software is designed to calculate isovist measurements in the environment. After calculating a set of measurements, the software allows the user to combine them and view the result as a color image. The software also considers the combination of measurements as a valuation function that guides the algorithm design process. Next, the software allows you to design the environment algorithmically based on this valuation function.

It should be noted that this software is in the early stages of development and may have several problems.

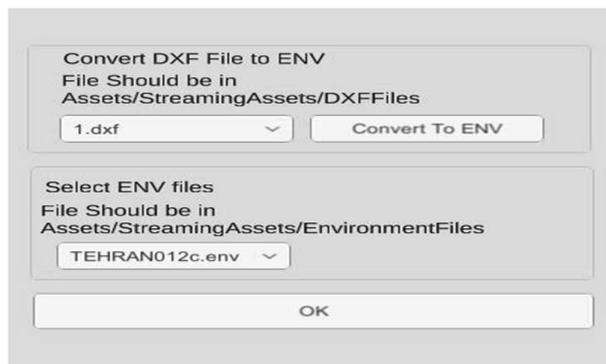
Steps to use the software

A - Import new environment:

To import a new environment into the software, you must save the environment in DXF 2010 format and copy it to the Assets/StreamingAssets/DXFFiles folder in the installed software. The following points must be observed in entering the new environment.

- The lines of the walls should not intersect
- The whole environment should be surrounded by a closed wall. Be sure to create this shape with CAD boundary command.
- Cross sections will be recognized separately
- Closed shapes must be drawn with continuous lines. It is recommended to turn all the parts into closed areas after drawing the environment by the CAD boundary command.
- Algorithmic design based on intelligent removal of shapes. The shape of the external environment will always be constant. If you want other shapes to be fixed, put them in a layer with the name "constant".

1- Convert new file to ENV file



Convert DXF File to ENV
File Should be in
Assets/StreamingAssets/DXFFiles
1.dxf Convert To ENV

Select ENV files
File Should be in
Assets/StreamingAssets/EnvironmentFiles
TEHRAN012c.env
OK

For some reason and to allow expansion in the future, after importing the files must be converted to a software-specific format. To do this, select the file from the menu "convert DXF file to ENV" and click the Converse button. Then select the file from the menu "select ENV File" and click ok.

B- Creating isovist measurements and their combination

1- Determine the size of the network

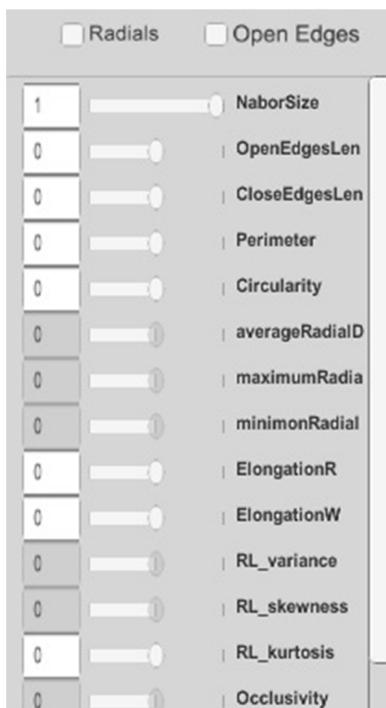
First, select the grid size of the sample points by moving the slider at the top of the screen. The grid dimensions of the sample points are shown below the slider (Example 150 84 84). The more sample points, the slower the calculation and instead the more accurate the results.



2- Calculation of initial measurements and scale matching

After setting the network size, click the Generate button. This software calculates the isovist measurements of the environment after a few seconds. The software also calculates the average value for each measurement. From now on, to equalize and combine, each measurement is divided by its initial mean value and then used. This value may be very different for different measurements.

3- Creating a valuation function



To combine variables, in addition to their scale equalization, which is done automatically, the user can specify the importance of each measurement. This value is multiplied by the standardized values of the measurement and creates the final measurement value. The sum of these values creates the value of the whole environment. The overall goal of algorithm design is to maximize the overall value of the environment, so by determining the importance of the measurements, the user can determine what measurements the software increases or decreases in the algorithm design.

The importance of each measurement can be changed by the user using the available slider or entering numbers in the input box next to the slider. The environment image is immediately painted based on the new value so that the user has a more accurate idea of the final value function created of all the entered values. Two buttons, Radials and Open Edges, allow access to new measurement sets. But if you do not use these variables, it is better not to turn them on. Play with the toolbar and see the result and also define the value function at the same time.

C- Necessary definitions for algorithmic designs

In general, algorithmic design in the present software is done in such a way that the software tries to remove some shapes to maximize the defined value function. Each removed object weighs according to its length or area. A ceiling is set for the total weight of the shape that can be removed.

To speed up the algorithm calculation the algorithm works like this:

Divides removable shapes into packages. Removes those packets one by one and calculates the values of the valuation function. It then selects the package that has the best ratio to increase the valuation function to the weight of the deleted package. In this package, it selects the shape that the removal of this shape creates the best result in the whole environment. It then deletes this shape. This process is repeated until the removal of the final selected shape causes the total weight of the removed shapes to exceed the allowable weight.

The variables of this trend can be changed as follows:



4- Weighting of shapes

The weight of shapes can be defined in two ways. This weight can be based on the length of the circumference or the area of the shape. By clicking on the two length or Area buttons, you can switch between these two modes.

5- A ceiling can be considered for the total removable weights. This roof can be changed with a weight slider.

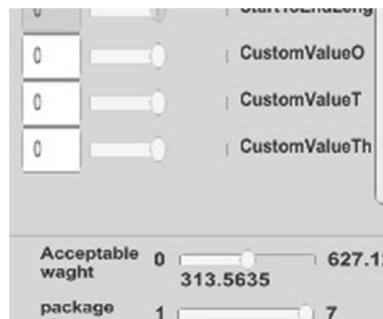
6- Package size.

With the package size toolbar you can change the size of the packages used in the algorithmic design. Reducing the package size increases accuracy but decreases overall speed.

7- After making the necessary settings, press the generate button and experience the process of designing the environment by the software.

Define new variables

Unfortunately, it is not possible to define new variables in the software version. But defining new variables in the open source version is very easy. The open source version is a Unity 3D application, so you must have Unity 2018 or higher. To simplify this, there are three custom variables in the software at the bottom of the list of variables. You just have to define some of these variables.



To do this, open the Assets / scripts / main class / Class_ InvironmetForIsovist file. Go to line 3000. There are three functions called CustomValueOneClaculator, CustomValueTwoClaculator and CustomValueThreeClaculator. Each of these functions returns a value that is associated with the slider presented in the scene. You just have to write the code for the new measurement in provided functions in line 3000. You can also access Isovist slices and other variables that you have already calculated.

```
3000 float CustomValueOneClaculator(IsoPointStaticData staticData, Slice[] slices)
3001 {
3002     return 0;
3003 }
3004
3005
3006
3007 float CustomValueTwoClaculator(IsoPointStaticData staticData, Slice[] slices)
3008 {
3009     return 0;
3010 }
3011
3012
3013 float CustomValueThreeClaculator(IsoPointStaticData staticData, Slice[] slices)
3014 {
3015     return 0;
3016 }
3017
```

Define some of these three functions and run the program