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Theme issue:

**FORGING ADVANCES IN SUSTAINABLE ARCHITECTURE AND URBANISM**

Design for Change

Green Urbanism

Gulf Cities

Space / Nature Syntax

The Urban Laboratory

Traditional Masterplanning

Sustainable Urban Development

Urban Texture

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The journal of an association of institutes concerned with the quality of built environment. The publishing framework is shaped around the forces which act on built environment, which maintain, change and transform it. The content consists of articles which deal with these issues and in particular with responsive, self-sustaining and re-usable environments which have the capacity to respond to change, provide user choice and value for money.

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The Open House International Association (OHIA) aims to communicate, disseminate and exchange housing and planning information. The focus of this exchange is on tools, methods and processes which enable the various professional disciplines to understand the dynamics of housing and so contribute more effectively to it.

To achieve its aims, the OHIA organizes and co-ordinates a number of activities which include the publication of a quarterly journal, and, in the near future, an international seminar and an annual competition. The Association has the more general aim of seeking to improve the quality of built environment through encouraging a greater sharing of decision-making by ordinary people and to help develop the necessary institutional frameworks which will support the local initiatives of people in the building process.

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The journal of an association of institutes and individuals concerned with housing, design and development in the built environment. Theories, tools and practice with special emphasis on the local scale.

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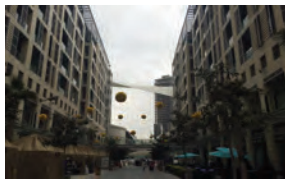
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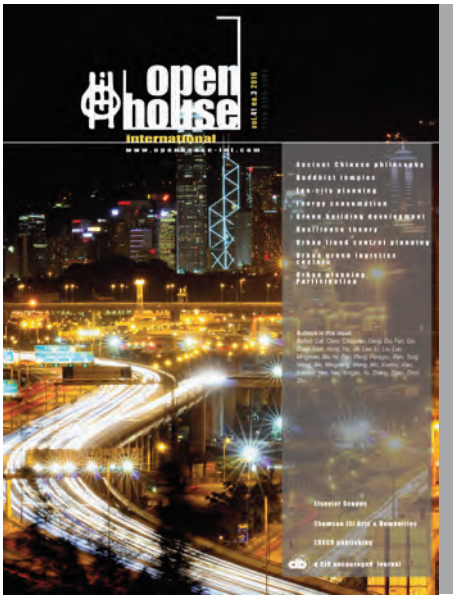
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## FORGING ADVANCES IN SUSTAINABLE ARCHITECTURE AND URBANISM.

Sustainability has been an important topic in many disciplines over two decades, and its urgency is rising. At the same time, a conceptual understanding of sustainability remains rather vague, posing a challenge for research in this area. Nevertheless the term 'sustainability' is increasingly used in the context of ecological, economic, and social studies. In green economics it is often used interchangeably with the term 'sustainable development', defined by the World Commission on Environment and Development in 1987 as, "development which meets the needs of the present without compromising the ability of future generations to meet their own needs." This underlines sustainability's ethical dimension where a normative view implies treating sustainability as a form of intergenerational equity and fairness. The question of intergenerational equity constitutes a growing concern, and our obligation to future generations requires us to look beyond short-term public policy preoccupations to anticipate building a better future for all.

Although the process of urbanisation has occurred at varying rates throughout human history, the speed and nature of growth in cities in recent years, and the scale of their environmental impact, means that today our own place in the history of the built environment is unique. Since the middle of the 20<sup>th</sup> century the population of the world's cities has soared from 200 million to almost 3.5 billion. Although physically they occupy just 2% of the earth's surface, cities consume most of the world's natural resources, produce vast amounts of waste, and are the main source of pollution throughout the world. Environmentalists question whether the rapid growth of cities in recent years can be sustained. In the 'developed' world urban environments consume so many resources that they are dramatically reducing the natural capital that we depend upon. Cities in the Global South, particularly in Asia and Africa, are now growing five times faster than those in developed nations, with a staggering 1 billion people joining the world's urban population by 2020, when 27 mega-cities (with populations exceeding 8 million) will have emerged within the 'developing' nations. While some are flourishing, many others contain large and concentrated poor urban populations living in life-threatening conditions caused by environmental pollution, political turmoil, social disorder, and economic upheaval. The aggregate impact of these cities on the environment – a product of the relationship between population, per capita consumption or economic activity, and energy/material flow per unit – must be radically reduced if quality of life is to be maintained.

Alternative approaches to rethinking and reforming the built environment in ways that imply a more frugal use of energy and natural resources, and

a better quality of life, are being explored within academic and policy literature and research around the world. As part of the activities of the 'Cluster for Research in Design and Sustainability (CRIDS) at the Department of Architecture at the University of Strathclyde, Glasgow, this issue of Open House International addresses various contexts in Scotland, Turkey, the Middle East, and the United States of America highlighting various theoretical and practical dimensions of sustainability. It includes research contributions on architecture and urbanism as they relate to historical and morphological studies of urban regeneration (in Glasgow, Scotland), housing typological transformations (in Konya in the Central Anatolia region of Turkey), issues of sustainability and national identity (at Masdar City in Abu Dhabi, UAE and the Msheireb in Doha, Qatar), the impact on sustainability of housing development patterns (in Doha, Qatar and Dubai, UAE), an exploration of resilience theory as it relates to urban morphology, research work (in Arizona, USA) exploring the boundary between the built and natural environments and the development of a Space/Nature syntax methodology, and two contributions that examine the theoretical concept of Arcology and the development of the urban laboratory at Arcosanti (in Arizona, USA) as both a model for Green urbanism, and a place to critically evaluate a radical redefinition of the relationship between society, technology, and Nature.

In a European context, Dicle Aydin examines social and architectural characteristics as dominant conjoined components of urban planning, through the introduction of new housing typologies that express changing lifestyles, socio-cultural structures, tastes and expectations in the Moram region of Konya in Turkey. Aydin's morphological, sociological and ontological analysis supports his argument that new developer-led dwellings, constructed in the last 10 – 15 years, have caused a negative change in the identity and texture of neighbourhoods in Konya, and might signal permanent, and irreversible changes, in the urban fabric that endanger values of sustainability. Moving further to the West, the work of Barbour, Romice, and Porta laments the failure of post-war development in Glasgow to implement housing-led regeneration and argue that the public sector could take a lead by providing development opportunity to inner-city neighbourhoods, supporting methods derived from traditional master planning processes, and encouraging neighbourhood self-organisation and opportunities for small-scale house building, and 'performative' design guidance directed towards social and environmental sustainability. In another contribution, Feliciotti, Romice, and Porta combine established knowledge in urban morphology with

resilience theory to define five proxies of resilience, discussing interdependencies between constituent elements of the physical city incorporating the element of change, and the dimension of time, that determine the form of cities.

The emerging importance of the context in the Middle East is examined in two papers selected to demonstrate different aspects of concern for sustainability in the region. Weidmann, Salama, and Ibrahim, in discussing some of the outcomes of an on going collaborative research project of the Qatar National Research Fund (QNRF), present an overview of current development patterns, and offers a sustainability framework to enable a preliminary assessment of large-scale affordable housing projects in the Gulf cities of Doha and Dubai. The assessment reveals differences between two major projects and their impact on the environment, economy and society in the Middle East. In reframing the notion of sustainable urban development in the Middle East, Samer Bagaeen, reflects on some underpinning assumptions and inequalities, and invites us to consider the aggregate impact of individual master planned projects on the urban fabric of fast growing cities and to think about how projects such as Masdar City in Abu Dhabi and the Msheireb downtown redevelopment in Doha demonstrate how sustainability and nationalist discourses are intertwined.

Munro and Grierson invite us to consider how we can maintain a human connection to Nature in an increasingly urbanising world. Based on their current research work on the development of a Space/Nature Syntax methodology, the paper supports the Biophilia Hypothesis in attempting to understand how designing to maintain our instinctive bond with Nature can promote social interaction and inform future design choices within built environments. The authors present initial findings, achieved through recent case study work at Arcosanti, in Arizona, USA, and outline future development of the methodology. The urban laboratory at Arcosanti, and Paolo Soleri's Arcology theory that underpins it, provide the context for the remaining two contributions to this special issue. The work of Ruth Rae examines how the concept of Arcology and the development of the Arcosanti prototype encompass principles of Green Urbanism and sustainable development, and describes how it is that the laboratory, through a dual process of experimentation and construction has attracted over 7,000 participants since 1970, and continues to provide positive experiential learning opportunities within a relevant model of sustainable urban living. David Grierson, in his reflective piece, argues that the positive utopian tendencies in Paolo Soleri's work should be reaffirmed and, at the same time, he underlines an urgent need for multi-aspect and multi-disciplinary research, and postgraduate education, to be undertaken at Arcosanti, to test the parameters of micro- and macro-structures within alternative models of ecological design as a major contribution to understanding the complexities of sustainability and the reformulation of the built environment. Both Grierson and Rae, in their contributions, give acknowledgement to the ongoing

work of the Cosanti Foundation's Board of Directors and its new Strategic Plan Steering Committee, and their commitment to attract renewed levels of financial and human resource in support of the urban laboratory's unfinished business.

It is clear that the discourse and research findings on sustainable architecture and urbanism that are discussed in this issue of Open House International, represent serious attempts on the part of academics and practitioners from across the world to shift our thinking and practice in the built environment away from a current condition of unsustainable activity towards a process of improvement and increased quality. The task of building a better world for all, as demonstrated by the 8 contributions by 12 scholars, remains hugely challenging and complex.

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# MORPHOLOGICAL-ONTOLOGICAL ANALYSIS OF URBAN TEXTURE CHANGING WITH DWELLING TYPOLOGIES.

Dicle Aydın

## Abstract

Cities are defined by historical, geographical, sociological, cultural, economic and administrative aspects; each concept exposes different characteristics of cities as social structure and architecture from the others. The differentiating characteristics also form the identity of cities/settlements. While the physical fabric of cities makes it necessary to analyse in a morphological way, the ontological structure which is affective on the formation of this morphological structure and searches background of "existence" is seen as an unknown aspect of space. In fact, morphological and ontological space calls into being and affects each other. In this study, urban fabric changing with the existence of new dwelling types is accepted as a factor affecting the urban change. The ontology of the new one is investigated and the negation brought to the context is handled morphologically and sociologically. Konya is selected as site area; it is focused on Meram region as one of the main districts. Differentiating life conditions and the reasons of that is various in Meram regions like any other area; the existence of new dwelling typologies deteriorates the fabric pattern. This negative situation is investigated in this study not only morphologically but also sociologically because of different user profiles. In last 10-15 years, high rise buildings with security, private buildings with security, studio type dwelling applications started to exterminate the original one. Especially studio dwelling applications and designs disowning the social dimension have the potential of exterminating and changing the morphological and ontological sustainability of the neighbourhoods defined as sub-public area.

**Keywords:** Konya, Morphological Analysis, Urban Texture, Neighbourhoods, Dwelling Typology.

## INTRODUCTION

Today cities are undergoing a change and development process as a variable and a dynamic phenomena (Adams, 1988; Sey, 1998) involving social, sociological, and cultural features and standing alone with their economic and social data. Debord (1996) emphasised in terms of an economic perspective that cities have been considered as the "opportunity areas" of ideas, freedoms, religions and cultures throughout the historical process and today turned into an intricate web of capitalist relations based on consumption or needs. Nevertheless, we are confronted with each and every concept which has a share in the presence of cities as a social and architectural structure accompanied by the features varying between the cities. These changeable features also constitute the identity of cities. The cities named with their historical, geographical and cultural values such as Ottoman city, harbour city, University City, ancient city, medieval city etc. hold the information regarding their social and physical characteristics. These alterable features both reflect the identities of the cities as the indicators of social *modus vivendi* and their interaction order with the environment that reflects on the physical space but also cause the urban identity to be redefined and recreated with a continuous development and change (Birlık, 2002; Köseoğlu and Aydın, 2009). While the physical texture of the cities requires a morphological

analysis, the ontological structure that is effective on the formation of this morphological structure and by which the background of "presence" is sought, confronts us as a not so much investigated aspect of space. In fact, the morphological and ontological aspects of space affect and mutually generate each other (Taşçı, 2014). The emergence and characteristics of space confront us at the intersection of morphological and ontological reasons and determine the identity of the texture. The interactions between everybody and everything with everything due to the impact of globalisation has caused the space to become inauthentic and led to the emergence of uniform urban spaces. Uniform and similar implementations have occurred especially in the texture of the dwellings.

The dwelling textures of the cities substantially cover the majority of the city area. Bilgin (2010) stated that *the structure type called as "housing" constitutes nearly 85% of all the structures in the cities*. The changes having been undergone as the dominant zoning factors that are effective in physical appearance on parcel/property basis singly or on fabric basis more holistically in the housing areas might influence the whole city in time. The applications taken as a reference to each other might appear as the triggering factor of the physical changes hence the identity change.

Being one of the most basic needs of the people, dwelling—meets this demand and has undergone a change depending upon various social, cultural, economic, societal factors. With the changes in the production process, the dwelling and dwelling textures vary with respect to the users and their preferences and gain a place in the cities. Bilgin (2010) mentioned about the significance of housing and housing areas by underscoring that the *“evaluation over the dwelling culture is in a sense equivalent to the understanding the DNA of a city since they are the structures constituting a city’s backbone”*. Robert (1999) emphasised that we can make readings about a culture by underlining the definition *“the housing is beyond a construction activity, and it is an “action” field that one’s identity, habits, social and local authenticities, social and family circle, taste and delicacy are reflected upon”*.

In this study, the urban texture changing with the emerging of new housing types is accepted as a factor influencing the urban change, and the morphological and sociological negations active on the texture are handled by examining the ontology of the new housing type. Konya is selected as the research site area, and one of its central districts Meram is focused for the study. The urban texture known as Green Meram due to its low density of buildings and geographical features is exemplified in terms of the housing typology and the change of this typology. Especially, the morphological and sociological structures which have started to change with the presence of studio type apartments in usual textures with different qualities are discussed as a significant problem.

## URBAN DEVELOPMENT AND HOUSING IN ANATOLIA

There have been many factors triggering and affecting urbanisation in Turkey. The establishment of the Republic of Turkey (1923) after the Ottoman Empire and the recovering of the state did not become easy. The phenomenon of the modern city attempted to be realised through the development plans was aimed to spread all over the country from the underdeveloped towns to the cities. According to Çetin (2012), a modern city was considered as the building block of the nation-state. The expansion of industrialisation, the revival of the economy hence the rapid immigration from rural to cities and interurban migrations, the attitudes of political powers depending on the economy and globalisation have been the factors sometimes accelerating and sometimes slowing down the housing process of the cities in Anatolia. Until 1941, annually ten to fifteen urban plans have been launched in Turkey by the state agencies, contractors or via their joint efforts.

The 1950s became an important milestone for Turkey in terms of production in architecture and construction due to either political developments or economic and social occurrences arising from these developments (Sey, 1998). Housing should be taken into consideration in order to understand the mod-

ernisation of zoning after 1950s. From 1950s to 1980s, almost always apartments were built. Especially in the Anatolian cities, apartments existed by reflecting the traces of traditional architecture on plan basis at first, then on a completely diversifying form. The main streets of the cities were defined, the ground floors of the apartments constructed on these streets were used as groceries, retailers and bank branches in order to increase the commercial viability of the streets (Bilgin, 1998). By the end of 1960s and in 1970s, the apartmentisation process started to evolve from a singular block of multi-dwelling unit into a large scale housing production (Sey, 1998). By 1990s, the aspects of the housing processes began to change. On the plan basis, the detached rows of single dwellings were superseded by the rows of dwellings formed by the construction of huge blocks which were produced in groups in the periphery of the cities (Bilgin, 1998). Accompanied with an unlimited comfort and service as the element of competition in many cities, today, these dwellings are offered to the people.

## URBAN DEVELOPMENT AND HOUSING IN KONYA

Located at the middle of the Central Anatolia, Konya carries the traces of a civilisation dating back to the BC 7000s. The view of housing in Konya in the early 20<sup>th</sup> century was mainly formed by settlements composed of adobe houses (Figure 1). Even though the development of Konya did not occur as fast as the other cities in Anatolia, the increase in the number of housing and public buildings, the development of zoning played great role in the development of Konya. In Konya, until the 1940s, especially the public buildings were constructed, and the increase in the housing occurred after the 1950s with the effect of population growth. The first development plan of Konya was drawn up in 1944, in which an area of 540 ha was reserved for residential purposes.

1950s was a period during which the developments in the fields of education, organisation, design and application have begun to be experienced. The population of Konya showed an increase of 41.3% between years 1950 and 1955 (Gökçe and



Figure 1. The view of housing in Konya in the early 20<sup>th</sup> century. (Source: Tevfik Ataberk).



Figure 2. The storey increase in Konya 1950's. (Source: Author).

Çukurçayır, 1999), and the factories opened in 1954 and 1956 accelerated this increase. As a result, the demand for housing grew by the start of population growth, and new contemporary modern architecture,

In 1954, a new development plan was put into practice for Konya, which comprises the area increase of 912 ha in residential areas. However, sunless and airless city pieces started to increase when one to two storied old houses that had occupied less space on narrow ground in the old urban texture were demolished, and four-five storied even six storied buildings were constructed on the same street in places and the parcel was filled for 80-90% (Aydın and Diren, 2004) (Figure 2). In 1960s, as a result of the developments in industry and commerce, the market activity became continuous. With this development, the increase of the capital, the support of Emlak Bank and the encouraging bank loans for construction in addition to intensifying property ownership and increasing building co-ops caused the dwelling texture to increase (Aydın and Diren, 2004). Between years 1960 and 1970, the most important innovation for Konya was "Konya Development Plan" obtained as a result of a competition in 1965. Thanks to the new plan, the place for the bus station was defined and ground floors around transportation axis started to be implemented with a commercial function and new housing formations became high rise. At that time, the elevators in addition to stairs to reach the floors and radiators for heating started to become widespread in the houses, the conditions of comfort changed depending on the profiles of the occupants.

1965 plan was revised in 1983 and the traditional texture of the city gave its place to the current urban texture in 1980 and the aftermath which was formed with modernism (Topçu, 2011). In 1987, Konya achieved metropolitan municipality status and the city centre was divided into three district municipalities named as Meram, Selçuklu and Karatay. Selçuklu District does not accommodate the traditional texture as an area which has recently been opened to development; the traditional and historical texture is



Figure 3. Transformation of low-rise and single storey texture into gated communities due to urban transformation. (Source: <https://www.facebook.com/kentbilgisi> November 2015).

dominant in Karatay however. On the other hand, Meram has a physical structure that accommodates both historical and natural beauties and incorporates a dwelling texture that is known for its integration with green.

