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## A Longitudinal Study on the Transformation of Farm Areas in Çukurova, Turkey

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### ABSTRACT

Recently, agricultural production methods have changed drastically in the Çukurova region. Due to the decrease in the need for workforce and the change in agricultural product types in Turkey, there has been a significant transformation in the definition of farming and the use of farm spaces. The main subject of this pilot study is the morphological formation and transformation of the spatial components of farms and the reflections on human behaviour through space syntax. Therefore, six farm areas built since the 1850s in Çukurova were selected. Study aims to find traces of technology and human behaviour in farm spaces, revealing the boundaries between the common and private areas. Two different datasets were obtained to test the validity of the hypothesis. First consists of behavioural data obtained through observations. The second consists of survey diagrams, photogrammetric drone mappings, and aerial photographs from the Civil Aviation Command since 1944 to reveal the changes throughout history.

This research shows that use of farms has varied over time in terms of technological changes and living conditions. Recently, the distinction between private and production spaces in the farm layouts has begun to change. These recent morphological changes may be relevant when describing contemporary farm sites. Thus, study is aimed to reveal the spatial adaptation process of the farm areas in Çukurova in this article. Therefore, contemporary agriculture and syntactic studies show how the adaptation of farms has progressed over time. This study also aims to predict spatial planning in sustainability, especially in contemporary/modern agricultural environments.

### KEYWORDS

Architecture, Farm, Morphology, Space Syntax, Rural Courtyard Houses



## 1 INTRODUCTION

Çukurova is a region in Turkey which includes Mersin, Adana, and Antakya provinces. Çukurova is bounded to the north by the Taurus Mountains and the south by the Mediterranean Sea.

Çukurova serves as a bridge between Anatolia, Mesopotamia, and the Eastern Mediterranean, connecting these areas via sea, land, and rivers. Thus, it is essential for the history of civilisation with its vast lands suitable for agriculture (Ünal and Girginer, 2007).

The first settlement in Çukurova dates back to the Neolithic Period and the Yumuktepe archaeological site. The Yumuktepe archaeological site extending back to 7000 BC is the first settlement area discovered when the agricultural settlements emerged (Aydin&Cetinturk, 2014). The first farm structures reaching today are Villa Rusticas, which date back to the period of the Roman Empire (Aydinoglu, 2017).

Predominantly, at their first use, the farm buildings in Çukurova were planned as open spaces to be protected from external factors. Nonetheless, the global transformation experienced in the last century, the settlements and the environmental perception toward these settlements have started to alter. Therefore, the agricultural heritage values in the Çukurova region have begun to differ from their historical accumulation, and even to the extent of erasing it.

This pilot study aims to make a syntactic analysis of six different farms in the Çukurova region. These farms have similar typological layouts even though they were built in different periods. Therefore, the aim is to reveal the syntactic similarities and differences of their transformations by examining the spatial relations of these farms. Another objective of the study is revealing the spatial components of the farms because of the sociocultural structure and agricultural transformation.

The goals of the study are as summarised below:

- Change in agricultural policies, production methods, and the local agricultural products' syntactic effects on spaces will be determined.
- The information and documents compiled during the research would form the basis for conserving the morphological and spatial culture. It will help to generate new design solutions for farms by examining the transformation of syntactic parameters.
- Rather than new solution proposals for sustainable farms, the transformation of traditional Çukurova farm design criteria would be syntactically analysed and reutilised to evaluate these patterns.



## 2 THEORY

According to Oliver (2006), vernacular architecture is broadly defined as an architectural language consisting of ethnic and regional languages of people who are not experts in construction works. Hillier et al. (1987) dealt with the living areas of 17 rural houses in France in their work titled "Ideas are in Things," which is essential research on traditional and local houses. This study examines the relationship between the courtyard and connected indoor spaces regarding their functions.

The farmhouses will be evaluated as interior-oriented and courtyard-oriented. While most of their functions serve for living, eating, sleeping, bathing, entertainment, and similar needs as in urban residences; additionally, they include extra functions brought by the countryside such as food storage, raw product processing, barn, stone oven, well, and social landscape areas. Functions/activities run together; however, they are separated in terms of their functions (Hanson, 1999). As stated by Hanson, this situation works in the same way on farms.

Nevertheless, the farms within the scope of the study are belonging to different periods (19<sup>th</sup> & 20<sup>th</sup> centuris), they show spatial similarities with their first built(former) conditions. Space syntax has been used to analytically address the transformation of these farms, which continues to transform to this day. Firstly, this approach requires the division of continuous space into discrete units. Afterwards, each unit can be labelled, assigned to groups or activities, and unique behavioural patterns and customs associated with them (Bafna, 2003).

