Associative Architectural Design

The Potential of Land Economical and Ecological Factors in Determining Variations in Housing Design

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Abstract: Capitalism does play a decisive role in the planning and generation of countless generic typologies in the urban landscape to a certain extent. This also includes the planning and generation of housing models. As a result of conventional planning that is based on ‘entrepreneurship subdivision’, only similar housing model for a specific income group is sometimes offered. In the long term, this kind of development occupies massive land, which is not suitable for sustainable growth and creates social segregation. This paper suggests an alternative approach of ‘associative design’. Parametric design software is utilized to generate the housing diversity. It aims to construct a population of housing units that together form a new neighborhood model based on the land specificity that emphasizes its economic and ecological factors.

Keywords: Associative design; parametric; housing; ecology; land specificity.

Introduction

Adequate housing is enshrined in ‘The United Nations Housing Rights Programme’ and yet, it is probably the most difficult aspect to satisfy. Aggravating the situation is that modern housing is often linked with capitalistic approach of mass-production and the weaknesses thereof. The demolition of the Pruitt-Igoe housing and criticisms upon Le Corbusier’s housing projects such as at Pessac and Chandigarh, also Unite d’Habitacion at Marseilles, are cases in point (Brolin, 1976). As a result, modern housing is often condemned for its repetitiveness, monotony, homogeneity, regimentation and anonymity. A quick visual scan of Levittown, as an example of the earliest model in mass-produced housing typifies these characteristics (Davies, 2005). Speculative tendencies in housing development have also resulted in ‘entrepreneurship subdivision’ where every lot is of the same type and size. This development is also often targeted at specific income groups, ranging from low-cost units to the gated-communities (Coates and Stetter, 2000). A case study on the Malaysian vernacular village or ‘kampung’ however, has shown that the appearance of housing is informed over time by its specific environment (Syed, 2003). Similarly, even though the newer housing types appear as identical objects, instead all are different. This difference and diversity is influenced by environmental forces, resources and local knowledge of the users. The consequence of this approach demands a redefinition to the idea of housing type. Such a design approach cannot operate by the simplification on the notions of types, but has to
consider the differences that define appearance and create variations. This is why associativity-based design approach with the aid of associative software, is required as an alternative technique in the research program for housing. Associative software enables the design of endless variations, with the input of specific data (Lee & Jacoby, 2007). In terms of housing, it is not interesting anymore what could be or what is the best or optimal housing type for a particular group of individuals or families. Rather, more pertinent questions are in what ways could the various social, political, materials, economics and ecologies of the specific land drive the differences of the housing model?

**Housing production**

The main drawback in the current approach to housing production is that the project site carries no significant meaning. Soeters (2005, p.69) lamented, “If we look at history, we could say that the norm was for the poor man to help himself by forming his own dwelling, his village and his town, all the while praying to the gods, with an appropriate humility, that what he made would please them as well as himself. But then, in the early twentieth century, architects took upon themselves not the role of people trying to make their own place in the best way they could, but of being gods themselves. Whereas the gods of the past had sanctioned the creations of men, these new gods determined that nothing was properly ordered and set out rearranging it all for the better. By means of the *tabula rasa*, a completely new order could be created*. A development based on the clean-slate approach divorces the design from the site context or *genius loci*. A piece of land and its natural landscape become simply a surface for the bulldozer to dominate and destruct where land subdivisions based on a grid could be achieved with the highest return. On these lots, the house units will be constructed and every lot, regardless of its sun-orientation, will share the same face and appearance (figure 1).

It is also not an exaggeration to see this approach as contributing to the problem of speculative housing-market and urban sprawl. The city of Phoenix, Arizona like all other major cities of the world needs an imminent demand of space to accommodate their urban growth. However, its current approach has been criticized as creating ‘non-sustainable patterns of suburban development’ (Crown, 1999, p.38). In the case of Madrid, (Trummer et al, 2005) the city has expanded its administrative borders and had to establish within a few years an administrative and architectural model that could fit the market demands and change the governmental role of providing subsidized housing. In Jiangnan River Delta, China, (Trummer et al, 2006) the Government was forced to establish a land strategy in order to let the market regulate the demands of housing. Despite its tremendous effort, the government still struggles since WWII, to increase the provision of average floor area per person. In these cities, architecture has been subjected to accommodating capitalism within their