Until 1990s, the construction of the houses continued by way of exact replicas of each other, which were built through building co-ops. The apartments built on a single parcel and city blocks on which detached houses implemented again on a single parcel were created in addition to these mass produced housings. The first example to gated communities which exhibits a different stance and forms its own public sphere in the cities was built in Meram District in 1997. According to Koyuncu (2013), the demand of the urban elite for a safe and respectable neighbourhood made this new self-sufficient dwelling type attractive with its shopping centre, social and cultural activity areas, etc.

By 2010s, the urban transformation accelerated and high-rise apartment blocks started to be con-

structured in the city by the construction companies on flat for land basis to be given to the landowners. The rearrangements were specially made for the planning of the areas with adobe or brick-made low-rise houses where single families settled, and then multi-storey and multifamily housing blocks emerged (Figure 3). The studio flats were added to multi-family and multi-storey housing productions in 2010 in Selçuklu District. As this type of housing that is mainly offered to students and individuals who prefer to lead an individual life got widespread in Selçuklu District, it has also come to be marketed in Karatay and Meram as of 2012.

## RESEARCH AREA Meram Region and Dwelling

Located at the southeast and west of Konya in general, Meram region has a texture that has integrated with history and green. Until 1950s, the dwelling in Meram has been used as vineyard house in summers. The southwestern and western axes of the city were projected as a residential area in the 1954 development plan in order to meet the housing demand of the increasing population due to migrations. In the development plan of 1966, the residential areas were also increased in the same axis.

The building of Education Faculty on Meram Yeni Yol Street in 1962 increased the transportation density of the region. In the development plan of 1966, both sides of Meram Yeni Yol were allotted as residential areas, and the other areas on the road were designated as official and public buildings such as military zone (military units, lodging and school), educational areas and hospital (SSK hospital, 1996). The proximity of the region to the centre, accessibility, clean air and distance from the city noise made Meram an appealing district. The principle of low-density settlement in garden layout was adopted in the plan of 1983. In 1984, a series of conservation orders were brought for Konya to have a natural protected area in this period, and then Meram Natural Protected Area Conservation Plan was prepared in 1992 for Meram.

In 1990 plan, 167 ha housing development area and 5000 population were foreseen for Meram. The trigger for the change in the region was the alterations made following the increase in the population density and the region becoming a lucrative one. A functional change emerged in the dwellings located on the axis of Meram Yeni Yol after the year 2000, the use of private offices has become widespread (architectural firms, travel agencies, insurance companies, law firms).

In Meram District, the multi-storey dwellings were observed especially in the areas that were zoned for housing in the last two decades. While the dwellings were previously having four or five storeys, today these dwellings can reach up to ten to twelve storeys. The number of gated communities that are located closely on the south axis of Meram Yeni Yol in Meram District also increased. The fact that land value of the area is relatively higher compared to the provin-



Figure 4. The gated communities in Meram region (Source: Google-Earth, December 2015).

cial-wide triggered the regulations in zoning and thus in the storied housing in the name of gaining profit (Aydın and Sıramkaya, 2014) (Figure 4). When the city is considered temporally/in terms of its presence in time, although the parcel size, building height, housing as proportional to the geometry of the building, its texture built in harmony with green and sociological relations express the integrity for long years, it started to resemble to the other residential areas of the city with the recent applications.

## Studio Apartments in Meram Region

Especially in the last years, the presence of new construction patterns as different dwelling spaces in Meram region has constituted a threat to the composition of neighbourhood texture which is devoid of social meaning and spatial integrity. Within the scope of this study, the most obvious illustration of this is the buildings which consist of studio flats.

This dwelling type called as “studio-apartment”, “studio-flat” names is a small-scale dwelling type in which the kitchen space is integrated with the living room and the bathroom and toilet needs are met in one space.

In the study, the area in the northern part of Meram Yeni Yol axis remaining within the walking distance of the faculty buildings is focused. Five studio-



Figure 5. The locations of the studio houses chosen as examples (Source: Author, Google-Earth).

The questions addressed to the studio apartment users:	The questions posed to the neighbourhood residents:
<b>1. Group questions</b> Social status of the user (a. Students b. Employee c. Family) - How many people share the flat? - Do you own this flat? <b>2. Group questions</b> What is your reason for preferring a studio apartment? Do you know the other users of the building? Do you know the other flat owners in the neighbourhood? What do you think about the amenities of the neighbourhood/district you live in? - Shops & Local amenities (Market, stationery, copy centre) Existing cafés, restaurants etc. The relation of the office/school to the location Proximity to the City Centre Degree of Safety	Duration of residency in the neighbourhood The level of relations with the neighbours Condition of greeting Meeting for special occasions (funerals, weddings) Calling or visiting in need of help Chatting Whether they know the users of the studio apartments in the neighbourhood Views on the presence of studio apartments in the neighbourhood Whether they desire to own a studio flat or not

Table 1. The questions addressed in the interviews to the studio flat users and neighbourhood residents.

apartment examples in the area were analysed and questioned in morphological and ontological aspects by considering the nature of the surrounding texture (Figure 5).

Also, the interviews were conducted with the studio apartment residents (30 people) and the residents of the dwellings in the neighbourhood of the studio apartment building (30 people), and the questions regarding their inhabitancy were addressed. The questions addressed to studio flat users and the neighbourhood residents are summarised in Table-1. The aim was to determine the users' reasons of preferring a studio flat, their communication with the other users, their views on the location of the building and the qualities of their flat with these questions. In addition, it was also aimed to determine the views of the residents living in the neighbourhood about studio flats which are new to the neighbourhood texture, the residents' situation of acceptance and acknowledgement as a qualitative study.

### Example 1

Example 1 was constructed in 2013 by integrating two separate parcels after demolishing the existing dwelling in the adjacent parcel. The parcel geometry is nearly square, and the building geometry is rectangular. The new building consisting of 1+0 and 1+1 residences are mainly used by students. The gross floor area is 35 m<sup>2</sup> in 1+0 residences, and 60 m<sup>2</sup> for 1+1 ones. 1+1 flats are built as duplex apartments and using the size projected by the planning, the attic floor of the duplex apartments is built as a bedroom. Though a few apartments are shared by two people, they are mostly used by a single person. The apartments are used on a rental basis by university students and a small number of professionals (academicians/nurses/banker). There is a total of 50 studio apartments in the building (Figure 6).

There is two storey duplex or two storey semi-detached family houses with gardens in the neighbourhood. The size of these houses ranges between 180 m<sup>2</sup> to 240 m<sup>2</sup>.

### Example 2

The building was constructed in 2013 on a rectangular parcel formed by integrating two separate quadratic-like parcels. The geometry of the building is consistent with the parcel form. It is a building comprising of 1+1 = 50-60 m<sup>2</sup> 20 studio flats that are mostly

► 10



Figure 6. Analysis of Example 1 and its neighbourhood texture. (Source: Author, Google-Earth).

used by students, however, the professionals (lawyers, police and civil engineers) dwell individually as well. A few numbers of flats are shared by two, and some are used by a student and parents. The occupants are tenants (Figure 7).

In the neighbourhood of the building, single detached, two storeys, duplex villas are situated, which are inhabited by nuclear families and extended families. In the immediate neighbourhood, there are small businesses around the mosque.

### Example 3

The building whose construction started in 2013 consists of twenty-seven duplex studio flats of 1+1 = 80 m<sup>2</sup>. A new parcel in L-shape was obtained by integrating two parcels each of which has different facades to different streets. Therefore the building geometry was formed in L-shape surrounding the adjacent corner parcel. The ground floor and the basement, first floor and the roof are integrated with each other in order to enable the use as a duplex flat. The size permitted by the development plan is used to the maximum degree. They are used either individually or shared by two students. The students living alone are sometimes visited by their families. The users of the apartments are tenants, and none of the landlords lives here (Figure 8).

In the immediate vicinity, single detached, two storeys, three storey and duplex villas are situated, which are dwelled by nuclear families and extended families. The faculty buildings are in the immediate neighbourhood.

### Example 4

The building is constructed in 2013 on two adjacent





Figure 10. Analysis of Example 5 and its neighbourhood texture. (Source: Author, Google-Earth).

floor+1 storied is located with two or three flats on every floor. Inhabitants are nuclear families or extended families with grandparents.

### The Evaluation of the Physical Characteristics

Upon evaluating the physical analyses with the texture around the studio flats, the following conclusions can be reached:

The parcel size of the studio flats varies according to the building parcels in the surrounding texture. In the three analysed samples, there are differences resulting from the construction after the integration of two parcels. This changes the size of the building as well. The parcel sizes of the other buildings existing in the texture are either equal or close to each other.

Though the formation of the parcel and the form of the studio flats are the same, the parcel integrations make the parcel geometry different from the shape of the adjacent buildings (Examples 1, 2 and 3). This illustrates the difference of studio flats in the texture. The area occupied by the studio flats on the site due to parcel integrations has also differed from the others, and while the other buildings in the texture were single detached buildings, the studio examples gained a place in the form of detached building size.

The height and the number of floors of studio

flats do not differ from the other dwellings in the texture and they are in the same form projected by the plan. However, when the building use is examined, it is seen that particularly in duplex studio flats, the ground floor is utilised with the basement floor and the first floor is with the attic. This situation differentiates the character of the frontage from the other applications that are present in the texture. Furthermore, although the building height does not change, the use of the attic floors throughout the building changes the perception of building size and differentiates the façade character.

In the examined studio flats, the number of flats varies between 4 and 20. The sample dwelling formed from 4 flats was due to the large size of the parcel. However, the examples of other dwellings involve either 1 or 2 flats. Most of the surrounding buildings were designed for the occupancy of single families and in the form of either single storey or duplex. Due to the presence of several flats on one storey in studio flats, and the placement of narrow side to the frontage in order to benefit from the sunshine more makes the character of the frontage different, and the opening of living spaces to the outdoors with balcony and the collocation of this accompanies the detachment from the housing identity.

When the analyses are evaluated morphologically, it can be claimed that studio flats have a different identity in the texture in terms of overall formation, floor use and flat formation, the size of the area occupied on the ground and frontage character. The cause of the characteristic differences are physically the application by integrating the parcels and the inclusion of the basement and attic in order to increase the number of flats, the high number of flats on one storey and opening of narrow side of the flat to the exterior in order to increase the number of flats benefiting from the sun.

### The Evaluation of the User Opinions

The residents of the studio flats describe the studio flats as new and comfortable and the life in studio flats with freedom and comfort. This is also the reason of selecting the studio flats as a dwelling. The offering of some studio flats as fully furnished becomes the reason of choice for the students who are new to the city and who had previously lived in the dormitory. It is observed that the majority of the students who use studio flats previously lived in houses or dormitories. The restriction of freedom, the inability of inviting guests to dorms, the obligation to enter the dorm at a specific time and the insufficiency of study rooms become the other reasons of choice in favour of studio flats. Almost all of the students using studio flats have lived in Konya at least two years. The majority is in their fourth year. The close proximity to their workplace or faculties is also desired.

The tenants mainly do not know each other. It is determined that there is no communication between the occupants of the building and also with the occupants of the other buildings, i.e. with their neighbours. The shopping opportunities in the vicinity of the build-

ing, the presence of local amenities like cafés and restaurants, the proximity to the city centre all affect the positive evaluation of the location.

The residents of the dwelling texture surrounding the building have been living at the same neighbourhood for 15-20 years. Therefore, they indicated that they recognise almost everybody and have good communication with their neighbours. Conversations and sittings between women take place in the daily life. However, they mention that they are not familiar with the studio apartment occupants and were not involved in any kind of neighbourhood relations with these occupants. They were disturbed with the presence of studio apartments, did not know who used these flats, and could not communicate because of the absence of family environment, and there was noise since the occupants lived alone and are mostly young. In addition, they are worried about the increase in the number of studio apartments which they do not want. However, there are people who like to own a studio flat at elsewhere and people who lean towards the idea of earning an income by letting it for rent.

Upon evaluating the user opinions, it can be claimed that the studio flats are preferred by users/students that prefer freedom, comfort and living individually. In addition, it can be seen that they live here either for educational or professional purposes.—The studio flats are preferred since they are close to the user's office or faculty. No neighbourhood relationships occur both inside the building and with the residents of the adjacent building. Students' or professionals' view that the choice for the fully furnished apartments would provide an advantage in case of a move to another city or district indicates impermanence.

While the residents of the neighbourhood had conversations with each other or knew each other, the absence of communication between the users of studio apartments was attributed to their leading of an individual life. The flux of users, their unfamiliarity, and the diversity of friends visiting them all caused distrust among the neighbours. The residents in the neighbourhood do not want an increase in the number of studio flats by underscoring the impermanence and the absence of families as occupants in these dwellings. According to the residents in the neighbourhood, it is important to be permanent, exhibit a family life for the feeling of belonging and confidence.

## CONCLUSION

As a dominant component of planning, the alteration in housing is inevitable throughout the changing line of lifestyles, socio-cultural structures, tastes and expectations. However, the growth and change of cities are also affected from many factors that cause the alterations in housing. In Konya City, the different housing typologies exist in a way virtually eradicating the previous applications. Even the new one is demolished; the current applications occur with different types and life styles. New housing is inhabited by new occupants, and the preference of the newer can sometimes is an

indicator of an image or status. However, in each case, the flat and its occupants become a part of the neighbourhood in the urban context, and the neighbourhoods gain identity by their residents and physical structures.

The alteration in housing causes the change of identity in the texture of the neighbourhoods in which the applications of studio apartments are seen in this study. Identity differentiates not only through morphological change but also through sociological change. The morphological change starts especially by the integration of the parcels and the application of a single building on two parcels. Therefore, the parcel geometry in the texture and the building geometry (and its volumetric effect) alters. The size of the studio apartments and the less number of spaces in them brings forward the question of the necessity of constructing large number of dwellings in one building. This also becomes a design preferred by the people who construct the building, i.e. the owner of the building. Therefore, the morphology of the building, parcel size, the foundation area of the building and its mass effect, the housing size and design, the inclusion of the basement and attics floors to the living spaces exhibit a diversity that does not conform to the surrounding texture in terms of the repeating view on the facade. These changes experienced on parcel scale comply with the traditional texture morphologically, and they are made in order to gain profit. All the examples started in 2013 were constructed sequentially by triggering each other and put into use. The number of these applications is expected to increase as it is clearly seen from some of the constructions to be completed and the presence of studio flats in the texture that were not examined in the study. Space is a result of organisation. The organisation character of the studio apartments, meaning the new ones, is different from the other dwelling patterns in the fabric from point of both the unit dwelling and the whole building evaluation. It can be said that the new one is a transfer of a model without a history beyond exhibiting continuity. Whereas in gated communities or multiple apartment applications, the families are using the dwellings, the individual life, the isolation of individual lives from the other residents in the neighbourhood, the temporariness of the living area for the tenant which results in the non-acceptance of the "new" impair the sociological structure in studio type dwellings. The occurrence of the new and different and the duplications of these applications will lead to the loss of real values pertaining to the urban texture in the places where the traditional neighbourhood relations are maintained and everyone knows and trusts each other. With the presence of studio flats, one or two parcels are no longer occupied by a single family but many people individually. Being neither a dormitory nor housing this physical settlement causes impermanence, but not permanence. The permanent and alteration triggering concept is the physical presence of the studio flats. The reason for building studio flats can be emphasized as the Turkish Nation's consideration of becoming a community instead of becoming a congregation. Initially, the families had



traditional living conditions with moral values and wider family structures; however today, the family structure turned into a nuclear family structure. Many sociological conditions such as economic freedom, marrying age, divorces, etc. affect the living place preference naturally. Therefore, the land owners constructed different dwelling types by evaluating this demand in terms of their profits. As a result, different sociological structures and dwelling types in the district textures have emerged the “new” variety/alteration/differentiation or rupture overlapping and existing together in the context of place. The construction and the possibility of construction of the copies of the “new one” and the potential of the existing texture to damage the physical and sociological continuity become the indicators of the disassociation. The answer to the question whether the change occurs with the preferences of the users or with the preferences of the housing offered to the users is unclear. However, it is important to consider that these two situations will be in a continuous cause and effect relationship in terms of controlling the changes. The alteration starts step by step from the smallest building site/parcel in the cities and becomes the harbinger of permanent and irreversible changes in the long term. The individual applications that trigger successive change have the risk of causing an unconscious, uncalculated and unplanned housing different from urban transformation. In the formation of conscious and sensitive housing textures, the morphological, sociological and ontological characteristics should be the main considerations, otherwise the negativities spread like a virus, the distinctive and valuable features get damaged, the disidentification starts and the values that should be sustainable disappear.

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# SUSTAINABLE PLOT-BASED URBAN REGENERATION AND TRADITIONAL MASTER PLANNING PRACTICE IN GLASGOW.

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## Abstract

*The failure of conventional, post-war development to bring about the housing-led regeneration of much of Glasgow's vacant and derelict inner-city land has exacerbated the loss of middle-income households to car-dominated suburbs built on green-field sites. Plot-based urbanism offers an innovative approach to development, based on an urban structure made up of fine-grained elements, in the form of plots, capable of incremental development by a range of agencies. The historical and morphological study of traditional, pre-war masterplanning methods in Glasgow suggests that a typically disaggregated pattern of land subdivision remains of great relevance for development, and that the physical form and organisation of urban land may relate to the capacity for neighbourhood self-organisation. This study assists future masterplanning and investment in the regeneration of inner-city neighbourhoods by suggesting ways of making investment more informed, and the development process more responsive to urban change. We argue that the publicly-funded sector could take on the role of lead provider of development opportunity through the adoption of methods derived from traditional masterplanning processes, providing opportunities for small-scale house building, and thereby supporting resilient and adaptable communities in the sustainable reuse of vacant inner-city land.*

**Keywords:** Regeneration, Plot-Based Urbanism, Urban Morphology, Urban Resilience, Sustainable Masterplanning, Glasgow.

## INTRODUCTION

The urban form of Glasgow has undergone radical change since the early 19th century, initially in the form of rapid expansion in response to sustained economic and population growth and, since the 1950s, of an equally rapid population contraction in tandem with economic, social and environmental decline (Checkland, 1981; Keating, 1988; Pacione, 1995). Glasgow has this history in common with other cities in the northern hemisphere founded on heavy industry and manufacturing, such as Detroit, USA, with which it shares the dubious distinction of being a former million-plus city (Ryan, 2006). These periods of change can be seen to have had a pronounced effect on the formation, subdivision and clustering of development land, particularly in phases of most intense change: those of Glasgow's late 19th century growth, and the 'destructive' phase of inner-city comprehensive redevelopment, from the 1950s to mid-1970s (McKean, 1993).