The farms will be analysed in terms of direct visibility, angular mean depth, and integration parameters within this framework. This analysis will help to expose hierarchical and social relationship patterns within the spatial configuration, which is calculated in terms of mean depth, the measured distance between different spaces (Bafna, 2003). Moreover, another analysis is the isovist analysis, which is dependent on the visual perception of the active user of the space. Considering the integration value, the reasons for the change in the use of the courtyard will be discussed, based on how the change in all places affects the integration of the courtyard due to the difference between the former situation and the existing situation. In this manner, information will be obtained to understand the space syntax of the farms and the users' sociocultural, hierarchical, and spatial utilisation characteristics.

## 3 DATASETS AND METHODS

This section includes how case studies are documented and analysed in the field. Also, explaining how space syntax is applied and which parameters are used specifically for the study.

### 3.1 Data Collecting

In the data collection stage, six different farm floor plans were studied, and 500 to 1000 photographs were taken with a drone for each farm. A photogrammetric 3D scaled model was created with the help of Reality Capture program. For interiors, sketches were drawn by taking reference measurements into account. Finally, with the help of the orthographic views produced, the plans were drawn using Rhinoceros software with the help of the ratios presented by 3d models. Thus, within the scope of the study, the plans and models of the farms could be drawn without the necessity of a team.

Furthermore, behavioural data and other data regarding the usage of the inhabitants of the farms are obtained through observations and interviews to ensure the accuracy of the changes in the farm buildings. The data obtained from the observations and reports were supported with the help of aerial photographs from 1944 to the present, available from the Civil Aviation Command.

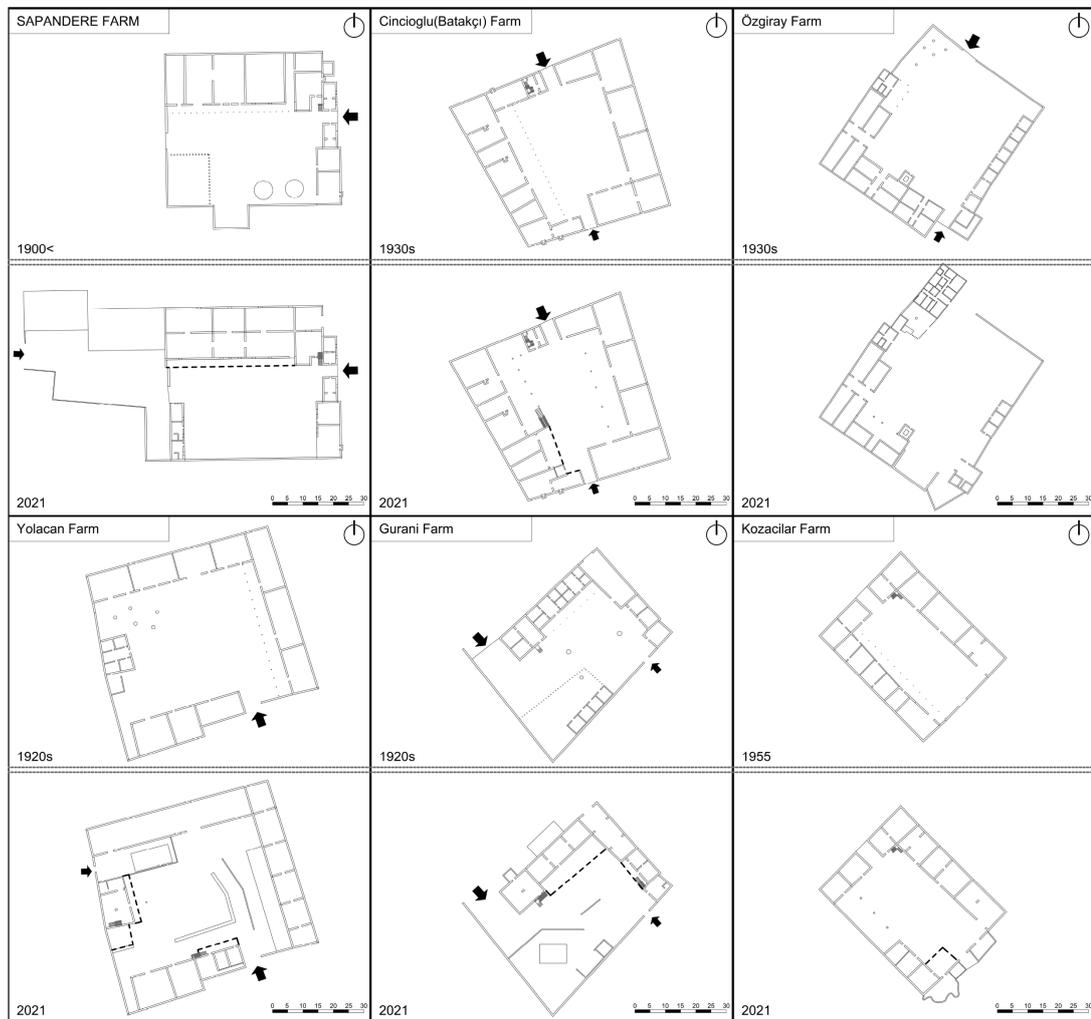


Figure 1. Matrix table showing the farm layouts to be analysed.

