The project proposed is a network of promenades along with a group of facilities, in order to create a synthesis of a viable urban park and a profitable network of gardens.

In general, inhabitants of Thessaloniki, as every city in Greece, have been experiencing psychological issues and depression, along with unemployment (almost 30%), due to the economical crisis since 2009. In particular, according to recent statistics held by the Hellenic Statistical Authority, the major depression level in a nationally representative sample of adults 18-69 years old was almost doubled from 2008 to 2011 (3.3% to 8.2%), whereas in 2014 reached 12.3%. Also, according to the same source, the risk for experiencing is 2.6 times greater than 2008, especially in younger age and married people. Therefore, as stated in Maslow’s hierarchy of needs (from bottom to top: physiological needs, safety and security needs, love and belongingness needs, self-worth and self-esteem needs, need to know and understand, aesthetic needs, self-actualization needs), self-worth and self-esteem needs are at a low level. This fact leads to a complication regarding both deficiency and growth needs of the people.

Furthermore, the ratio of green areas in the city is 2.5%, which means that there is a significant lack of parks and green areas.

The site is located in an urban residential area near the seaside. It is a former army campus. There are many functions around the specific site, including markets, schools, stadium, marine. But the site includes only three functions located near its borders (exhibition area, school, stadium). Those meeting points do not activate the area regularly. In addition to that, users tend to avoid crossing the site and prefer moving around it; thus they visit it periodically.

During research of the cultural context of public spaces in Thessaloniki, the notion and value of meeting place emerged. More specifically, the idea of meeting points or points of gathering people are of great importance in a greek urban environment. These points of plurality can be play a crucial role in the improvement of social aspect of the users, since plurality is needed for the construction of a social space. Except from established spaces, landmarks, or buildings, other meeting points can be linear promenades, markets, balconies, areas where children play, or people exercise. All this points provide users with collective experience and improve their social, educational, cultural state.

Also, since 2011, another category of meeting place was created; urban community gardens. The team Perka started cultivating a former army campus, for non-commercial reasons. This occupation improves their daily life, including their psychological state (horticultural therapy), economical state, and socialize.

So, can values of meeting points, promenades, and urban farming be extracted and implemented in the site, in order to respond to the basic culture of society, and meliorate the economical, social, and educational level of the urban realm? And which is a possible strategy/ approach to set the functional organization using computational tools? And what is a possible way/technique to extract, translate and convert the functional organization into form and architectural space?

Another aspect of investigation is the level of control and freedom in public spaces. Louis Kahn stated that "It is a fact that some spaces should be flexible, but there also some which should
be completely inflexible”. The first is just a place to be, a place of freedom within social limits. The latter should act as an institution, a landmark that helps organizing the society and serves as an orientation mark.

Thus, how a hierarchy of controlled spaces (controlled spaces where one needs permission to enter and is open during particular hours, semi-controlled spaces where a function is implied but can work without it still, and non-controlled spaces) can compose a viable urban environment? And what is the interaction between promenades, space of movement and space of institutions? How can this be visualized, and translated into architectural space?

The design proposal investigates the generation of a possible social and physical structure within the area of the former army campus of Kodra; thus a communal flexible space for people to meet, act, produce and socialize.

In order to simulate and receive data of functional and path organization, I use a behavioral simulation using multi-agent based swarm. One part of the simulation is group of agents representing users, who are attracted by the existing and new functions in the site. In particular, with the use of characteristics of swarm behavior (alignment, cohesion, separation), it is possible to simulate multiple directional traces by trying different level of those characteristics, so as to extract the most suitable for the site; the best performance of the experiment, the clearest traces formed that can be converted into paths. A second part of the simulation, which runs simultaneously with the first one, is a set of agents representing the functions set in the site. Again here agents represent functions, where are attracted in different levels between them and between spacial characteristics. So to sum up, spacial characteristics (eg. good solar radiation, existing roots, areas unsuitable for cultivation, existing functions in the site) are the values toward which variables (users, new functions) in a dynamical system tend to evolve.

Hence, four types of infrastructure are suggested, which correspond to the four different categories of spaces. First, four buildings are set in the site; a cultural center that will strengthen the existing exhibition area, a building for seminars connected with the farm and the existing school, a market to promote the products of farming, and a farm. Each building consists of multiple functions. The farm hosts outdoor crops(800sqm), hydroponic crops(3000sqm), plant processing(800sqm), plant seed lab(800sqm), market(800sqm) and open spaces(700sqm). The market consists of small stores(600sqm), food court(300sqm) and storage(300sqm). The seminars’ building has seminars rooms(210sqm), laboratories(240sqm) and offices(170sqm). The cultural center has a multifunctional hall(610sqm), offices(170sqm), and parking(350sqm). During to studios’ contrains (the building area should be around 7,000sqm), the focus will be on the building of farm.