Primarily as a legacy of this destructive phase, Glasgow still retains some 1,300 hectares designated as vacant and derelict land (VDL). This is about 7.5% of its total land area, and by some distance the highest proportion in any Scottish city (GCC, 2010). Much of this land is in public ownership and located in the inner urban area, close to the existing roads network, services and centres of employment. It is recognised in Government strategy that the reuse of this vacant and derelict land could have a direct bearing on the city's

potential for both sustainable economic development, and environmental improvement, by redirecting house building activity away from the urban periphery to locations already well-served by transport and utilities infrastructure (Scottish Government, 2013).

There has long been a tendency for Glasgow's middle-income households to be displaced to the urban fringe (Pacione, 1991), (Gibb, K et al, 2000), typically to commuter suburbs dominated by car-oriented speculative development on green-field land (GCVSPDA, 2012). This is partly the result of decades in which the City Council insisted on reserving virtually all inner-city sites cleared through redevelopment for subsidised housing (Checkland, 1981). Displacement of population to the suburbs has been described as an effect of the 'centrifugal trends inherent in the urbanisation process' (Pacione, 1991, p168), to which regeneration can be considered a counter-strategy, by reusing existing infrastructure and substantially reducing long-term energy use in car-borne journeys to work and city amenities, while bringing people and economic activity back to rein-vigorate inner-city neighbourhoods.

The undeveloped land bank in the city must be viewed in a growth context, with a population expected to increase after decades of decline by around 90,000 over the next 25 years, or 3-4,000 people per year. At the same time, there is a measured shortfall in delivery of new housing against the planned requirement, of over 11,000 in the period 2008-2015 alone (GCC, 2015b). Annual comple-

tions of housing for sale fell from a peak of 2,542 in 2003-4 to 701 in 2014-15 (GCC, 2013, 2015a), considerably fewer than annual completions of affordable housing by the city's housing associations. The opportunity for projected additional households to purchase housing to meet their requirements in the inner city, rather than on the urban fringe, is therefore significantly compromised. We suggest here that these three factors- vacant land, middle-income household migration, and shortfall in new housing supply-together provide a sufficiently problematic set of circumstances to demand a fresh approach to physical regeneration.

The suggested approach is based on the study of traditional masterplanning, in which a clear separation between initial land subdivision, and the design and development of individual buildings, provides a durable and resilient urban structure capable of enduring historical cycles of change in urban form. This form endures in, for example, the early-19<sup>th</sup> century plan of Glasgow's Blythswood estate (now the city's central business district), and notably in the earlier example of Edinburgh's original New Town, both of which are distinguished by a fine-grained definition of plots in a clear relationship to the street network, enabling buildings to be developed incrementally under light-touch regulation. Conventional modernist, post-war masterplanning in contrast, by giving primacy to buildings, underplays this critical distinction between building and plot; the fate of one is bound up with the other.

This work is part of a broader task to establish a normative approach to masterplanning, based on a systematic understanding of city form, currently being pursued by the Urban Design Studies Unit (UDSU) in the University of Strathclyde, under the label of plot-based urbanism (see Porta and Romice, 2014). The study focuses on the delivery of this normative approach using the exemplary tale of the Gallowgate neighbourhood, but one example of many we are currently examining. The paper will briefly illustrate the case, before going on to draw more widely applicable conclusions from the historical study.

## APPROACH TO ANALYSIS

Urban form is inevitably linked to the nature of the investment activity which produces it; this form is evident in such properties as scale, location, density and urban character depending on the nature of the capital that is harnessed to its production, management and maintenance. It is possible therefore, through the study of changes in urban form at the level of land subdivisions, to observe cycles in the relationship between form and patterns of investment.

The objective of regeneration is to enable a city or neighbourhood to attain a self-perpetuating state of complexity and diversity, beyond the capacity of market force (Scottish Government, 2011). Clues about the nature of previous investment processes can be taken from this study of a typical regeneration area in Glasgow, in which a clear cycle of historic change is apparent in the process of plot formation. By under-

standing these cycles it is possible to suggest the form that investment should take in future in order to better support regeneration activity, as it has been defined above. The process of land subdivision adopted appears particularly important for a more effective investment strategy that might actually increase development activity, bring wider public access to the control of individual plots of land, and ultimately endow the urban structure with the capacity to respond to changing demands, without a perpetual need to undertake new masterplanning.

The idea of broadly spread control, as it relates to physical change brought about by a range of means, and by various agencies over the course of time, has been considered a significant factor in successful and enduring built form (Habracken, Teicher, 2000), (Akbar, 1988), making the housing development process more responsive to changing priorities and demands than other, less differentiated forms of provision. The observed adaptive response of plot-based urban form to external change over time suggests that it represents a means by which land use in the city can be made more economically useful, socially responsive and resource-effective in future.

The principles of urban analysis based on the plot- this being defined succinctly as 'the smallest expression of undivided ownership, and therefore decision-making, within the townscape' (Conzen, 2004, p75) - are well-established in the field of urban morphology (Conzen, 1960; Samuels, 1990; Porta and Romice, 2014, Tarbatt, 2012). To study the changes in the formation of plots over time, we identified key determinants of plot character measurable on plan, and applied these determinants to large-scale map records of the Gallowgate neighbourhood, at points from the mid-19<sup>th</sup> Century to the present. This area was selected for its status as a current regeneration priority area, and because its history of physical change is fairly typical for inner-city Glasgow.

One of the key characteristics of the urban fabric is the relationship between the plot and the street edge to which it belongs (Porta and Romice, 2014); hence the street edge may be viewed as an assembly of plots, rather than the plot being derived from the subdivision of a larger block (Porta, et al, 2011). The study allowed us to uncover the relative, or potential, autonomy of the individual plot, with its inherent potential to respond flexibly to changing demands and needs, independent of the larger urban organisation of which it forms part.<sup>1</sup> Thus, we recorded how plot size changed over time, and how in a related way larger, but directly connected, urban elements also changed; that is, street edges, and blocks formed from these street edges.

Whilst urban morphology is not yet recognised as having normative implications, to us, its capacity to express temporal clustering or grouping of plots is revealing. This can be used to move from a process of analysis to one of prescription, in enshrining specific physical characteristics of plots considered important for the promotion of particular modes of development, through the formulation of 'form-based codes' governing the design parameters of that devel-

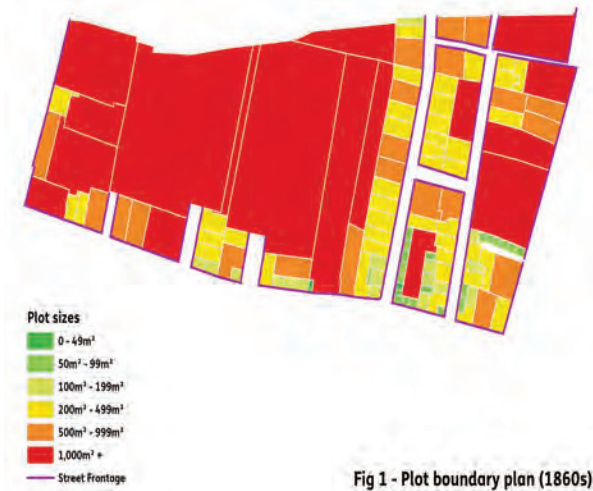


Fig 1 - Plot boundary plan (1860s)

Figure 1. Plot boundary plans

opment (Porta and Romice, 2014). The five periods selected for study correspond broadly to recognised morphological ‘plan-periods’, in which significant formative processes have led to urban form of a particular character (Conzen, 1960). Large-scale series maps were available for the years 1860, 1895, 1933, 1980 and 2014.

The physical analysis is set out in a series of figures:

- Plot boundary plans (Figures 1-5)
- Plot size distribution (Figure 6)
- Proportion of area defined in plots (Figure 7)
- Length of plot/street frontage (Figure 8)

Plot boundaries were defined as precisely as the detail of map sources allowed, and plots were then categorised by plan area (shown in the key to the plans). These individual plots might be occupied completely by buildings, partially by buildings, or vacant. All may be reasonably regarded as plots, provided they display the basic characteristics of the ‘regular’ plot, in being a defined piece of land that: a) has been developed; b) faces a street; and c) has access from the street on a primary edge.<sup>2</sup> This is a useful definition in its clear relation of plot to street, both as a reminder of the overall urban structure within which the plot exists, and in highlighting the presence of an independent means of access as an essential property, from which the potential for control and development of the plot is derived.

The 1860 plan (Figure 1) shows the neighbourhood in the process of urbanisation, with main streets already laid out, and some large plots occupied at low density by single villas, or unoccupied.

By the 1890s (Figure 2) urbanisation has progressed and the process of subdivision has extended over much of the area, increasing the number of defined plots, the majority of which are used for denser blocks of tenement housing. Plot definition is advanced, and new streets formed, accompanying the process of regular plot formation.

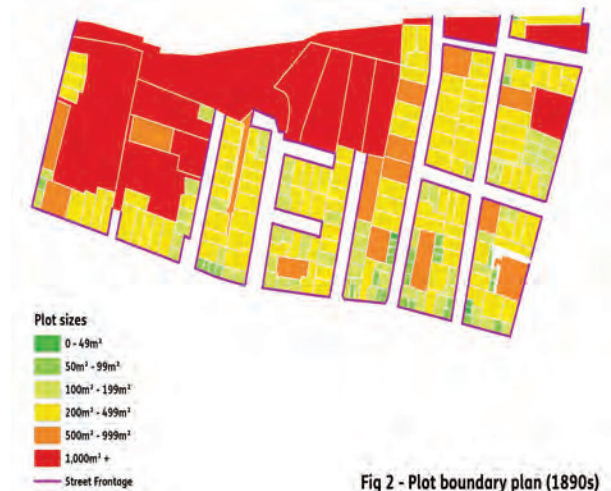


Fig 2 - Plot boundary plan (1890s)

Figure 2. Plot boundary plans

By 1933 (Figure 3) the number of plots is seen to have increased, and some evidence of consolidation is evident where larger plots are formed through a process of amalgamation to accommodate public buildings, cinemas and factories and the like within the existing urban fabric and street structure.

The 1980 plan (Figure 4) post-dates the comprehensive redevelopment of the area, and represents a phase of ‘metamorphosis’, in which the urban structure is radically revised (Conzen, 2004). This reflects the adoption by the municipal authority, from the late 1950s, of a comprehensive development strategy for inner-city renewal, in which the public acquisition of land and buildings was a prelude to widespread demolition and reconstruction following modernist planning principles.<sup>3</sup>

Two features are particularly striking; (i) the urban structure has fundamentally changed, so that the dominant street geometry internal to the area has altered from established north-south orientation to east-west; and (ii) the proportion of land that is left

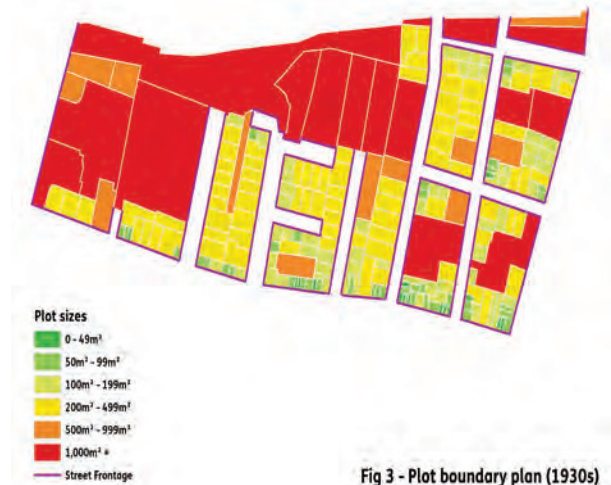


Fig 3 - Plot boundary plan (1930s)

Figure 3. Plot boundary plans



Figure 4. Plot boundary plans

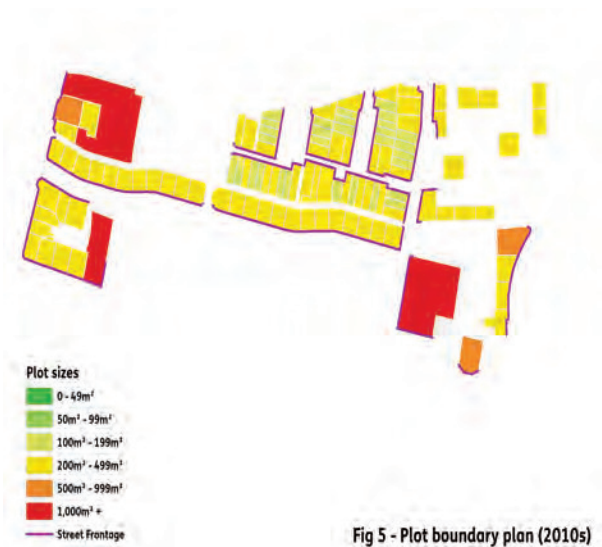


Figure 5. Plot boundary plans.

over, that is, undefined in plot boundaries, has risen considerably. The relationship of plots to streets in 1980 has generally become far more complex, notably in the northwest corner of the area now occupied by housing. While the majority of plots can still be said to be 'regular' (being clearly defined, and directly entered from a street), new plots appearing on the plan take on a more ambiguous relationship to the street.

In the most recent plan, (Figure 5) the essential structure established in 1980 is maintained, with notable changes being the clearance of clusters of plots in the north and south of the area, and their partial replacement in a rather more regular pattern on a new east-west street, this being an apparent attempt to return to a stronger and clearer plot-street relationship, after the chaotic interventions of comprehensive development.

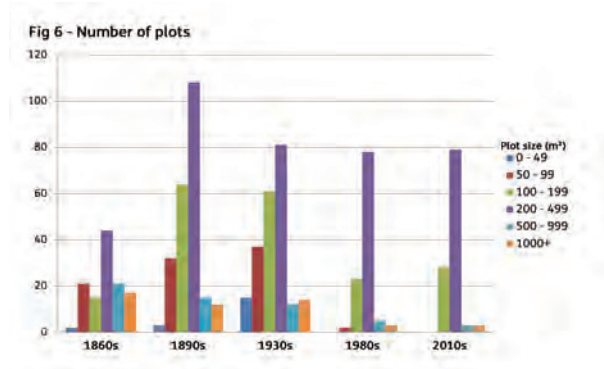


Figure 6. Plot size distribution.

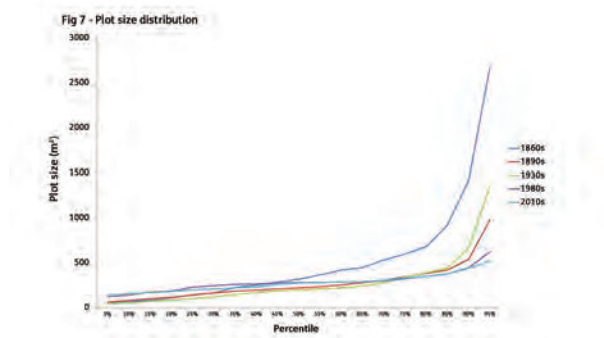


Figure 7. Proportion of area defined in plots.



Figure 8. Length of plot/street frontage.

## ANALYSIS AND INTERPRETATION

Having delineated the individual plot boundaries through this series of five maps, and captured these as individual shape files on a Geographic Information System (GIS), the data was then interrogated further:

The distribution of a range of plot sizes is shown, from the very small, below 50m<sup>2</sup> to the very large, over 1,000m<sup>2</sup>. While the period up to 1933 has a relatively consistent distribution, a striking feature is the narrowing of the range of plot sizes post-redevelopment, in 1980 and 2014; now virtually no plots fall into the small (below 100m<sup>2</sup>) or large (above 500m<sup>2</sup>) categories. There has evidently been a tightening of plot size distribution, corresponding to the provision of much more uniform built form through the process of redevelopment, bringing with it a simplification of urban structure and reduction in its diversity.

The total number of delineated plots increases significantly from 1860 to 1895, before declining slightly as a result of the amalgamation or accretion of existing plots to accommodate larger building types, an aspect of cyclical renewal through the process of plot repletion (Conzen, 1960). Plot numbers then decline steeply in the period between 1933 and 1980, after comprehensive development.

The effect of redevelopment on the proportion of total area actually defined within plot boundaries is seen to fall from 70% and above in the period 1860-1933, to around 30% in later years. Whilst some of this change might be accounted for in the technical difficulty of plot definition around non-conventional built forms (such as multi-storey flatted blocks), which may tend to under-record the area included in plots, it remains clear that the proportion of undesignated area (i.e. land outwith plots) has risen dramatically.

Measurement of length of plot/street frontage reveals change in the pattern of 'regular' plots- those with access to the street on a primary edge, thereby contributing actively to the functioning of the street network of the neighbourhood. Gradual increase between 1860 and 1933 is evidently the result of the formation of new plots on streets, although this process has been inhibited by the construction of a railway cutting on the northern boundary of the neighbourhood, preventing significant extension of north-south streets after 1860. Beyond the 1930s the frontage length declines, as much plot development (in the form of new municipal housing) has been laid out without a clear and recognisable plot-street interface; it does not contribute, in a functional sense, to the street. But by 2010 this housing has been demolished, and its replacement is once again formed on plots facing new streets, a change reflected in a modest increase in measured plot/street frontage.

## SUMMARY OF FINDINGS

The results of the analysis of plot development and change over the period 1860-2014 in this series of graphs consistently describe two distinct and contrasting periods of development: the period from 1860 to 1933, in which significant change in the composition of the neighbourhood took place through subdivision and repletion, and (to some extent in later years), amalgamation of plots, developing, strengthening and clarifying the urban structure; and the period after 1933 in which radical change, or 'metamorphosis' was seen to comprehensively reorder the plot definitions of the area, along with its buildings.

In this latter period a number of processes are seen to act, if not together, then certainly at the same time: the number of plots reduces, mainly as a result of an increase in undefined land; the relationship of plots to streets becomes more complex and indirect in respect of entrances and fronts on to streets; and the diversity of plot size diminishes. These findings, corroborated by further similar case studies in Glasgow not presented here, provide the basis for observations which, we argue, can assist in the regeneration

process in inner-urban areas which, like the Gallowgate, are subjected to redevelopment blight.

An obvious consequence of comprehensive development is the wholesale removal of existing buildings; what this study has shown is that the removal of existing urban structure and plot definition is just as important, since these two elements have been seen throughout the period covered to be capable, over time, of embracing change and modulating the new with the existing, without a loss of overall coherence, diversity and, ultimately, resilience. The historical, cultural and economic background to Glasgow's development meant that its evolution from mid-19<sup>th</sup> to mid-20<sup>th</sup> century frequently happened in a rather spontaneous and intermittent manner depending on the availability of capital, within an interconnected urban layout, well integrated into the wider urban context (Morgan, 1996; Reed, 1993, Pacione, 1995). From the 1960s however, the Gallowgate was redeveloped on radical spatial principles, disconnected externally, and made reliant on fewer, less clear plot/street relationships. New plots and streets were comprehensively imposed on the existing layout, suggesting the co-ordinated and systematic intervention of a single authority. These are the circumstances known to have existed during the period of comprehensive development in Glasgow, guided centrally by a municipal authority with wide powers to acquire and redevelop land (Keating, 1988; Markus, 1993). The built form apart, what remains as a legacy of that process is a set of land subdivisions that seems to lack the capability for supporting change, other than in the manner initially created, and equally destined to failure; it is, then, a self-perpetuating but self-limiting form. In order for change to then happen, renewed masterplanning is inevitable, and such plans have indeed been commissioned in recent years by the public agencies leading the current regeneration of the area.