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Figure 1
the Federal Government channelled more water by building the Roosevelt Reservoir in the nearby mountains. In 1970 the population of Phoenix was 971,228 on 148,500 acres (232 square miles). In 1990, it grew to 2,122,101 within 301,400 acres (471 square miles) (http://www.census.gov/hhes/www/housing/ahs/metropolitandata.html; May 2009). It soon became one of the fastest growing cities in the United States. Limited natural resources such as water, causes certain constraints to the city’s spatial ecology in maintaining growth and supply. The massive bout of migration increased after World War II and many retirees settled in places such as Sun City and Mesa in Phoenix. The so-called “light” industries, such as electronics and aerospace engineering, replaced agriculture as the city’s primary economic activity. Tourism in the “Valley of the Sun”, as Phoenix is commonly known, became its second leading industry.

To investigate this matter, a design exercise has been conducted to propose a neighbourhood housing in Phoenix, Arizona. The desert climate there has always attracted new residents because of perceived health benefits and warm winters. Phoenix was founded in the 1870s due to accessibility to natural water supply (Booth-Clibborn and Ellin, 2006) and prospered as the center of commerce for the Salt River Valley, an irrigated agricultural region. In the early 1900s, the Federal Government channelled more water by building the Roosevelt Reservoir in the nearby mountains. In 1970 the population of Phoenix was 971,228 on 148,500 acres (232 square miles). In 1990, it grew to 2,122,101 within 301,400 acres (471 square miles) (http://www.census.gov/hhes/www/housing/ahs/metropolitandata.html; May 2009). It soon became one of the fastest growing cities in the United States. Limited natural resources such as water, causes certain constraints to the city’s spatial ecology in maintaining growth and supply. The massive bout of migration increased after World War II and many retirees settled in places such as Sun City and Mesa in Phoenix. The so-called “light” industries, such as electronics and aerospace engineering, replaced agriculture as the city’s primary economic activity. Tourism in the “Valley of the Sun”, as Phoenix is commonly known, became its second leading industry.

After the war, housing production increased and transformed agricultural land into urban fabrics. In the 90s, the housing market became the driving force of the city’s growth, turning nearly all agricultural land into an endless urbanized field. The effect of this process allows developers to purchase 40–50 square mile of raw desert landscape that are converted into city-size building developments with up to 100,000 houses facilitated by public, commercial

Project background

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and leisure programs (http://www.unhabitat.org/programmes/housingrights/; May 2009). The forces of this growth have generated an urban environment with its own particular social distribution – a wide spectrum of population density, with huge differences in household incomes, family structure and density. At first glance, Phoenix seems to be a homogenous city. In reality, its urban fabric accommodates a variety of housing environments, each with different levels of densities and architectural typologies, from the commonly known single-family dwelling with its private yard, to apartment blocks with collective green-lungs. These differences are all visible within the current housing market, which offers housing units from USD 50,000 to USD 1 million. A complete comprehension of the urban morphology of Phoenix raised such questions as what is the architectural knowledge that gives form to this urban layout and what are the regimes that govern its design logic. These provided the initial inputs to correlate and collate other information within the associative design process.

**Associative design – methodology**

A site was selected in Belmont, west of Phoenix’s city center between 331 and 371 Avenues for investigation. The site is located to the North of the I-10 highway and is framed by the CAP Canal. The natural landscape is of raw desert. This development master plan for Belmont covers roughly 38 square miles (24,826 acres) with proposal for 82,200 housing unit, commercial and mixed-use space, including a business park, and open spaces. The proposed project is structured in four phases and only covers a ¼ mile section of the desert as our test-case. This site was subdivided into a 30 meter by 30 meter grid or 900m2, which is an appropriate build-able land area based upon the current housing market variations in the United States. This takes into account the same diversity of the current American social housing market that range from one-bedroom to seven-bedroom housing types. This approach deviates from how American developers normally subdivide a specific land. The typical approach is by building property of the highest value on the piece of land with the least density and by building it with the maximum density possible. Within a certain scale of the land and appropriate planning decision, the highest value of land with the highest density will be more profitable to the developers. However, this test-case tries to standardize the lots size to be coherent with the context of the ecological performance, the social relations and the economic factors of the site. Each phase of the project then considered a particular characteristic of the site, starting with the economic land evaluation.