Another important architectural aspect is the one of promenades. The walkabouts generated start from key points where either a large amount of people gather or are points of traffic. These paths enter the site and interact both with the existing facilities and the proposed ones. In particular, the routes approach the buildings, and integrate with the function.

All this manipulation of routes is achieved by the use of simulation tool (Processing). During the first step, the agents(users) enter the site from critical points and are attracted by the functions set in the site, to generate paths, which are used for the design later on. Also, the functions’ location(agents) are simultaneously attracted to areas where they are more suitable to be; for example, the hydroponics are attracted by the area where there is good solar radiation.

During the next step, the location of the functions and the footprints of the paths generated in the simulation is imported in 3D modelling software. The challenge here is to translate the difference in units between Processing and Rhino. In particular, Processing works in pixels, whereas Rhino works in meters, thus to abstract the information generated from the simulation, I had to export the data as points and lines, and scale them to fit the metric model.

Within the theoretical framework of “experimental green strategies in non-standard architecture”, the next step of this process was to analyze the form of the building, according to local and global needs. To do so, I investigated the form of each function be the use of
sectional investigation along the main path of the building area, where every function has specific local contrains (proximity with other functions), and global contrains (indirest sunlight, direct sunlight).

The next step was to evaluate and optimize the geometry concluded by the above manipulation in order to fulfill requirements of satisfactory sunlight, especially where the gardens are situated. This was achieved with the use of Ecotect. During this step, the Rhino 3d model was linked directly with Ecotect through Geco plugin in GRasshopper, and calculated the amount of solar radiation on the surface during three different periods in a day (morning, afternoon, evening), during all seasons. The first evaluation was not satisfactory, since the level of solar radiation in areas needed sunlight was poor; thus, the geometry needed to change in those areas until they meet the requirements set. Then, after the alterations needed, the last simulation showed the optimized geometry, and already set a location where the openings could be placed.

To develop the space around the geometry more, I introduced a system of arches which are combined with the sectional system. The arches are used both as an architectural expression and structural elements which support the obtained geometry. Furthermore, the arches’ thickness is optimized in Grasshopper with the use of Karamba; the arches are split into parts between their critical joints, and then the Grasshopper definition suggested an optimal thickness to achieve minimal displacement.

During the next step, I combine the new geometry generated and the results from Ecotect analysis and simulation to determine the openings. More particularly, I divide the geometry in u and v direction, so as to manipulate the surface accordingly. Thus, the openings are determined by the displacement/movement of the control points of v-direction divisions from u-direction. The level of movement differs in each section/component, where a function needed much direct sunlight has maximum displacement of control points from u-direction, whereas functions that need less sunlight and more indirect that direct, have minimum displacement of control points from u-direction. In this way, the same principle adapts in every need differently, and reflects on the non-standard idea of building environment.

Later on, I investigated the materiality of the architectural development. The goal is to design prefabricated parts (file-to-factory technique), which can be transported at the construction site and assembled there. This scenario is preferable because it will be efficient to construct all the components of the structure before, so the construction of it will be determined before arriving to the construction site, with less loses on the material and predetermined expenses regarding the economical aspect of the construction. In general, the project covers a holistic approach, in which the research, performance, design, optimization and structure analysis will be considered in an optimal way via computational techniques, before implementing the project in the site.

Thus, the main material used for the building is polystyrene foam; this material can be formed by robotic fabrication into complex geometries with double curves. It can also play an important role on the insulation of the building. After the fabrication, the parts can be sprayed with glass fibers and have coating as finishing layer, and then can be transported to the construction site for assembly.

All in all, the general result of this process was to investigate the implementation of computational techniques to generate a building enviroment to reflect social and spacial needs, within the context of experimental green strategies theme. Hence, on a social/cultural base, I tried to develop a communal space of meeting, socializing, but also acting/producing not only ideas but also products, which can improve inhabitants’s daily life. On an architectural level, my intention was to investigate the idea of optimized network of paths and design an artificial enviromnent, which performance is analyzed and evaluated through computational tools of simulation and optimization of geometry.

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