## IMPLICATIONS FOR MASTERPLANNING

Our historical analysis, combined with complementary work by UDSU on masterplanning and urban morphology, suggests that a historical perspective on the role of urban structure at the level of the plot can help to re-establish sound approaches to dealing with the physical regeneration of inner-city sites in future, opening these up for development in new ways.

If we consider the urban structure to be made up of relatively independent elements- the streets, plot boundaries and buildings occupying individual plots- the potential durability of this basic structure appears to provide the desired conditions for diversity of use and of occupant control (Talen, 2006). Change in both its synchronic and diachronic aspects is seen to be possible, so that diversity of development, and evolution of use over time, are capable of being accommodated within an established and enduring plot structure (Tarbatt, 2012), (Whitehand, 1992). It may follow, then, that a process of urban development which supports and engenders meaningful levels of individual control has some kind of definable grain, or

texture, at the detailed level which distinguishes it from less supportive and engendering forms (Jacobs and Appleyard, 2013).

This emphasis on the plot as the smallest unit of urban form differentiates the plot-based approach from conventional urban design techniques, which, while frequently sharing an interest in the basic arrangement of buildings facing streets, take the urban block to be the defining, or primary, unit of that morphology (the approach adopted, for example, in much of the Berlin IBA development zone (Davey and Clelland, 1987)). It appears that a development process based on fundamentally changing the pattern of land subdivisions across a defined area, removing the majority of historic plot definitions and establishing a completely new and different pattern, is unlikely to come about through an organic process in which the next stage can be seen to emerge naturally from the circumstances of the last.

If new masterplanning – by which we mean a structural approach establishing the spatial parameters of future evolutionary change – is to be used in the regeneration of numerous physically damaged and disordered neighbourhoods, the present study suggests that the recognition of the fundamental importance of plot definition is a starting point to help escape the fate of a continuing cycle of failure and metamorphosis. The evidence of the period 1860-1933 in the Gallowgate shows that a neighbourhood can undergo significant change and development, within the parameters of the existing urban structure in an incremental fashion, and without the loss of the fundamental integrity of urban form based on streets and the land subdivisions which relate directly to those streets. Change can be brought about piecemeal and spontaneously, rather than necessarily large-scale and comprehensively, provided a suitable base is established to start from. This is precisely the proper role and scope of the masterplan.

Development in late 19<sup>th</sup> century Glasgow was fuelled by the investment of small-scale capital released gradually into physical development (Morgan, 1996); the existing urban structure was in turn capable of accommodating the physical change brought about by this gradual flow of capital. By way of contrast, the comprehensive development funded by municipal capital significantly reduced the diversity of plot sizes in the Gallowgate, generating new and inefficient relationships between plots and streets, both of which acted in this process (as much as the clearance of the established diverse range of land ownerships and functions) to remove the existing ability of the urban structure to self-regulate and change incrementally.

Municipal authorities in charge of implementing radical urban change increasingly used compulsory purchase powers as a means of land consolidation, as the 20<sup>th</sup> century progressed. Certainly, the record of municipal development in Glasgow since the 1960s indicates an over-dependence on large-scale planning and the use of these powers to control land and pursue urban development (Robertson, 1998). Indeed, the use of compulsory powers in this way,

backed by large controlling municipal capital as a means of land consolidation for redevelopment, has been viewed as being a general trend in the latter half of the 20<sup>th</sup> century (Whitehand, 2001). Perceiving quite the same dynamics in New York in the late 1950s, Jane Jacobs made the distinction between ‘gradual money’ and ‘cataclysmic money’ (Jacobs, 1961). Gradual money was believed capable of supporting enduring complexity and diversity, in ways cataclysmic money was not. More than fifty years later, it is probably time to take her words seriously and work for a new plot-based planning agenda where gradual money is the new normal (again).

Even the Urban Task Force of the late 1990s chaired by Lord Rogers, proposed a development approach based on priority areas with reduced bureaucracy and weakened protection for existing ownership rights (Urban Task Force, 1999). Neighbourhood renewal has indeed often been seen as a process dependent on centralisation of the control of land (Cochrane, 2007). While central co-ordination may be a necessity, the role for the authority needs to be realigned to the establishment of a suitable framework (both spatial and regulatory), followed by its strategic withdrawal. This balancing of masterplanning by a central authority, with opportunities for creating an open structure and small-scale opportunity, has been characterised as ‘top-down meets bottom-up’ (Campbell, 2010), a fundamental feature of complex adaptive systems in nature and society (Gunderson and Holling, 2002).

## CONCLUSION

We argue here for a new approach to the masterplanning of inner-city regeneration areas like the Gallowgate, based upon the sound foundation and suitably strong underlying structure of streets, infrastructure and land subdivisions (rather than buildings, necessarily) to enable and support a virtuous cycle of gradual investment, capable of meeting changing human needs over time in a flexible and responsive manner. An underlying structure which does this can assist urban sustainability by avoiding the waste of resources, environmental blight and social dislocation that have been attendant on inflexible change requiring wholesale demolition, physical re-planning and dispersal of population. Such an incremental approach might also, incidentally, because of its capacity to reduce development risk, be more likely than conventional speculative development to be supported by private investment (Adams and Tiesdell, 2013). There is nothing to suggest that a range of development forms, and their respective funding arrangements, could not coexist under the umbrella of a single masterplan structure.

It has been suggested that the UK has historically had difficulties with such an approach, partly because of a recent tendency towards non-intervention by public bodies directly in planning processes (Larkham, 2006), understandable perhaps given the manifold failures of the post-war decades. This is in contrast to a view held in other European countries in

which the role of the public sector in planning for, and directing, private sector input is better grasped and embraced (e.g. the well-documented redevelopment of Tubingen South (De Maddalena and Schuster, 2005)).

What must be countenanced by the public sector, if it is to take on an effective master-planning role as lead authority, is a process that allows ownership and control of individual pieces of land to become as diverse and broad as possible, in order, primarily, to break the cycle of 'cataclysmic' intervention. This diversification might be assisted by a return to something resembling the breadth and diversity of plot distribution seen in the 1895 plan of Gallowgate (Figure 2 above), to be achieved through careful masterplanning that carries with it an awareness of the fundamental importance of plots as the building-blocks of the urban environment. It appears that land subdivision must be decided upon before land ownership, if a process of sustainable urban development is to be nurtured.

This also requires a fresh look at how low-risk opportunities might be provided, making inner-city vacant sites as attractive to investors as the green-field urban periphery. But land can also be made available to a wider range of interests, including small-scale and individual developers, and to support a range of delivery methods including self-managed and self-build housing. By offering access to a supply of land ready for development, with the infrastructure in place and a roads network forming (or reinforcing) the structure of the neighbourhood already established, the lead authority can provide a real opportunity for middle-income households, able to raise mortgage finance, to fund new housing in the form they wish to have it and at the pace of development they wish to follow. Demand for such a break with conventional housing processes appears well established (Parvin, et al 2011).

In taking responsibility for infrastructure and observing a critical separation between urban structure and the buildings which populate it, the lead authority can, at the same time as supporting self-managed housing processes, ensure that new development meets statutory planning standards, and that the roads and other infrastructure within which plots are delineated is supportive of this approach, being hierarchical, interconnected, and with good connections to the existing street network outside the regeneration area.

In Glasgow, the City Council has recently indicated its interest in accelerating housing production by progressing from an over-dependency on conventional private development, adopting instead a lead-enabling role. Its activities are intended to include 'pump-priming sites for development, investing in up-front infrastructure and land remediation, taking new and innovative approaches to ensure flexibility and shared risk between partners' (GCC, 2015a, p12); this process is intended to 'increase the range of housing options on offer including self-build and custom-build plots' (ibid, p9). While detailed strategy remains to be formed, a clear return is sig-

nalled to an incremental form of development, harnessing the benign power of gradual money, and the small scale, fine-grained and diverse development it can support.

The challenge becomes one of developing, from a morphological approach to the analysis of urban change processes, a set of principles of plot formation on which to base detailed urban design guidance for future development; design guidance that is 'performative' rather than 'prescriptive' in its approach (Marcus, 1985), emphasising the primacy of plot characteristics and underlying structure rather than buildings. These principles need to be capable of both establishing formal constraints, and enabling the orderly passing over of development initiatives to the lowest appropriate level of control, even down to the individual self-builder. It is this 'performative' quality that we see as being essential to the resilience and adaptability of urban structure, making it able to offer a realistic, desirable and achievable route to regeneration and greater social and environmental sustainability than the car-dependent and socially-isolated suburbs of the urban periphery.

Guidance in the form of design codes might, indeed, go beyond the governance of the initial formation stages of urban development and, taking a cue from this study of the Gallowgate, set out principles that future subdivision and amalgamation of plot form should follow, to support an urban structure capable of adaptive response to changing demands over time, rather than one condemned by its own rigidity to 'cataclysmic' change.

## Notes

[1] While noting that morphological analysis must be placed within a context of social and economic factors in order to get the whole story of urban form and change (Conzen, 1960), the method of physical definition and description of plots is of more immediate interest, given the intention to move towards a prescriptive approach to plot-based development.

[2] We are indebted to the work of Jacob Dibble of UDSU for clarifying these terms.

[3] 29 Comprehensive Development Areas were declared in Glasgow by 1959. Few progressed significantly beyond the clearance of existing urban fabric.

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# DESIGN FOR CHANGE: FIVE PROXIES FOR RESILIENCE IN THE URBAN FORM.

Alessandra Feliciotti, Ombretta Romice, Sergio Porta

## Abstract

*The sheer complexity and unpredictability characterising cities challenges the adequacy of existing disciplinary knowledge and tools in urban design and highlights the necessity to incorporate explicitly the element of change and the dimension of time in the understanding of, and intervention on, the form of cities. To this regard the concept of resilience is a powerful lens through which to understand and engage with a changing world. However, resilience is currently only superficially addressed by urban designers, and an explicit effort to relate elements of urban form to resilience principles is still lacking. This represents a great limit for urban designers, as the physical dimension of cities is the matter they work with in the first place. In this paper, we combine established knowledge in urban morphology and resilience theory. We firstly look at resilience theory and consistently define five proxies of resilience in urban form, namely diversity, redundancy, modularity, connectivity and efficiency. Secondly, we discuss the configuration of, and interdependencies between, several constituent elements of the physical city, as defined in urban morphology and design, in light of the mentioned five proxies. Finally, we conduct this exploration at five scales that are relevant to urban morphology and design: plot, street edge, block, street and sanctuary area / district.*

**Keywords:** Urban Design, Resilience, Proxies, Urban Morphology, Urban Form.

## INTRODUCTION

Up to fifty years ago, planners and designers believed that urban problems could be solved with high certainty over the long time (Firley and Grön 2014). Today, we see cities as extremely complex systems characterised by the dynamic interaction of intermediate nested human, physical and institutional systems (Moench, Tyler and Lage 2011) and by a condition of perpetual disequilibrium (Batty 2013b). This sheer complexity greatly outstrips our ability to make reliable predictions (Holling and Goldberg 1971) and leaves planners and designers with the seemingly impossible task of making long-term plans in the face of an uncertain future. It challenges the very adequacy of existing disciplinary knowledge and tools in urban design and highlights the need to incorporate explicitly the element of *change* and the dimension of *time* in the understanding of, and intervention on, the form of cities (Porta and Romice 2014; Thwaites et al. 2007). This shift is not straightforward; however, over the last three decades, the sustainability agenda has already brought important new values, methods and tools in both urban design theory (Carmona 2010) and practice (Rudlin and Falk 2009) that seem pointing in this direction. More recently, the term sustainability was reformulated in a dynamic dimension as an “*inherently moving target*” (Novotny, Ahern and Brown 2010:141) whose path cannot be charted in advance. At this regard the concept of resilience becomes a way to understand and engage with a changing world tun-

ing and adapting our action in the urban system as the “*target*” of sustainability moves over time.

Resilience and urban design are hence potentially important allies to meet the challenge of future urbanisation (Marcus and Colding 2014). Currently, however, resilience remains a relatively new concept in urban design (Hassler and Kohler 2014), where it is often only superficially evoked but is still far from reaching a solid and operational status (Allan and Bryant 2011). Despite resilience theory being “*the most promising trans-disciplinary arena in the built environment*” (Hassler and Kohler 2014:120), and whilst urban form greatly influences environmental (Mehaffy 2015), social (Thwaites, Mathers and Simkins 2013) and economic (Tachieva 2010) sustainability in cities, an explicit effort to relate the constitutive elements of urban form to principles of resilience is still lacking. At present, there is no systematic way to account for the distinct contribution of the urban form to resilience. This is a remarkable impediment for urban designers to positively contribute to the understanding and management of current urbanisation, as form is their elective *medium* of intervention in the urban system (Marcus and Colding 2011).

Fortunately the emergence of a stronger evidence-based approach in urban design research, supported by an increasing interest on the physical form of cities (Batty and Marshall 2009) and greater data availability and computing techniques (Batty 2013a), gives us means and opportunity to make the concept

of resilience more directly applicable to urban design. In that sense, this paper is an effort to make research on resilience in cities more relevant to urban designers by developing a specific focus of this research in the area of urban morphology.

In the following pages, the form of cities is explored from a resilience perspective. In particular, as resilience is a complex and layered concept, this is looked at by breaking it down into what Carpenter, Westley and Turner (2005) define as *resilience proxies*: context-base attributes indirectly inferable to resilience and ascertainable through observation. These are presented with an updated definition that accounts for their role in building resilience in relation to the urban form, combining literature from resilience theory, system ecology and urban design. Finally, after introducing the spatial-temporal scales which make up urban form and are typical of the urban design area of knowledge, each will be discussed in relation to its contribution to the selected proxies. Ongoing research by the authors is currently focusing on the development of additional and integrative proxies that aim at increasing the potential inclusivity of the proposed framework, tying together formal and human-ecological and behavioural aspects.

## RESILIENCE PROXIES FOR THE URBAN FORM

There is currently no agreement in literature on a unified list of proxies encompassing all aspects of resilience: a multidisciplinary review of literature carried out by the authors (Feliciotti, Romice and Porta 2015), highlighted over 30 attributes associated to resilience across over a selection of more than 40 publications over the last 40 years. From this total, and for the purposes of this study, the 5 most frequently associated to urban form were selected.

### Diversity

A core concept in resilience theory, diversity enables systems to implement multiple coping strategies (Marcus and Colding 2011), helping them remain relatively stable through change and providing them with higher potential for innovation. Diversity frequently appears in urban design literature in relation to the use and form of cities (Jacobs 1961; Montgomery 1998; Tarbatt 2012). Diversity of uses and transport modes is linked to liveability, economic attractiveness and healthier lifestyles (Mehaffy 2015; Wood and Dovey 2015). Diversity of form is important even beyond any specific function: the very way urban space is divided and subdivided can give places an intrinsic capacity to carry diversity. This enables them to “*continue to succeed despite changes in economic conditions, technology and culture*” (Montgomery 1998:106) despite some uses change or are lost, also supporting diffusion of innovation through knowledge spill-overs (Wood and Dovey 2015).

### Connectivity

Connectivity describes the ease of flow within a system and across systems. In resilience both high and low connectivity can be desirable: the first facilitates diffu-

sion of knowledge and recovery after disturbance, the second reduces the spread for disturbance and enables the preservation of pockets of memory (Marcus and Colding 2014), although when this brings fragmentation, it affects negatively the system. In the urban form, both internal and external connectivity greatly affect people movement and the location and intensity of activities (Mehaffy et al. 2010): this reflects how lively and well-used places are (Remali et al. 2015). Because higher connectivity increases the points of contact and exchange between elements of the urban fabric, often the *structure of connections* between them matters even more than their *nature* (Salat and Bourdic 2014).

### Redundancy

In a system, redundancy is the availability of multiple components or pathways “*performing the same, similar or backup functions*” (Ahern 2011:342) providing an *insurance* mechanism for anticipating change, damage or failure. A redundant system has lower probability to stall: in case of failure of one or more components, redundancy ensures continuity through availability of substitutes (Anderies 2014). Notably, redundancy is not just about duplication of functions, as the degree of internal variability within each functional group (Liao 2012) is what gives the system the *buffer capacity* to use alternative resources or paths when the principal ones are lost (Anderies 2014). Redundancy is a structural property of the urban form independent from any particular future scenario (Lhomme et al. 2013), but can help the survival of a system, when traumatic events occur.

### Modularity

Modularity describes a system where functions or services are locally distributed and spread across decentralised sub-systems (Ahern 2011). Internally, modules are tied by strong close-range internal connections while externally, they are kept together by relatively weak long-range connections (Salingaros 2000). Individually, each module is structurally and functionally unitary and independent while, as a whole, modules are loosely interdependent (Anderies 2014). This makes modules both autonomous elements and part of the system and enables them to aggregate to form new higher-scale *wholes* without ever losing their individual identity (Salingaros 2000). Hence, modularity is crucial for resilience. Thanks to a relative autonomy, each module or sub-system is sheltered from *over-connectedness* (Pickett, Cadenasso and McGrath 2013): it can fail without severely affecting others and test novelty without disturbing other modules, thus ensuring stability. At the same time, the interdependency between modules allows innovation and knowledge to spread, promoting adaptation. In the urban form, modularity controls how urban elements interact with each other and across scales. Hence, it depends on the degree to which smaller components integrate, assemble, link or are autonomous from others. In a modular nested structure, “*not even one scale can be missing, otherwise the whole system is unstable*” (Salingaros 2000:293).