### 3.2 Syntactical Analyses

The angular mean depth, integration, and direct visibility values were examined for both the former and existing conditions of the farms. Each space in farms possesses a different syntactic value. However, the average value obtained from the centres of the courtyards, which happen to be the centres of the farms, was examined to find any significant change in the farms. Therefore, courtyards with the same function became comparable in terms of their syntactic values to demonstrate the transformation on different farms.

The "Isovist" (Benedikt & McElhinney, 2019) program was used for syntactic calculation. Integration, direct visibility, and angular mean depth values are used. Integration (HH) value, a normalised version of Average Visual Depth (Hillier & Hanson, 1984), shows a high value representing integrated spaces, while a low value indicates reserved spaces. Additionally, direct visibility is related to the isovist space visualising a viewer's panoptic vision from a particular point in the built environment (Benedikt, 1979), a field of view (Batty, 2001). Through the values of direct visibility, on the other hand, isovist values were taken from many parts of the plan so that the areas with the highest and lowest field of view were revealed. Besides, through the value of Angular Mean Depth based on the total depths of parts of all spaces calculated in a system (Turner, 2001). It became possible to examine how the changes in the surrounding spaces affected the average of the courtyard, whereas the courtyard remained constant.

As a result, the study dataset was formed by the graph and values obtained from the three parameters above. In these datasets, information was obtained regarding the continuity of the relations between the differentiated production and private zones. Consequently, the social, political, economic, and technological factors underlying these changes and transformations are discussed.

## 4 RESULTS

As seen from the line charts in figure 2, there is a similar movement in the syntactic values of the cases. In general, the closed spaces of the walls were reduced/demolished, and the vehicle parking area is transformed into similar areas. Also, hierarchical privacy separate spaces and reduces these values.



Figure 2. Syntactic Values and Cases Chart.

Considering the value of integration, (fig.3) the courtyard is still the most integrated space, and it is a direct connection to the other spaces. Nowadays, since most of the indoor areas are directly connected to the courtyard, the average integration value of the courtyard increases and becomes a shallower space. Courtyards appear to be much integrated because new products and new production methods require fewer units but more production area. Few employees can access the spaces more swiftly and directly in today's courtyards with increased integration and reduced mean depth.

Because in former cases primary production was on cotton especially until the 1970s, cotton production required much workforce. Changing from cotton to citrus orchards has changed production techniques such as pesticides, fertilisers, irrigation systems, tractors, and various agricultural machinery increased. Thereby, increasing the various of agricultural machinery has been changing space required by the farm.