Economic land evaluation is the method for predicting the micro-economic value of the land based upon specific land characteristics. These may result in decreased yields or increased costs and ultimately on the implications of the desired built forms. The main analysis covers the ecological and environmental performance. This is detailed down to encompass six economic principles of land evaluation namely, the evaluation of the topography, vegetation density, water retention capacity, sound comfort level, the feasibility of existing infrastructure, and the precipitation level of the site. Each of the six factors is assigned a point value ranging from 0.2 to 1.0 to estimate the land quality of each grid on the site (figure 3).

For topography, lower values are assigned to steep slopes, while higher values are assigned to plain areas due to the ease of site works. For vegetation, the densest areas of vegetation receive the lowest values because of the need for clearance and demolition. For water retention capacity, soil porosity determines water retention ability. The highest value is given to the most porous soil types, for its ability to avoid flooding risks. The same methodology is also used for sound comfort levels, the feasibility of infrastructure, and precipitation levels on the site. Using the methodology, a diagram of land value is produced, with a range of 3.00 to 5.40 points. (figure 4).
The next step involved evaluating and negotiating four major economic forces that determined the American housing variations. These include (i) the land value ratio to floor area, (ii) the shapes of the houses, (iii) the housing lot’s frontage and (iv) the relation of public and private open area (figure 5).

The 1st strategy is positioning units with smaller area on land with the highest value. Higher density on the more expensive land creates more profit for the developers. The 2nd strategy involves positioning fewer units on lots of higher value, in a combination of various geometric shapes and sizes. With the 3rd strategy, the lots’ frontage was differentiated from 7m to 30m wide. The width of the frontage affects the values of each house. The 4th strategy deals with the relation of public and private un-built area, and its effect to the housing variations. The ‘cross shape’ housing units have more un-built public spaces, in contrast to the square shaped courtyard house. In between these transformations, various configurations of geometric forms emerge, resulting in a diversity of public and private open spaces, in term of size, shape and spatial quality. These four strategies created differentiation with each lot’s value, and established a range of housing value from the lowest to the highest price, thus providing a variety of
housing units for the Phoenix population of diverse income groups (figure 6).

This series of housing morphologies then were transferred and ‘assimilated’ on each specific grid of the given site. At this point, it has to comply with two environmental concerns parameters, (i) minimum abolishment of the natural vegetation and (ii) minimum construction on the slopes (figure 7).

Further negotiation and decision have to be made in providing access to each lot whilst minimizing the area for road network. The road networks also have to be related with the specific value of each housing unit, which have to be maintained by the local authority. Due to the diversification of its natural ecology and spatial spaces in the ¼ mile neighbourhood, the public and commercial programs are provided along the ‘wash’ spaces, which respond to their ecology needs. In combination with the negotiation process of the land specified economic and ecological aspects, the proposed scheme attempts an alternative basis of urban planning methodology that linked associativity of the site nature with its pertinent economic features (figure 8).

**Conclusion**

It is within the framework of ‘associative design’ in an urban model that a more ‘delightful’ experience of the built environment would be provided. As we speak, parametric design is entering the era of architectural practicality. Associated design software is continuously being developed within the manufacturing industries to link design and manufacturing processes more efficiently and coherently. This applies to all aspects of the design configurations, spatial organizations, scales, structures, housing typology, construction techniques, materials, manufacturing process and other related disciplines of architecture and urbanism. In this case, the research tries to apply it responsively to nature and ecology. Our ecology is beautiful yet it is so vulnerable. Inspired by the ecological diversity of the desert, the proposed housing model examined the site-specific possibilities by using associative design approach to explore potential housing morphologies through multiple numbers of design options. The generated
schemes resist homogeneity and identical districts would be avoided even though every component of the urban form is an embodiment of the whole. By being in contrast with the conventional master planning subdivision method, the variations of each house subsequently will be affected by each of the lot’s ecology, social and economic specificity. The flexibility of the associative design approach is open for further design contemplation and serves to liberate from the homogeneity of architectural and urban design works.

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