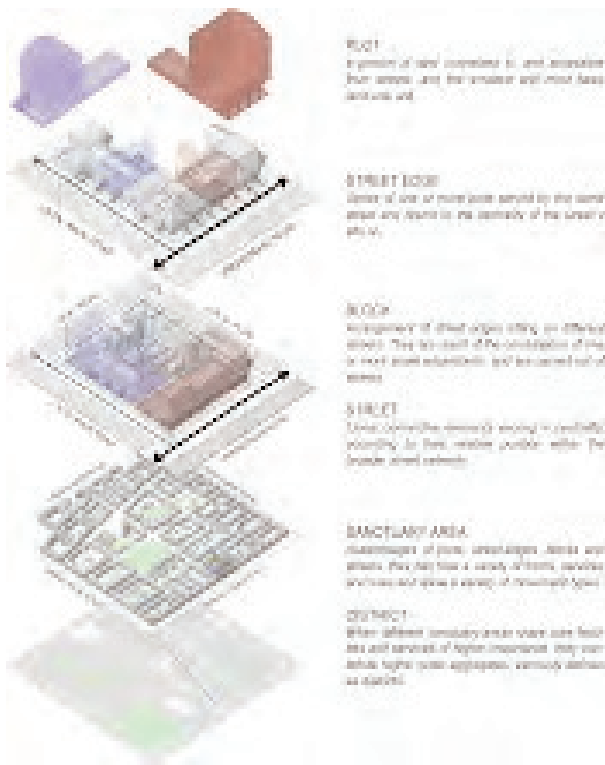


Figure 1. Hierarchy of morphological scales. (Source: Authors).

### Efficiency

The concept of efficiency in resilience, while often listed, is controversial. Several authors argue that efficiency is achieved at the expense of diversity (Anderies 2014), connectivity (Chelleri and Olazabal 2012), redundancy and modularity (Novotny et al. 2010), thereby decreasing overall resilience. This is the case when efficiency is addressed to form a short-term perspective that seeks to simplify problems by *optimising processes* and *maximising outputs* at only one scale: in fact, in complex systems there is no optimal state and, due to scale interdependency, maximisation of one element or process has unpredictable non-linear repercussions on others (Holling and Goldberg 1971). Indeed, in complex systems, efficiency does not derive from a process of simplification but, conversely, it requires an increase in structural complexity *at each and every scale* (Salat and Bourdic 2012). In the urban form, efficiency has to do with the hierarchic organisation of different urban elements and requires that, at all scales, the same level of complexity is guaranteed. In this regard, several studies have found that this corresponds to a scale-free urban structure, mathematically described with an inverse power law that accounts for the frequency of an element's appearance in relation to its size (Salat and Bourdic 2012): in an efficient urban structure, a long tail of smaller elements and tighter links is countered by progressively fewer larger elements and looser links.

### RESILIENCE PROXIES ACROSS THE SCALES OF THE URBAN FORM

As in all complex systems, also in cities, sub-systems

(human, institutional and physical) operate across multiple scales. The urban form owes its ability to adapt to fluctuating economic, environmental and social circumstances to the dynamic interplay between scales. Thus, we will now observe how the five proxies manifest themselves across what we see as fundamental scales of the urban form (Figure 1). The adopted classification combines classical methods of urban (Caniggia and Maffei 1979; Conzen 1969), with original research carried out at the Urban Design Studies Unit (UDSU) of University of Strathclyde (Dibble et al. 2015; Mehaffy et al. 2010; Porta and Romice 2014).

The smallest scale is that of the *plot*, a portion of land connected to, and accessible from, streets (Caniggia and Maffei 1979; Tarbatt 2012) and the smallest and most basic land-use unit (Panerai, Castex and Depaule 2004). Series of one or more plots served by the same street form the *street edge*. This is bound to the centrality (i.e. relative importance) of the street it sits on, which in turn, depends on the street's role within the larger network (Porta and Romice 2014). Arrangements of street edges sitting on different streets - often characterised by different centrality - form *blocks*. Blocks are the result of the combination of one or more street edges/plots, and are carved out of *streets*. Streets are linear connective elements varying in centrality, according to their relative position within the broader street network. Several blocks and streets bounded by urban main roads or natural boundaries are called *sanctuary areas* (Appleyard, 1980; Mehaffy et al. 2010). Depending on their size, they can host a variety of forms, services and uses and allow a variety of movement types. When different sanctuary areas share core facilities and services of higher importance, they constitute higher order aggregates, variously defined as neighbourhoods, districts, urban cells (Frey 1999) etc. depending on culture and context. While plots and streets are homogeneous units of investigation, street edges, blocks and sanctuary areas are aggregate elements defined in relation to other elements (the plot pattern, at the smallest scale, and the street network at the largest scale). Higher (i.e. region) and lower (i.e. buildings, dwelling units) scales are also of relevance to urban design, but will not be addressed specifically in this study.

### Resilience proxies at the plot scale

Plots have a crucial role in building resilience (Figure 2): as they can host a variety of functions vertically and horizontally, they are crucial for diversity. However, as functions tend to change quickly, the geometry of plots becomes crucial in its capacity to accommodate different functions in time (Kropf 1996; Moudon 1986). In particular, the presence of a long tail of small plots countered by fewer large plots is signature of a complex efficient scale-free structure: small plots are generally more flexible to change of use and adaptation, reason why they are favourite location for creative industries of all types (Wood and Dovey 2015); simultaneously small amounts of larger plots offer the perfect setting for more specialised functions. According to Salat, Bourdic and Labbe (2014:80) "A variety in sizes of plots provides investment opportunities for

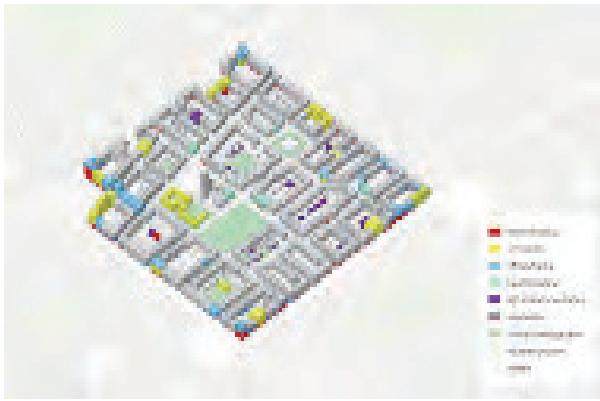


Figure 2. Resilience at the scale of plots (Source: Authors).

every budget and every investor, which creates a diversified market with a multiplicity of actors”, increasing the chances that similar functions are provided in different ways simultaneously, and hence redundancy: if one fails others can subsist, promoting the ability of places and people to self-organise and re-organise easily (Marcus and Colding 2014). Over time this also allows the emergence of other types of diversity thus generating a higher level of *mixité* in terms of building ages, values, layouts and sizes, etc. (Jacobs 1961). As each plot is occupied by an independent function and is subject to an autonomous ownership regime, to a large extent plots work as proper modular elements: they are individually, functionally and geometrically independent from other plots while at the same time somewhat connected to each other (as they rely all on the same network). However, modularity at the scale of plots significantly depends on plot geometry: with size comes a different capacity to aggregate or disaggregate, where larger plots are particularly disadvantaged, compared to small plots (Habraken 1998; Moudon 1986; Panerai et al. 2004). Furthermore, simpler geometries (generally rectangular) are better suited to favour the emergence of coherent wholes. Finally, as plots represent the origin and destination to most trips, plot accessibility is important for connectivity: higher number of accessible plots, implies larger availability of different and independent destinations reachable within short distance or time (Marcus and Colding 2011), hence higher internal connectivity.

#### Resilience proxies at the scale of street edges

Street edges are the interface between streets and plots, and hence between public and private domains (Thwaites et al. 2013). Diversity of street edges is a reflection of the diversity of abutting streets but this “synchronisation” can be facilitated or impeded depending on the *grain* of its constituent plots, the distance between street intersections, and crucially by the level of “constitutedness” of the street (Van Nes and López 2007), that is the extent to which building fronts and street are in close visual and functional relationship with each other. Generally, this comes through a gradual process of adaptation through time that leads to higher diversification: when there is good responsiveness between hierarchy of streets and plot pattern, street fronts become a constituent component of the

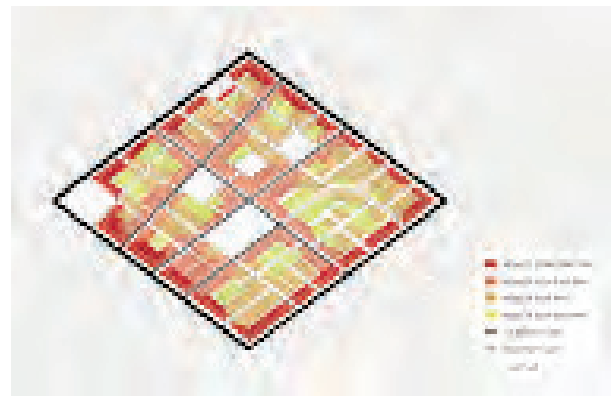


Figure 3. Resilience at the scale of street edges (Source: Authors).

complexity of the urban landscape, which in turn leads to higher efficiency. However, in much post-war development street edges were explicitly designed in order to be “unconstituted”, reduced to iteration at vast scale of very few types; that resulted in a drastic reduction of the number of different urban interfaces and a mismatch between plots and streets. As interfaces between streets and plots, street edges also control how different urban elements connect to each other (Thwaites et al. 2013). In this, street edges are crucial for modularity: the degree of autonomy of and inter-dependency between modules partly rests on the degree to which their borders are permeable to different kind of flows. Alexander et al. (1977) stressed extensively the fundamental role of edges and interface elements in the creation of coherent wholes. Again, depending on their “constitutedness”, street edges can be “soft” and porous to exchange (active fronts, arcades etc.), or, conversely, limit interaction (setbacks, etc.) or even preclude any joining (high fences, blank fronts no access points, etc.), in which case, adjacent modules can be isolated despite their physical proximity (Gehl 2011). The degree of permeability of street edges also depends on the presence of many or few access points and, in this sense it becomes very important for connectivity, particularly at the local scale. A greater number of tightly paced access points, made possible by the presence of many relatively narrow plots, increases accessible destinations, which is beneficial for social life (Romice et al. in print). Either ways, the desirable degree of permeability of street edges depends on street importance (Figure 3). Street edges located onto major thoroughfares require greater permeability to support continuous interaction between public and private space. Conversely predominantly residential streets do not need the same intensity of exchange, hence they can afford lower permeability.

#### Resilience proxies at the block scale

As aggregation of different street edges, blocks size depends on the pace of street intersections and their grain on the assemblage of plots. Both impact on the distribution of uses and activities and patterns of movement (Figure 4). On the one hand, blocks constituted by one or very few super-plots have limited

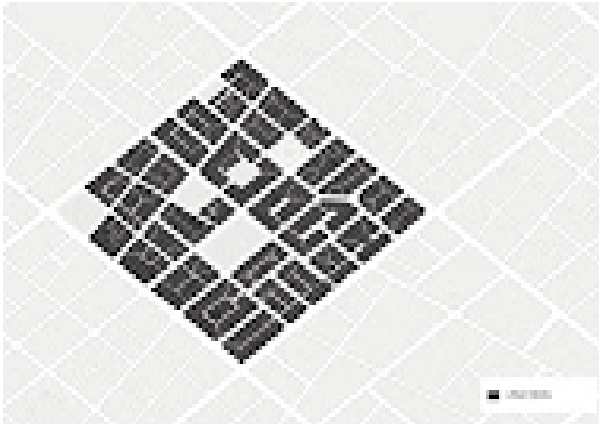


Figure 4. Resilience at the scale blocks (Source: Authors).

potential for diversity and redundancy, reduced accessibility and poor modular capacity to aggregate or subdivide. On the other hand, small-sized blocks invite greater diversity and variability in form and use and higher internal connectivity, particularly for pedestrians (Jacobs 1961). At the same time, (Salat and Bourdic 2012) argue that, if a more complex and efficient structure at all scales is to be established, along with many small blocks also several intermediate blocks and a few large blocks should be present; that ultimately favours diversity by creating the conditions for hosting specialist functions, or additional uses on them. Indeed, when large blocks are the result of the aggregation of street edges, they achieve greater complexity also to their core (collective gardens and workshops accessible from small streets or alleys).

### Resilience proxies at the street scale

By virtue of their location within the wider network, layout and individual geometrical properties, streets have different potential to foster resilience (Lhomme et al. 2013) (Figure 5). The way a street is connected to all others in the overall street network locally and globally determines its centrality, which has a direct impact on its potential to support several interrelated dynamics which are crucial for urban life, such as location of retail and other land uses, size and form of plots, footfall, etc. (Porta et al. 2012). Street networks change and grow in time and tend to exhibit recursive characters: for example centrality tends to a power law, that combines global connectivity and local clustering (Strano et al. 2012). Such network architecture is structured as to include few urban mains links out-reaching to the wider metropolitan and regional context, several local mains linking districts and neighbourhoods, and many human-scale, walkable and dense local streets (Porta, Crucitti and Latora 2006). Street networks are characterised by modularity when they feature many tightly connected sub-networks, linked to each other by means of “weak” ties that distribute flows across them. According to Webb et al. (2008) a balance between a modularity and connectivity should exist, so that many links are able to effectively connect to each other clusters of strongly connected nodes.

The configuration of street layout determines

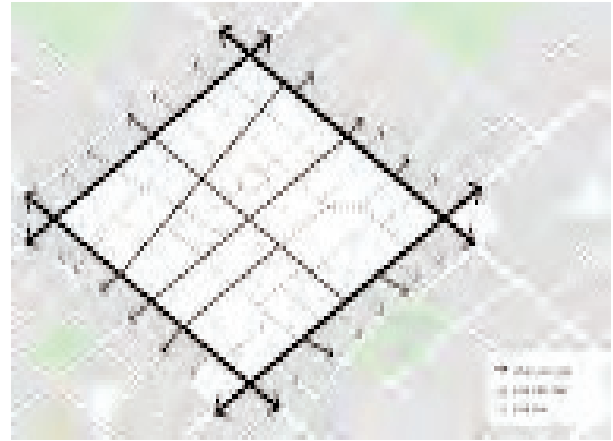


Figure 5. Resilience at the scale of streets (Source: Authors)

the connectivity of each street to its surrounding. A street layout characterised by a predominance of four-way intersections and few cul-de-sacs allows highest movement choice while creating a small number of pockets where movement is reduced. As an efficient street network should “make every location in the city easily accessible from any other location” (Salat and Bourdic 2012:39), having a structure of this kind imparts greater resilience, compared to a situation where cul-de-sacs are predominant and even spatially proximate places result disconnected. Street layout configuration affects the redundancy of pathways linking destination (Lhomme et al. 2013), as this depends on the number of alternative paths available: interconnected grids feature higher redundancy while tree-like street networks generally have a very low degree of redundancy. When path redundancy is high, people have plenty of option in selecting a preferred path (Mehaffy 2015). Additionally, path redundancy helps reduce the impact of losing key connections: when a street is closed or pedestrianised, flows manage to get around the interruption via secondary paths, something that is impossible in tree-like networks.

Geometrical properties of streets such as width, length and number of intersections reflect the importance and role of each street in its immediate surrounding and affect the nature and intensity of movement supported. In order to be interconnected, street segments should be numerous, short and feature many close-by intersections (Carmona 2010; Jacobs 1961; Mehaffy 2015): more streets and more frequent intersections produce finer-mesh circulation and allow for multiple routes and frequent shortcuts. From this derives greater diversity and a greater scope for variability of use.

### Resilience proxies at the scale of sanctuary areas / districts

Sanctuary areas are anchors tying together small scale elements (blocks, streets, plots) to larger scale aggregates (districts, cities and regions); in a balanced dynamic between local needs and wider resources (Figure 6). On the one hand a degree of autonomy permits to supply core needs without excessive dependence on outside sources, on the other interdepend-

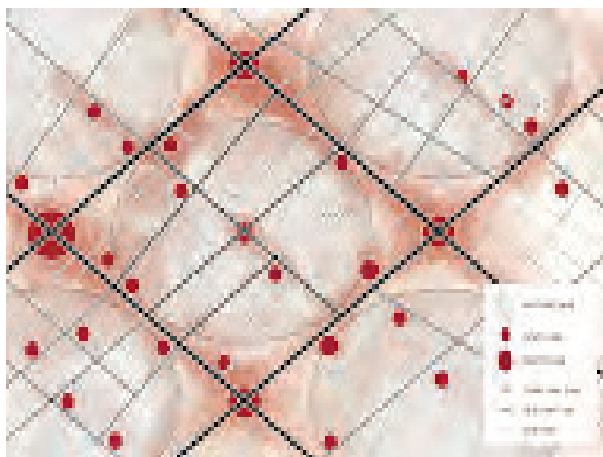


Figure 6. Resilience at the scale of sanctuary areas and districts (Source: Authors).

dence with the wider urban context allows to access higher functions.

At the lower scales, sanctuary areas contribute to redundancy by ensuring variability in forms, a range of readily accessible uses and services and convenient internal connections. Hence, they should be easy to cross via tight local connections and their bounding streets should be easy to walk to. As very often uses tend to cluster around and extend along main streets in the form of *local nodes* (Mehaffy et al. 2010), sanctuary areas need not to be too large and intersection between main streets should not be too far apart. Recent studies found that a good interval between main streets should not exceed 400 meters (Porta et al. 2014).

At the larger urban scale, availability of diverse transport means and redundant modal options to move across sanctuary areas not only increases choice in terms of destinations and forms of mobility, but creates important synergies across scales: different infrastructures do not work independently but as multiplex networks reinforcing each other (Strano et al. 2015): as they meet, they create central nodes in the system (i.e. public transport hubs at busy street intersections) where interchanges are higher. This synergy allows each sanctuary area to *share* higher-level facilities or *nodes* hosting larger amount of less conventional or “*district*” uses or even *speciality “metropolitan”* uses (i.e. universities, large hospitals). Their existence is crucial for urban dynamics at district and metropolitan scale and no single sanctuary area alone would be able to support them. The way these nodes are distributed in space gives important cues on whether different areas benefit from a good balance between local, district and metropolitan nodes. An equitable and diffused distribution of such nodes across different sanctuary areas ensures both choice and accessibility: the firsts should be very common and frequently interspersed, the second distributed less tightly, while the lasts in fewer and more centralised locations (Urban Task Force 1999)

## CONCLUSIONS

Intervention on the urban form of cities is a time and

resource intensive endeavour. As such, sustainability depends (also) on the longevity of form in response to changing demands. The observation that “*there are urban forms that appear ‘inherently’ more resilient to change over the long run than others*” (Davis and Uffer 2013:11) is evidenced by abundant research documenting the different degree of success with which cities form responded to structural change over time (Brand 1994; Moudon 1986; Panerai et al. 2004; Vale and Campanella 2005). Such research suggests that the configuration of, and relationships between, the physical elements of cities have an influence on the resilience of the urban ecosystem as a whole. By focusing on urban form and morphological analysis we aim to build a knowledge-interface between resilience thinking and urban design. As the form of cities is the distinctive object of urban design, urban designers have the power to influence their resilience through its manipulation. In this sense, the proxies here identified could be deployed as guiding urban design principles for intervention on existing urban form and the design of new ones. Hassler and Kohler (2014) recently wrote that “*resilience, as a design principle, was an implicit part of traditional construction knowledge*” (119); understanding how form, at different scales, relates and contributes to resilience can help us rediscover such knowledge.