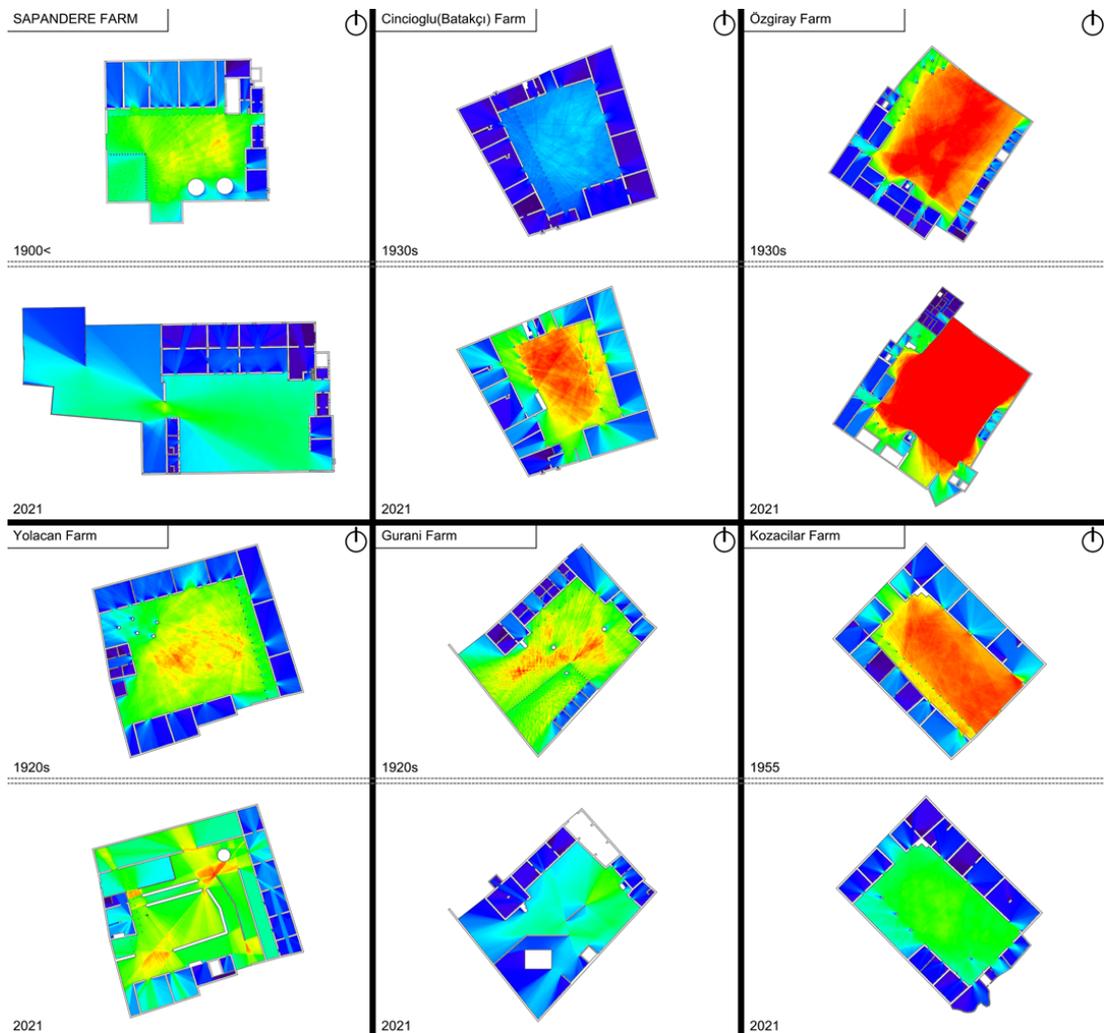


Figure 3. Matrix Table showing integration values of farm areas



Visibility value is differentiating (fig. 2) in the existing situation. The separators or additions split new landscaping areas, either have created less visible and deeper open spaces. In former conditions, both employees and owners were housed together in the courtyard, without hierarchical differences. Hence, a single courtyard is insufficient due to the increasing necessity of privacy and hierarchical needs. The hierarchy of the spaces can be read in direct visibility according to their frequency of use.

## 5 CONCLUSIONS

Since the farms in the study have served agriculture for many decades and are not newly designed pursuant to today's agricultural production conditions, Pilot study cases are fundamental to research agricultural spaces' changes. The accessibility to rural areas, agricultural technologies, the supply-demand relationship affect agricultural production. This situation reduced employees' needs and created particular sheltered areas for production, storage, and machinery. Consequently, the spaces of old farms could not suffice new needs. Due to these factors, the farm areas in the Çukurova had to adapt to this situation. As this adaptation was unplanned, today, the farms have more personalised, differentiated spaces.

Due to social and economic demands, parallel changes syntactic values. That background effects did not drastically change the spatial scheme and typology of farms. In fact, indoor and outdoor spaces using purposes have been changing conformably; hence all cases' syntactic values showed similar movement. In the former cases, the storage areas for products such as grain and cotton have now been converted into a semi-open car park, irrigation centre, or smaller workshops. Unchanged old storage areas are no longer in use, and many are neglected and half-ruined. Also, most former employee lodgings have been turned into small storage/workshop areas or combined car parks by demolishing the walls.

Apart from that, the courtyard is no longer a single and common place. Since the courtyard has both private and production spaces, various separators provide hierarchical separation. The use of plant material in the courtyard is not observed at all in the 1944 aerial photographs, but today, plant material is a visual separator in the courtyard. Articulations to the outside of the courtyard or the car parking areas and porticoes that directly divide the courtyard. The former farm space can no longer adapt to today's social life as an organising and connecting space. Farms are trying to adapt to both daily life and production, which is an important compelling factor in the adaptation process.

Direct visibility maps demonstrate that the spatial separation of farms has begun to separate into primary and secondary defensible and hierarchical spaces. However, it is arguable that this separation will become sharper. The syntactic adaptation of farms to technology and agricultural needs is more understandable. On the contrary, the process of adapting to living space needs seems to be a more personal and incomplete process.



Considering today's farm design, the spatial relations can be determined in production spaces. Since living spaces are more personal and not directly related to production spaces. The evaluation of living spaces can be done with a user-oriented review, so the design of new farms in the future needs more (POE) Post-Occupancy Evaluation cases in the region, so these cases will highlight the changes and they will present the outcomes of changed or changing functional zones. As a sum, this paper presented how syntactic measurands played an important role in the evaluation of ecological and technological impacts on farm design.

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