## FINAL REMARKS

This paper focuses on the physical dimension of cities as one component of the urban ecosystem, which is relevant to its overall resilience. Yet, whilst urban form might well be “*the most tangible dimension of cities*” (Marcus and Colding 2011:4) this “*does not exist in isolation, but within a framework of rules and regulations, actors and agents, networks and local cultures*” (Marcus and Holding 2011:4).

As all systems, cities rely on complex multi-scale interactions between the human, physical and institutional matter they are made of. These are the pillars on which much resilience research is being built upon (Moench et al. 2011). Therefore, in order to develop further knowledge on urban resilience and on the design of resilient places, we must necessarily adopt a holistic approach in combining the proposed interpretation of urban form to disciplines such as urban social geography (Knox and Pinch 2006), human geography (Holloway and Hubbard 2001), environmental psychology (Gifford 2007), economic geography (Henderson and Thisse 2004) and real estate development studies (Tiesdell and Adams 2011). These offer important insights on the relationship between the physical environment and people’s behaviour across spatial and temporal scales, including aspects of quality of life (Montgomery 2013), control (Romice et al. in print), satisfaction (Pacione 1982) place attachment and identity (Gifford 2014), adding an important temporal, user-centred dimension to urban form to the understanding of transformations in urban form.

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# THE IMPACT OF AFFORDABLE HOUSING DEVELOPMENTS ON SUSTAINABILITY IN GULF CITIES.

Florian Wiedmann, Ashraf M. Salama, Hatem G. Ibrahim

## Abstract

*The recent construction boom has led to new urban development dynamics in Gulf cities driven by real-estate speculations and large infrastructure investments. While in the past affordable housing for medium income migrants and their families was integrated within the fringes of old downtown areas and compound developments in the suburbs, recent investment patterns have led to an increasing challenge of these economically highly engaged social groups to find residences. In recent years, a newly emerging trend in the Gulf region has been the establishment of large scale mass housing projects as new dormitory settlements to address the growing demand for affordable housing. This paper presents an overview of current development patterns by exploring two major affordable housing projects and their impact on sustainability in Doha and Dubai. This is undertaken by establishing a preliminary assessment framework that involves relevant sustainability parameters. The assessment reveals the major differences between both projects and their impact on environment, economy, and society.*

**Keywords:** Affordable housing, Gulf, Urban Qualities, Sustainability, Urbanism, Doha, Dubai.

## INTRODUCTION

Since the industrial revolution the struggle of providing affordable housing to all social groups has been a major urban planning challenge. Modern urban planning itself is thus rooted in the first planning policies for mass housing developments for labourers, such as the five-story "rental barracks" in Berlin, which were a result of the city plan of 1858 (Hall, 2002, p. 33). Historic city cores became surrounded by a fringe of high density housing redefining the previous urban structure. The decreasing urban qualities caused by overcrowded and highly polluted urban areas had a significant influence on the era of urban utopias at the turn of the century. These utopias can be seen from Ebenezer Howard (1902), who envisioned the "Garden City" concept to be based on affordable housing in well-connected villages surrounding the industrial centres and escaping the pollution, to the Swiss-French architect Le Corbusier, who introduced mass housing schemes with large integrated open spaces, which he called "Ville Radieuse (The Radiant City)" (Le Corbusier, 1967). These city visions were accompanied by technological advancement of new and efficient modes of transportation.

While the development of first tram lines and subways during the 19th century already permitted a rapid increase of urban areas, the mass production of cars and certain public incentives during the first half of the 20th century led to a new urban form shaped by a sprawling low-rise urban periphery in the United States and subsequently worldwide (Jackson, 1985). The escape of middle and higher income groups to

the new suburbs led to an increasing social segregation and labour housing was mainly found in proximity to old urban centres and industrial areas (Nightingale, 2012). Various public strategies were launched to integrate social housing in the case of newly developed urban areas. Based on new visions and economic concerns mass housing estates were initiated in geometrical grids, particularly during the 1960s and 1970s, the peak of planning for the "automotive city" (Newman and Kenworthy, 1989). These social housing projects were usually built on the basis of a modular system to save costs and first residential tower blocks for lower income groups changed urban landscapes (Lund, 1996).

Since the end of the 20th century cities worldwide have gained an increasing importance as main nodal points within an expanding global network of advanced service sectors (Sassen, 1994). The newly emerging knowledge economies led to a new phenomenon, known as gentrification, which has been a direct result of the lifestyle choices of a highly educated workforce and associated urban lifestyles as well as investment flows (Ley, 1994). Richard Florida (2002) claims that these knowledge workers have had a direct impact on the upgrading process of many downtown areas in Western cities. One inevitable consequence of this tendency has been rising rental rates in recent years and the subsequent move of low to medium income groups towards the urban periphery.

Today, the continuous tendency of investing in central urban areas has led to an emerging need for affordable housing for both low and medium income groups. The result has been various new programs

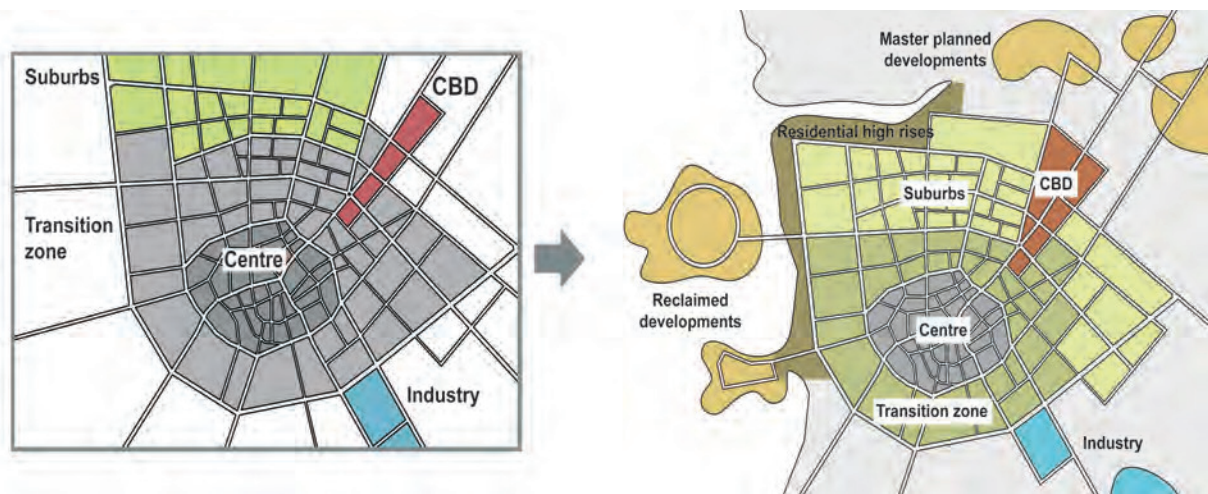


Figure 1. The urban transformation from Gulf cities: The shift of high urban densities towards the urban periphery (Source: Authors).

including public-private-partnerships in order to accommodate these large and diverse social groups, who play a key role in enabling economic growth and whose daily commutes are critical for the general energy efficiency of any city. Furthermore, they have an important role in establishing distinctive communities and thus particular urban identities due to their large number and the general diversity of their social structure. Once again the need for affordable housing has begun to transform spatial urban conditions and large scale development sites have been initiated to establish new dormitory settlements instead of introducing intervention schemes to permit the integration of affordable housing in already existing urban areas. Therefore, there is an emerging demand to understand the impact of these mega projects on urban sustainability. In the context of the Gulf region, this paper presents an overview of current development patterns by exploring two major affordable housing projects and their impact on sustainability in Doha and Dubai. Based a preliminary assessment framework major differences between both projects and their impact on environment, economy, and society are revealed.

### THE HISTORY OF AFFORDABLE HOUSING IN THE GULF

When the oil production commenced in the middle of the 20th century public subsidies were needed to supply modern housing standards to local populations in Gulf cities (Scholz, 1999, p. 77). In addition to the distribution of land, mortgages were supported and backed by governments to enable improved housing conditions for locals. The tendency of subdividing new unbuilt land and the expanding infrastructural networks resulted in excessive urban sprawl and the fast spread of suburban dwellings (Al Hathloul and Mughal, 2004). In parallel, the previous settlement areas were demolished and used as main commercial centres and home for low to medium income migrants, who resided in first multi-story apartment buildings as well as low-rise dwellings, some of which still held features of traditional architecture. Migrants

with higher income were accommodated in newly built compounds in suburban areas (Salama and Wiedmann, 2013, p. 31).

In general, the housing of a large part of the first migrants was supplied by companies, which rented dwellings and compounds from the newly founded semi-public holdings as well as locals, who became more and more involved as developers and landlords (Al Buainain, 1999, p. 92). This initial setup within the private sector has led to a reduced lack of affordable housing for migrant communities during the 1970s and 1980s. The continuous migration and the subsequent housing demand however led to first land speculations and thus large areas of unbuilt land, which caused a fragmentation of settlement areas, particularly along the urban periphery (Wiedmann, 2012, p. 24). The rising land prices in well accessible areas, particularly in the North of cities and along shorelines in proximity to urban centres led to two phenomena: The rising urban density in transition zones between downtown and industrial areas as well as the development of residential areas far from urban centres (Wiedmann, Salama and Thierstein, 2012, p. 42).

Since the 1990s a new urban development vision was introduced in Gulf cities based on the strategy to establish well connected hub cities between international markets. In addition to new airports and ports, new economies, such as tourism, were used as important catalysts in accelerating investment dynamics (Schmid, 2009). The subsequent construction boom has transformed Gulf cities from their rather simplistic structure based on mixed-use downtown areas surrounded by a low-rise urban periphery towards a more complex and diverse urban landscape (Scharfenort, 2009) (Figure 1). The main drivers of this spatial transformation were large-scale developers and their holdings that initiated mega projects covering vast areas towards inland as well as on reclaimed land along the coast (Salama and Wiedmann, 2013).

In 1999 the first freehold property project, known as Emirates Hills, in Dubai marked a new era in housing development, driven by investment interests rather than demand-driven dynamics. Davidson

(2009, p. 128) states that the exponential population increase has been a direct consequence of expanding service sectors associated with real-estate and construction industries. The newly emerging medium to high income guest workers and their families became important factors within the local housing markets leading to housing demand and a continuous increase of rental rates. Consequently, the lack of affordable housing for medium income groups began to challenge urban governance (Ernest & Young, 2013).

In the case of low income labourers employers have been usually obliged to provide accommodation, which has led to the phenomenon of large-scale labour camps in the outskirts and in proximity to industrial areas leading to widespread international criticism on social standards in Gulf States (Gardner, 2011). Furthermore, a large quantity of guest workers engaged in the retail sector and other low income service sectors usually reside without their families in Gulf cities and are forced to share apartments in order to afford the rising rental prices. This has led to overcrowded downtown districts and decreasing living standards in many areas (Beaugrand, 2014).

In the Emirate of Dubai, a large percentage of medium income groups have decided to move to neighbouring cities in the Northern Emirates in order to find affordable housing leading to challenging traffic congestion (Lipps, 2008). The move of affordable housing towards the urban periphery is one of the main contemporary development tendencies, which has been further enforced by the rather recent phenomenon of large scale mega projects in old city cores. The lack of distinctive urban identities led to major restoration and revitalisation investments followed by cultural landmark projects, such as museums, as well as the interest of the private sector to develop real-estate for the upper markets (Wiedmann, Mirincheva and Salama, 2013). These investments and public development strategies led to the demolition and replacement of various residential areas and thus a severe affordable housing deficit for lower income groups. The relocated social groups mainly consist of migrants from the Middle Eastern region as well as the Indian subcontinent, who often resided for generations in these inner city neighbourhoods (Law and Underwood, 2012).

The consequence of recent investment dynamics focusing on freehold properties as well as revitalisation strategies have been various large scale mass housing projects based on certain principles of public-private partnerships, such as the provision of land and infrastructure by governments. Therefore, one of the main objectives of this paper is an attempt to introduce the various spatial implications as well as current challenges by analysing two large-scale projects in the cities of Doha and Dubai.

## THE ASSESSMENT FRAMEWORK

Based on the triad of sustainability (environment, economy and social equity) a framework can be introduced based on eighteen key impact factors of new

Environmental Impact	Economic Impact	Social Impact
Proximity to main urban centers	Role as major local service center	Role as a new landmark and cultural center
Enabling short ways to services	Flexible demand-driven development	Integration of various social groups
Integration of green areas	Integration of business opportunities	Integration of social services
Well distributed urban densities	Sufficient urban densities	Healthy urban densities
Integration of new ecological technologies	Various investment opportunities	Integration of various lifestyle choices
Optimized spatial layout to encourage walking	Optimized spatial layout to encourage business	Optimized spatial layout for safety and comfort

Table 1. The eighteen key parameters to improve the impact of affordable mega projects on sustainability (Source: Authors).

affordable housing projects in generating sustainable urban structures (Table 1). Factors can be summed up underlying the three categories of sustainability: From an environmental impact perspective new projects need to be located in highly accessible areas with a sufficient level of land-use integration as well as balanced urban densities. Furthermore, the spatial layout needs to encourage walking and the integration of new technologies can reduce the waste of energy and water. From an economic impact perspective, a new project needs to become a local centre attracting a wide variety of businesses as well as investment opportunities. The spatial layout is important to permit and enhance diverse economic activities. From a social impact perspective key parameters apply, including the integration of various social groups and the role of the new projects as important landmarks for an emerging community with a high diversity of lifestyle choices (Salama, 2006 and 2011).

The main aim of the proposed framework is to enable a preliminary assessment of large-scale affordable housing projects without the excessive collection of data. The minimum data required for this assessment framework includes: The general distances of the new projects to key locations, the general land-use distribution and the maximum population as well as the general measurements of the development area in addition to a review of recent property prices and rental rates. This framework can be thus applied as a focused pre-assessment of the various parameters needed for a more sustainable urban development.

## THE CASES OF BARWA CITY IN DOHA AND DUBAI INTERNATIONAL CITY

The methodological approach for assessing the two cases follows the preceding framework. The data collected includes the evaluation of official planning reports including demographic and socio-economic studies from Qatar's Ministry of Municipality and Urban Planning and Dubai Municipality. Therefore, planning departments and their housing experts were visited in both cities as part of the information gathering procedures. In addition, local real-estate newspa-



Figure 2. The spatial location of Dubai International City (left) and Barwa City (right) and their general distances to key places (Source: Authors and Google Earth).

per articles were evaluated in order to review past and present development dynamics in both case studies. Furthermore, property and rental prices were reviewed by evaluating property websites and official statistics in order to assess recent market tendencies. Based on the authors' continuous research in the region since 2011, various field studies were carried out to explore contemporary spatial implications of the selected case studies.

Notably, both case studies were selected due to their size and major role in recent dynamics of affordable housing development. On one hand, Barwa is the largest real-estate developer in Qatar and was founded in 2005 on the basis of large public shares. 45% of shares are therefore owned by Qatari Diar, which belongs to the Qatar Investment Authority (Barwa, 2016). The main objective of Barwa is to drive the local real-estate market and to integrate new dynamics in accordance to the overall vision to establish a diversified economy. On the other hand, the Dubai International City's developer is Nakheel, a company that was transferred from a semi-public holding, known as Dubai World, to Dubai's government due to financial restructuring in 2011 (Fitch, 2011).

### Environmental Impact

Both projects are located in similar locations in proximity to industrial areas in the South and with distances of about 10 to 15 kilometres from main business centres and international airports (Figure 2) in both cities. Barwa City is located in the Mesaimeer district, which has become a main focal point of large scale developments in spite of its industrial surroundings. The International City in Dubai is located in the Al Warsan district, which is in proximity to the Southern end of the Dubai Creek. Both projects are located in average distances to main urban centres leading to travel times of at least thirty minutes by car. While the location of both developments is in a sufficient distance to main urban centres, the development sites hardly integrate a big

variety of services. Thus, schools can only be accessed by car in a distance of two or three kilometres where walking is not possible due to climatic conditions.

Today, around 60,000 people reside in Dubai International City. Once the project is completed it will cover an area of more than 800 hectares and offer housing units for a maximum of 120,000 residents in 413 buildings with more than 23,000 rental units (Nakheel, 2016). Thus, a rather high urban density of more than 100 inhabitants per hectare will be achieved. In comparison Barwa City's first phase has been completed including 128 residential buildings on around 270 hectares with a built-up area of 1.3 million square metres offering 5,968 apartments for up to 25,000 residents (Waseef, 2016) (Figure 3). The expected overall urban density is slightly less than 100 inhabitants per hectare, but in clear contrast to its desert surroundings. The medium urban densities are distributed rather evenly due to similar typologies enabling an efficient supply of infrastructure and the opportunity to establish a pedestrian-friendly environment. While a district cooling plant is integrated in the case of Barwa, no distinctive modern technologies

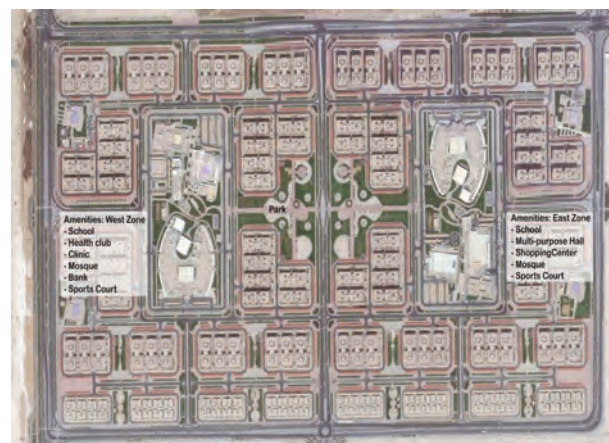


Figure 3. The general spatial layout of Barwa City (Source: Google Earth).



Figure 4. The current development stage of Dubai International City (Source: Google Earth).

have been introduced in Dubai International City to reduce energy waste. Both developments currently lack sufficient access to public transportation.

The spatial layout of Barwa City is dominated by the orthogonal road grid. While pedestrian movement is encouraged in the central spine between the two main service centres, the overall surroundings are less inviting to walk due to the general distances and the mainly residential land-use. In comparison International City lacks a clear emphasis on a main corridor and provides an evenly distributed mixed land-use. Due to the international financial crisis in 2008 a large central area of 240 hectares, known as Forbidden City, has not yet been developed, which has led to a vacant core and a fragmented structure (Construction Week, 2009) (Figure 4).

While on the one hand the mixed land-use in International City enables a greater incentive to walk to certain near-by services, the lack of a clear main corridor and centre has however led to a scattered distribution and far distances in many locations. Both spatial layouts thus lack a clear emphasis on walkability by developing main activity corridors and linking neighbourhoods. Sports grounds and green areas are integrated in both developments. While the central green corridor in Barwa City is linking all major public areas and services, the International City is lacking cohesive green spaces due to its ornamental grid.

It can be argued that Barwa City in Doha and Dubai International City are rather equal in the case of their current environmental impact. The similar locations and the similar urban densities have led to very comparable conditions. While Barwa City is more advanced due to improved construction standards and district cooling as well as a cohesive public realm in its core, Dubai International City provides certain opportunities to be developed into a highly mixed-use urban district with short walking distances.

### Economic Impact

In Barwa City seventeen commercial and amenities buildings have been built including a shopping centre and a medical centre. The residential buildings are



Figure 5. Typical residential buildings in Barwa City (Source: Authors).



Figure 6. A deserted public space in Barwa City (Source: Authors).

grouped in orthogonal clusters around two zones for amenities. The orthogonal grid of Barwa City permits a quick understanding of the general spatial layout, but it suffers from the rigid symmetrical repetition leading to many similar urban spaces. Additionally, Barwa City lacks adequate street life, which is mainly rooted in missing commercial activities along roads (Figures 5 and 6). The development of shopping centres instead of commercial pedestrian environment has led to a suburban setting. Barwa City is thus mainly perceived as dormitory settlement instead of an emerging centre at Doha's periphery.

In spite of integrated commercial use in most ground floors – 5,000 retail units according to Nakheel (2016) – Dubai International City has not yet emerged to a major local centre attracting residents from neighbouring districts. While the themed architectural design and typological variety in Dubai International City have led to a higher spatial diversity than in Barwa City, the ornamental layout and the limited entrances have weakened the general orientation. Today, many shops are vacant and the entire development is suffering from a missing diversity of income groups, which is the basis for any enhanced stimulation of commercial activities. The top-down development of both mass housing projects following strict master plans has resulted in a lack of demand-driven dynamics and a greater variety of housing typologies attracting a more diversity of tenants as well as buyers of real-estate.

Both projects offer sufficient urban densities to attract businesses and thus economic activities. While Dubai International City is currently providing various business opportunities depending on the general socio-economic context, Barwa City has been planned as a mega compound with no integration of small business initiatives to benefit from the rather high urban densities. Residents will thus rely on shopping malls and mega marts instead of funding small businesses in their neighbourhood.

### Social Impact

Based on their size both developments should have the potential to become main landmarks and cultural centres attracting various human interactions. The design as developments with limited public access along the urban periphery and the missing integration of important public transportation junctions and associated public realm have however resulted in gated-like urban environments rather than new urban centres with their own distinctive place identities. Thus, the opportunity to use these mass housing projects as catalysts igniting future upgrading processes and poly-centric urban development is rather limited.

Both projects are currently representing the complex spectrum of affordable housing concerns in Gulf cities. While rental prices have been increased dramatically in Barwa City challenging lower medium income tenants, the global financial crisis and the subsequent drop of real-estate prices in Dubai led to another phenomenon: the move of very low income groups to the International City.

The total of 5,968 apartments in Barwa City includes 1,024 studios, 1,056 two-bedroom and 3,888 three-bedroom apartments. While studios have a size of 31 square metres, the two-bedroom apartments reach 100 and the three-bedroom apartments 121 and 135 square metres (Waseef, 2012, p. 8). Based on average rental prices in 2013 a two-bedroom apartment in Barwa City was rented between QR 6,500 to QR 7,000 per month (Kovessy, 2015). In the beginning of 2015 the rental rates were increased between QR 2,000 and QR 3,000 per month. This rental price increase of 37% has been mainly an outcome of the urgent need for housing under QR 10,000 per month, which is the result of continuous migration as well as rising rental prices in Doha's Northern and Western districts leading to the move of medium income groups. Further factors have been the high urban density and traffic congestion in inner city districts as well as the generally high built quality of Barwa City in spite of its monotonous urban and architectural design and the still missing facilities (Scott, 2014).

According to various property online platforms for the UAE a two-bedroom apartment with 130 square metres is currently rented for less than AED 6,000 per month in Nakheel's International City. In 2007 however apartments were rented for more than AED 8,000 per month. Since then the international financial crisis rental prices have significantly dropped in areas located in the urban periphery of Dubai (Kumar, 2014). Furthermore, the move of particularly



Figure 7. A cluster of Dubai International City and spaces with hardly any visitor movements (yellow) (Source: Google Earth).



Figure 8. The built environment in the back of main roads in Dubai International City (Source: Authors).

Chinese migrants due to the Chinese investment in Dragon Mart project has led to a major demographic change. In addition, the proximity of the sewage plant has created stench issues in various areas (Al Serkal, 2013). Since Nakheel has faced major financial problems after 2009 the developer has dropped controls and checks over the city's security leading to an enhanced crime rate (Al Najami, 2009).

While most residential buildings in Barwa City vary from five to six floors leading to a rather uniform rectangular development surrounded by vacant land, there is a greater diversity of building heights up to eleven floors in the case of Nakheel's International City. In Dubai International City a multitude of roads and spaces can be found, which are hardly watched by residents. This has led to major urban safety concerns (Figures 7 and 8). The limited integration of social services, such as schools and a variety of leisure spaces and facilities, has led to a rather reduced compatibility to host a diversity of social groups and their lifestyles in both developments.

### CONCLUSION

The current development tendencies display the challenging and rapidly changing environment, in which both projects have been conceived and built. Neither

Environmental Impact	Dubai International City		Economic Impact	Dubai International City		Social Impact	Dubai International City	
	Barwa City	Dubai International City		Barwa City	Dubai International City		Barwa City	Dubai International City
Proximity to main urban centers	6	6	Role as major local service center	8	3	Role as a new landmark and cultural center	1	1
Enabling short ways to services	2	2	Flexible demand-driven development	1	1	Integration of various social groups	1	2
Integration of green areas	7	6	Integration of business opportunities	2	6	Integration of social services	4	4
Well distributed urban densities	7	3	Sufficient urban densities	7	7	Healthy urban densities	7	7
Integration of new ecological technologies	6	3	Various investment opportunities	3	4	Integration of various lifestyle choices	2	2
Optimized spatial layout to encourage walking	5	6	Optimized spatial layout to encourage business	3	6	Optimized spatial layout for safety and comfort	3	2
<b>Total:</b>	<b>33</b>	<b>31</b>	<b>Total:</b>	<b>20</b>	<b>27</b>	<b>Total:</b>	<b>20</b>	<b>18</b>

Table 2. Constance Region based on the intensity of network connectivity.

developers nor decision-makers can currently predict the role of these projects in the future, but as uniform mass housing projects the entire development sites will be affected by newly emerging conditions. Thus, overnight both city projects have witnessed a change of their roles within the local housing markets. While the upgrading can be mainly considered as a temporary effect of local housing shortage, the downgrading has to be seen as a severe threat due to the move of private sector investment. Dubai International City cannot be considered a contemporary case of a failed medium income city. At the same time, an emerging ghetto such as Barwa City cannot be identified as a complete failure to offer housing alternatives for medium income groups due to the recent increase of rental prices.

Based on the sustainability framework introduced earlier both projects can be compared by assessing each of the eighteen points. The introduction of an assessment scale (1 to 10) permits an illustration of the differing results in both cases (Table 2). While Dubai International City has the potential to become a main mixed-use district offering micro-economic development dynamics, Barwa City has a superior built environment of certain ecological and social concerns but with the higher potential to accommodate various income groups in future. The framework is thus a preliminary tool to underscore key differences and can support future planning and design guidance.

Affordable housing will remain one of the key challenges of urban planning to establish sustainable Gulf cities. The new mega projects have led to new dormitory settlements and an enhanced fragmentation of urban landscapes. Various factors endanger their role to become long-term solutions for affordable housing. Concomitantly, the authors argue that they have contributed to filter and disintegrate a crucial part of the urban population and thus to enhance social segregation. In generic terms, affordable housing strategies can play a crucial role in enabling sustainable cities. The widespread integration of afford-

able housing in a great variety of districts has proven to be less problematic long-term than mass housing projects covering large areas with monotonous building typologies on the peripheries of Gulf cities. This integration however needs an advanced coordination and the establishment of strict regulations within the clear sustainable development frameworks.

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# REFRAMING THE NOTION OF SUSTAINABLE URBAN DEVELOPMENT IN THE MIDDLE EAST.

Samer Bagaeen

## Abstract

*In offering reflections on key themes affecting sustainability in the Middle East, this paper explores how an imprecise concept such as sustainability can, co-constituted with other powerful political and economic systems, such as nation building, drive forward new agendas for urban development. Rather than focus on specific empirical findings, the paper reflects instead on some of the assumptions underpinning competing approaches to sustainability highlighting multiple alternate visions of urban sustainability. In doing so, the paper engages with the literature on sustainability, master-planning and real estate development inviting the reader in the process to think about and ponder on the role of vision in the process. The reader is therefore invited to consider the aggregate impact of individual master planned projects on the urban fabric of fast growing cities and to think about how projects such as Masdar City in Abu Dhabi and the Msheireb downtown redevelopment in Doha demonstrate how sustainability and nationalist discourses are intertwined offering competing visions of what a sustainable city might become while at the same time hiding urban inequalities in plain sight with the help of the 'forward looking' facade of sustainability.*

**Keywords:** Middle East, Sustainability, Sustainable Urbanism, Master Planning, Mega-Projects.

## INTRODUCTION

Across the Middle East, and particularly in the Gulf countries, the ambiguity around the definition of the terms 'sustainability' and 'sustainable design' has not only allowed their use to green-wash a development agenda built by international companies for an international audience, it has also suited the burgeoning nation-building agenda promoted by the leaders in the region.

In offering reflections on key themes affecting sustainability in the Middle East, this paper explores how an imprecise concept such as sustainability can, co-constituted with other powerful political and economic systems, such as nation building, drive forward new agendas for urban development. Rather than focus on specific empirical findings, the paper reflects instead on some of the assumptions underpinning competing approaches to sustainability highlighting multiple competing visions of urban sustainability. This position is not new and was previously highlighted by Guy and Marvin (1999: 269) when they noted that "our argument is that research and policy approaches that are shaped by a singular vision of the sustainable city are in danger of blinding themselves to alternative logics of environmental innovation". Noting previous research they had done, Guy and Marvin go further to point out that their research suggests that "within the sustainable-cities debate, a diverse and expanded group of social interests can be identified, each developing competing visions of what a sustainable city might become".

The paper engages with the literature on sus-

tainability, master-planning and real estate development inviting the reader in the process to think about and ponder on the role of the various actors at play. The reader is invited to consider the aggregate impact of individual projects on the urban fabric of fast growing cities and to think about how projects such as Masdar City in Abu Dhabi and the Msheireb downtown redevelopment in Doha demonstrate how sustainability and nationalist discourses are intertwined.

## REAL ESTATE DEVELOPMENT: A BROAD APPROACH

Real estate development continues to be one of those ubiquitous vehicles for economic development and diversification prevalent in the Middle East. Even those countries that, in the past, have had neither the desire nor the need to seek alternative economic sectors increasingly have been turning to real estate development as a potentially effective means of achieving economic growth and diversification (Bagaeen, 2015). Amin and Thrift (1995) had previously argued that the need and desire of cities to compete in the global market place, has driven them to seek to derive competitive advantage by means of place marketing and adopting certain approaches to regeneration, such as large scale property-based initiatives to achieve image enhancement.

Davidson and Gleeson (2014, 186) argue that it is not surprising, given the political and institutional dominance of globalized neoliberalism, that many "concepts and aspirations associated with the dominant interpretation of sustainability reflect the social, political and economic ideas of Friedrich

Hayek and the Chicago School of Economics". Reflecting an emphasis on privatization, economic liberalization and deregulation, Davidson and Gleeson point out that the 'smart-growth cities', 'compact cities' (Newman and Kenworthy, 1989) and 'new urbanism' (CNU, 1996, 2000; Katz, 1994) promoted free market mechanisms as drivers of sustainable growth.

Arguing that sustainability is a politically as well as intellectually contested concept, Davidson and Gleeson (2014, 186) apply an urban political ecology approach to interrogating the use of sustainability constructs in city planning, policymaking and master planning. They point out that sustainability "is a construct born of the growth of cities and our understanding of the demands they make on the environment...readily accepted as desirable, having entered public consciousness" (p. 174). In this respect, this is not too far from Mumford's description of cities not only as containers, but also as sites of profound ecological encounter and reconstitution (1956).

Until the 1980s, business leaders used the word *sustainability* to refer to a business company's ability to gradually increase its profits. The term became widely used in its present sense after it appeared in the 1987 Brundtland report (World Commission on Environment and Development, 1987) which defined sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability also has a dark side: 'green-washing', meaning "focusing more on communicating your green efforts than on the efforts themselves"<sup>1</sup>.

The release of the Brundtland Report (1987) encouraged a debate around the conceptualisation of sustainable cities. This was closely followed by the Commission of the European Communities – CEC (1990) who promoted sustainable development and advocated an end to urban sprawl. It promoted a return to mixed land uses in the city bringing about a reduction in travel distances. The relationship between sustainable development and public transport was investigated by Rydin (1992) and Jacobs (2000) and was demonstrated by the experience of countries such as the Netherlands who were committed to planning on a regional scale (Jacobs, 2000; Hajer and Zonneveld, 2000). New Zealand (Dixon and Dupuis, 2003) had also shown how development plans that integrate key principles of sustainable development can be successfully implemented. In an insight into the sustainable city, the Urban Villages Forum (Aldous, 1992) argued that creating mixed use developments, placing retail functions in residential areas and residential functions in retail areas, is not only essential from an economic point of view, but that it is also essential to community life and the health of the city.

Writing a year earlier, Elkin *et al.* (1991), argued that the implications for design and planning are that high density and integrated land use are needed not only to conserve resources, but also to provide for compactness that encourages social interaction. Elkin *et al.* argued that the concept of 'decentralised concentration' practised by Danish planners in

the preceding decades provided a useful framework.

This concept aims to concentrate those uses that are the focus of urban activity, particularly employment, in nodes: only one in the centre of small urban areas, more in larger cities. Policies to bring this about include the strengthening of small- to medium-sized local centres, integration of land uses, high densities and direction of growth to appropriate centres. This involves the promotion of higher density development along public transport corridors or the creation of high-density nodes or sub centres, which concentrate traffic flows sufficiently to encourage public transport provision.

Houghton and Hunter (1994) argued that high densities are fundamental to urban vitality and creativity. In the USA, higher densities were also seen to be an essential component of the 'walkable city' – the 'new urbanist' antidote to the car-dependent, sprawling city (Calthorpe, 1993; Duany and Plater-Zyberk, 1991). This takes on board social sustainability arguments – particularly those related to the quality of life in cities – often revolve around the idea of traditional streets and 'urban villages', which provide the conditions for social interaction and community.

Harris and Moore (2015) point out that this core set of agents and components of the sustainable city, operating through command centres such as London and mobilised through particular geographical channels, provides a relatively standardised menu of actors, ideas, terms and techniques. Rapoport (2015) identifies a core of international architecture, engineering and planning firms based in North America and Western Europe that are 'disproportionately represented on projects where sustainability is a key element'. Rapoport focuses on these companies who create the masterplans that guide the development of such sustainable urban projects. While these projects are appearing in a diverse array of locations around the world, Rapoport points out that they are largely conceived and designed by a small, elite group of international architecture, engineering and planning firms based in North America and Europe. All of this points to what Harris and Moore (2015: 106) call "the convergence of sustainable city visions through the domination of a few influential singular city 'models' and their prolific influence on urban policy agendas around the world (e.g. eco-cities of Dongtan and Masdar; liveable cities of Vancouver and Melbourne; the creative cities of Barcelona and Portland, to name but a few)". These exemplar city models, Harris and Moore point out, predefine the sustainable city by following certain key pathways of "enshrined best practice" promoted through master planning, sometimes on a massive scale.

## MASTER PLANNING

Master plans are lengthy documents usually produced in the early stages of project conception and development. Master plans play an important role in establishing the objectives and basic parameters of an urban development project although they rarely are precise blueprints for future development of a site.

Master plans have been a key element of New Urbanist practice in the USA and elsewhere (Katz, 1994; Dutton, 2000) and a consistent feature of UK government guidance on urban design and regeneration (DoE, 1994, 1997; DETR, 1998, 2000a, 2000b, CABE, 2003, 2004a, 2004b).

A master plan is seen as a useful tool to coordinate the objectives and actions of a wide range of actors and interests and to help reduce development risks (Bell 2005; Carmona *et al.* 2003). It goes on to consider the role of international master planners in the production and dissemination of a standardised global model of sustainable urbanism. Bell (2005) explores how the increased realization amongst promoters of development about the economic benefits of using master plans has meant that their use has become more common in Britain since the late 1990s. Bell also points out that “this is not the first time the term ‘master plan’ has been popular” (2005: 83) noting in particular that the master plan was a significant feature of town planning from the 1940s until the early 1970s. These were, he adds, “physical design-oriented plans, prepared by a small number of architects, surveyors or engineers, that were intended to govern both the policy and design dimension of urbanization or urban development projects and the implementation of the projects” (2005: 84). Tiesdell and MacFarlane (2007: 407) support the increase in the use of master plans noting that there has been “a significant increase in their use in urban development and regeneration, with high profile projects using masterplans, such as the Canary Wharf development in London’s Docklands (begun in the late 1980s) and Crown Street in Glasgow (begun in 1990)”.

For the purposes of the arguments made here, this paper adopts the following definition of the masterplan:

*“A masterplan is considered to be a document, or series of documents, explaining the development proposals for an area by including a strategy for the area, designs and implementation details”* (Bell, 2005: 85)

Additionally, the following is noted:

*“A master plan articulates a vision of the intended urban form/physical setting and provides a means of guiding development towards that desired/desirable state”* (Tiesdell and MacFarlane, 2007: 413)

Tiesdell and MacFarlane (2007: 413) outline four different ways in which master plans can come about. In the first, a single landowner (public or private) can commission and impose a master plan to be followed by developers purchasing land parcels. In the second, a public authority can perform the same role in terms of commissioning a master plan, which by private agreement or through statutory powers is binding on developers. In the third, a public authority may require a developer (or developers) to prepare a master plan as a condition of planning consent. This raises the problem of cost (who pays for the master plan). The

fourth way involves developers, landowners, community groups and other local stakeholders coming together and agreeing a master plan that becomes binding on all.

It is this diversity that is one of the key determinants of successful places. That said, Adams *et al.* (2013) point out, the design principles and actions required to enable more diverse places remain fundamentally at odds with the dominant philosophy of contemporary real estate development that favours uniform single-use residential development.

## SUSTAINABILITY AND MASTER PLANNING IN THE MIDDLE EAST

Unlike in the West, the social implications of rapid economic development in the Middle East have not yet substantially attracted the attention of academics, practitioners or politicians. That said, master planning is alive and well, thanks in greater part to what Rapoport (2015: 111) calls the “the global intelligence corps and the internationalisation of urban planning and design”. Across the Middle East, work on master plans for high-profile urban projects such as the King Abdallah Financial District (KAFD) (Riyadh) and Msheireb (Doha) is largely carried out by a relatively small, highly internationalised group of architecture, planning and engineering companies noted for their expertise in this field. KAFD, for example, is a massive undertaking that includes its own monorail, public transport interchange, LEED certified green buildings, office tower blocks and carefully laid out public squares.

Real estate development in the Middle East tends to have as much variety as the number of countries that constitute the region. For the purposes of this paper, and in initially tracing the history of the Middle East’s real estate boom up until the property crash and financial crisis of 2007-08, 1994 has been identified as a key moment in time (Bagaee, 2015). This was the year that the *Société libanaise pour le développement et la reconstruction de Beyrouth*, French for ‘The Lebanese Company for the Development and Reconstruction of Beirut’ – otherwise known as Solidere, was founded in the wake of the Lebanese Civil War which ended in 1990 by the assassinated former Lebanese Prime Minister Rafiq Hariri. In an ongoing enterprise since 1994, Solidere has been responsible for rebuilding large areas of downtown and waterfront Beirut (see Figure 1). The main drivers of master planning Beirut’s city centre included the installation of a modern and new infrastructure and the recovery of public space<sup>ii</sup>. This was achieved through a master plan conceived as a cluster of city quarters capitalising on the inherent values of the site instead of a single, homogeneous central district. This is in line with the principles outlined by Adams *et al.* (2013) whose paper showed how master developers can promote diversity through master plans that subdivide large development sites into smaller parcels, the development of which they then regulate by means of design controls, attached as conditions to the sale or lease of individual parcels.



Figure 1. Downtown Beirut (source: author).

In 2002, and in light of the country's systematic economic weaknesses, Jordan turned to the Lebanese model of real estate development by adopting alternative forms of urban governance in order to bring about substantial growth in the real estate sector. The weaknesses and mechanisms have been discussed elsewhere (see Bagaeen, 2006). But, for the purposes of this paper, it is worth restating that these weaknesses were financial, technical and administrative in nature. Jordan set about providing opportunities for the private sector to substantially invest in property by adopting the Solidere model. One of the outcomes, brought into the market in 2002-2003 was Abdali<sup>iii</sup> (Figure 2), Amman's own version of downtown Beirut.

Around the same time, and particularly during the period from 1999 to 2008, Dubai and the United Arab Emirates (UAE) as a whole had started to lead the way in master planning and real estate development in the Arabian Gulf. The Gulf Cooperation Council (GCC) countries experienced over this period high growth rates thanks, in great part, to surging oil

income and the overactive real estate market. The year 2016 heralded the end of this boom era in some of the GCC countries with the price of oil falling to below 40 USD a barrel<sup>iv</sup>.

In Dubai, during the boom years, the real estate market was so vibrant that properties were, in the majority of cases, sold 'off plan' and then exchanged hands frequently even before construction was complete (Bagaeen, 2007). More iconic buildings, including the world's tallest twisted tower, the Cayan Tower (Figure 3), was completed after the crisis in 2013. In November 2013, the United Arab Emirates won the right to host the World Expo in Dubai in 2020. This will be the first time that the World Expo is staged in the Middle East, North Africa and South Asia (MEASA). The Expo is held under the theme of *Connecting Minds, Creating the Future* with three main themes, *Opportunity, Mobility and Sustainability*<sup>v</sup>.

Hall warns how the creation of such bourgeois playgrounds in the name of economic development "may create considerable tension in the urban policy-making environment" (1994: 159). In spite of all of these successes, the literature picks up the impact of the absence of master planning at a city scale. Writing about the Qatari capital Doha, Rizzo (2014; 2013) notes how in the absence of a national planning framework for traffic congestion, localized environmental impacts, affordable housing shortages, and land value inflation, the implementation of mega-projects led the way in urban development. Writing about nearby Jordan, Daher (2007: 275) had previously noted that the Abdali project in Amman would lead "to urban geographies of inequality and exclusion and spatial and social displacement of second-class citizens, functions, histories, and itineraries in favour of first-class tourism developments and real-estate ventures". These geographies of exclusion are of course not only found in Jordan. Writing about Bahrain, Ben-Hamouche (2008: 212) noted how "at a social level, the nature of these projects, mostly prestigious and targeting foreign investments, bypass the



Figure 2. The Abdali Boulevard (source: author).



Figure 3. Dubai Marina with the Cayan Tower (source: author).

local reality and thus fuel social reactions". The situation in Saudi Arabia does not fare much better where neoliberal urban restructuring models are taking hold accentuating socioeconomic polarisation in Saudi cities (Shaikh, 2013) while also doing little to address a clear and accelerating housing shortage in the country for young Saudis.

Salama and Wiedmann (2013) have written extensively on urban development in Doha within its broader context of Gulf and Middle Eastern urbanism highlighting the need for sustainable urban growth in the future. Rizzo (2014: 57) reviewed past and current master planning efforts in Qatar highlighting the country's inability to manage rapid urban development. He argues that the failure to implement sound urban planning in Qatar – and the rest of the Arab Gulf Region – is the result of a "detachment between the master planning phase – usually sub-contracted to external consultants that are insensitive to Gulf dynamics – and the implementation phase – usually carried out by incapable and redundant local government agencies – all in absence of a serious discussion of ongoing mega-projects" or the impact they would have on the region's cities.

Narratives about urban sustainability are plentiful in the cities of the Gulf, even when their growth defies, as noted above, the logic of sustainability (Gardner, 2014). The frenetic pace and character of Dubai's unprecedented growth (Bagaee, 2007), particularly between 1999 and 2008 had suggested a likely future marred by environmental and sustainability problems. Development projects during that period generally ignored such fundamental environmental factors as climate or geography. This future has turned out to be somewhat different, thanks in large measure to the financial crisis of 2008 that has put a halt, albeit temporary, to some of the excesses of pre-crisis superfast urbanism.

Looking across the Gulf in 2014, in the majority of the cases, it can be seen that the real estate sector relies heavily on the 'ruler' intervening, on governments investing revenue surpluses in the infrastructure and initiatives that generate growth in the economy. A clear manifestation of this can be seen in the

redevelopment of Doha's Katara Cultural Village which, in spite of encouraging cultural encounters through design, offers VIP areas closed to the public, and the Msheireb Quarter promoted by Sheikha Mozah Bint Nasser al-Missned (see Law and Underwood 2012). Msheireb, a brownfield regeneration project involving a complete transformation of Doha's old core, is a largely political project displacing the city's urban immigrant workers and the poor to make way for the vision of the Msheireb Properties Real Estate Company. The 'green-wash' surrounding the project as outlined by Law and Underwood (2012: 131) bellows that the aim of the project "is to initiate large-scale, inner city regeneration that will create a modern Qatari homeland rooted in traditions and to renew a piece of the city where global cultures meet but not melt". This point is reinforced by Salama and Wiedmann (2013: 229) who point out that Doha's contemporary society consists of several parallel societies with often isolated social groups. Msheireb does little to address this and Qatari concerns about the influx of migrants into the country.

These contrasting 'visions', or multiple models of sustainability employed by competing urban actors in the development and management of cities, are not the preserve of the Middle East. Take for example the Russian 2014 Olympics in Sochi. When Russia was awarded in July 2007 the right to host the winter Olympics, the vision for Sochi 2014 stated that the Games would be hosted 'in a sustainable, inclusive, environmentally responsible manner' and that 'all key Olympic infrastructure locations have been selected to ensure maximum sustainability and legacy' (Bidding Committee Sochi, 2006: 17, 19). The event organisers modelled the Olympic sustainability agenda they were pursuing on international best practice gleaned from previous editions. Müller (2015) undertakes an inquiry into the mobilisation and transformation of sustainability knowledge and policy for the Sochi Games examining the reasons behind the overwhelming failure and isolated successes in achieving the goals that the organisers of the Olympic Games.

In Riyadh, KAFD is located on a plot measuring 1.6 million square metres and is planned to eventually play host to two million square metres of prime



Figure 4. KAFD (source: author).

office stock targeted at the financial sector and all of its ancillary needs including hotels, apartments and so on. It is a large, mixed use development that includes offices, hotels, residential units, shops, and cultural/entertainment facilities, all centred on a landscaped pedestrian route that weaves through and unifies the entire district.

Harvey (2008), like Soja (1989) before him, acknowledges the role of ideology and power in shaping a city. Harvey notes that the “kind of city we want cannot be divorced from that of what kind of social ties, relationship to nature, lifestyles, technologies and aesthetic values we desire” (2008: 23). Looking at the leaps and strides in real estate development examined in this paper, the reader can clearly see the driving forces of ideology and power, primarily the role of the ‘ruler’ or ‘governor’. In the United Arab Emirates for example, citizens and residents alike had little or no rights to participate in the processes driving the growth and development in cities like Dubai and Abu Dhabi (Bagaeen, 2007).

What these examples clearly show is that the right to the city, in contrast to antecedents in the cities of the Middle East, is too narrowly confined and restricted to a small political and economic elite who are in a position to shape cities. There is also another power dynamic at play in the real estate market. This is a direct result of real estate development projects whose inequality or unjustness is prevalent in the delivery vehicles of some of the Middle East’s most prominent real estate ventures over the years. This dynamic was rightly seized upon by Malik (2011) in a report on the condition under which migrant workers operate in Dubai noting that “Dubai seems to be a place where the worst of western capitalism and Gulf Arab racism meet in a horrible vortex”. Unions and strikes are illegal in the UAE and other Gulf states, and strikers can be detained for questioning. So when thousands of mainly Asian migrant workers employed by Arabtec, the largest *construction company* in the *Gulf* by market value, stopped work on 18 May 2013, Whitaker (2013) reported that dozens of migrant building workers who joined the strike faced deportation.

In spite of this apparent inequality, or unjustness, the real estate market continues to grow. An analysis of the Dubai Land Department data by Arabian Business<sup>vi</sup> showed property sales totalled USD 6.26bn between January and the end of July 2015, up from USD 3.74bn for the same period last year. For real estate sales, the data pointed to the number of transactions increasing from 1922, or 275 a month, last year to 3012, or 430 a month in 2015. According to Dudley (2013: 30), there were 41,767 property transactions in Dubai in 2012, worth some AED154bn (USD 41.9bn) representing a rise of 8 per cent in terms of the number of deals compared with the year before. However, Knight Frank estimated that average prices in Dubai fell 2.8 per cent in the three months to the end of June 2015 and 12.2 per cent compared with a year earlier<sup>vii</sup>.

Given the oversupply of office space in many markets across the Middle East, Davis Langdon (2013) argue that project owners are resorting to pro-

viding added-value services to tenants in order to attract more business. One of the ways in which owners are doing this is, as Jones Lang LaSalle have found out, is through an increased number of accredited buildings over the past few years adopting, in the majority of cases, the US based LEED system (over the UK based BREEAM system). A Jones Lang LaSalle report (2013) found over 1,250 LEED certified projects across the Middle East, with more than 65% of these within the UAE. LEED accreditation is clearly being used to further let and sales and further research will be needed to measure its impact on the real estate and property markets in the Middle East.

## CONCLUDING THOUGHTS

Addressing sustainability issues in relation to the design and planning of the urban environment is a complex, multi-disciplinary issue and solutions never arrive from a single perspective. This paper attempted to consider some of these. While some countries of the Middle East have faced exceptional development challenges and continue to do so, other, such as Dubai for example, have demonstrated an ability to overcome many of these challenges realising their potential, in spite of the growing political and financial crises in the world and the region. The frenetic pace and character of Dubai’s unprecedented growth, particularly between 1999 and 2008 had suggested a likely future marred by environmental and sustainability problems. Development projects during that period generally ignored such fundamental environmental factors as climate or geography. This future has turned out to be somewhat different, thanks in large measure to the financial crisis of 2008 that has put a halt, albeit temporary, to some of the excesses of pre-crisis super-fast urbanism.

Some of the trends and issues that underlie the renaissance of UK towns and cities and describes the sustainable urban neighbourhood as a model for rebuilding urban areas have been aptly outlined elsewhere (Rudlin and Falk 2009). The impetus for design-aware master planning in the UK was heavily influenced by poor standards of design and place monotony evident especially in speculative housing projects (Tiesdell and Adams 2004). Lord *et al.* (2015) outline findings from research in European cities where planning has been empowered and is provided with legislative and financial support we see startling results in terms of development quality, laying the foundations for sustainable, positive economic outcomes.

Forerunners in this endeavour, Guy and Marvin stressed back in 1999 that a multiple vision framework originates from the first principle that “the promotion of sustainable cities must start with a contested vision of the sustainable city” (1999, 272). Guy and Marvin reflect upon the conceptual challenges involved in undertaking sustainable-cities research drawing upon their work in a wide variety of sustainable-cities research projects, from studies of the emergence of demand-side management across utilities sectors, to the development of greener buildings and the role of new technologies such as smart utility

meters. Urban planning is, after all, about articulating a vision for the city rather than the city acting as a host or a container for projects claiming to be sustainable without articulating the missing vision for a sustainable city.

The research challenge for Guy and Marvin (1999: 272) was to “map the multiple constructions of the sustainable city, to understand the changing social contexts that produce them, and to build an understanding of the multiple logics emerging to re-order social relations, resources flows and urban form”. There are of course other means of articulating this vision and Harris and Moore (2015: 108) see *pathways* towards a sustainable city emerging not through the overcoming of social barriers by technical or managerial innovation but through the *contextual* richness of coalitions of interest and the bottom-up promotion of initiatives, strategies and plans through *partnership*, not merely consensus, across interests. Looking across the countries reviewed here, in the majority of the cases, it can be seen that the real estate sector relies heavily on the ‘ruler’ intervening, on governments investing revenue surpluses in the infrastructure and initiatives that generate growth in the economy. A clear manifestation of this can be seen in the redevelopment of Doha’s Msheireb quarter.

If anything, this paper has tried to ask what are believed to be the right questions, one of which is this: Who are these spaces designed for? Applying this way of thinking to either Msheireb or KAFD warrants a separate investigation and will be an interesting undertaking. Although it is clear from the literature reviewed here that sustainability experts have examined the sustainable city as both a conceptual and practical challenge. What they have not done is explore how the sustainability agenda can sometimes operate as ‘mask’ for the economic interests of actors who take advantage of the vagueness of the term ‘sustainability’.

Across the Middle East, and especially in the Gulf countries, this ambiguity around the notion of sustainability has not only been employed as a way to green-wash a development agenda built by international companies for an international audience, it also happens to be central to the nation-building agenda promoted by the leaders in the region. This can be clearly seen in public discourses in those countries surrounding the Qatari World Cup 2022 and the Dubai Expo 2020.

But are the Gulf countries completely at fault or do the global intelligence corps (GIC) (Rapoport 2015) take some of the blame? Is the small number of elite architectural and planning firms scrambling for prestigious commissions in cities around the world to blame? As an audience, we tend to forget that the reference point for the Middle East and the Gulf countries is not Ebenezer Howard’s garden city model that influenced planning of cities such as Ankara and Mexico City. The Gulf countries, who in the main gained independence from Great Britain in the 1970s, missed the peak of this ‘sustainable development’ trend in the 1920s and the 1930s. Their modern efforts and master planning and mega-projects

were formed after the large-scale exploitation of oil wealth became a reality from the 1960s onwards. With the price of oil already at less than 40 USD a barrel as already noted, these countries have had to re-examine their own long-term plans. So far though, what the projects pursued by the global firms with petrodollars have clearly emphasised is pushing scientific and technological frontiers rather than liveability. They did this by using high-tech materials to celebrate human triumph over the harsh climate they endure. This feeds in handily into official discourse and stories and histories about extreme climate conditions that are consistently used in the Gulf to emphasise the nations’ ability to conquer hardship. At the same time, technological projects that do so are treated as iconic markers of the nations’ modernity and LEED certifications (and others) are merely the jewel in the crown, so to speak. This is obvious for example when one visits or reads about Masdar City in Abu Dhabi, and in Doha, while clearly borrowing from the discussions around sustainability, one cannot escape the fact that the Msheireb downtown redevelopment resulted in the displacement of some of the city’s urban (non-citizen) poor illustrating how sustainability and nationalist discourses are intertwined. This fundamental inequality upon which the project rests is hidden in plain sight from the public with the help of the ‘forward looking’ facade of sustainability.

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# TOWARDS THE DEVELOPMENT OF A SPACE/NATURE SYNTAX AT ARCOSANTI.

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## Abstract

The world's urban population is rapidly growing, now exceeding its rural population, and is expected to reach 70% of the world's total by 2050. Research in environmental psychology increasingly supports the Biophilia Hypothesis which holds that our connection with Nature is innate. Thus, how do we maintain a human connection to Nature in an increasingly urbanising world? This paper is based on current research work and explores the boundary between built and natural environments, specifically how visual connectivity to Nature affects how people use social spaces, compared to spatial connectivity. Case study work is being undertaken at Arcosanti urban laboratory in the Arizona desert. Arcosanti construction began in 1970 to test Paolo Soleri's Arcology Theory which proposes, in opposition to sprawling cities, a new form of urban setting which is compact with tightly restricted horizontal growth, leaving the surrounding natural environment as undeveloped "wilderness". Through development of a Space/Nature Syntax methodology applied within a uniquely compact urban form, this research attempts to understand how designing to maintain the instinctive bond with Nature can affect social interaction and inform future design choices within built environments. This paper describes the development of, and basis for, the Space/Nature Syntax methodology, presents initial findings achieved through its recent application at Arcosanti, and outlines future work. Initial analysis indicates that visual connectivity to Nature is a significant influence on certain types of social interactions when compared to spatial connectivity, although more research is needed to verify the level of significance.

**Keywords:** Social Spaces, Biophilia, Environmental Psychology, Space Syntax, Urbanisation, Wilderness.

## INTRODUCTION

In his 1984 book "Biophilia" E.O. Wilson proposed that human beings have evolved to expect, and indeed physically need, a connection to other living species and the natural environment. He theorised that the increasing, and relatively recent, removal of human civilisation from Nature through urbanisation is detrimental to the human mind and its development. He called his theory the Biophilia Hypothesis, and presented a relationship with the natural environment as an innate need within humanity. (Grinde and Patil, 2009)

Humanity's appreciation of Nature has certainly been historically recognised and widely and consistently portrayed through media such as art and literature long before the Biophilia Hypothesis was proposed. Romanticism saw writers such as Henry David Thoreau, Lord Byron, and Ralph Waldo Emerson recognise the importance of Nature as cities grew due to the Industrial Revolution. Recently, this connection between humans and Nature has become a significant field of study as researchers seek to further explore and explain this undeniable bond. A number of studies in environmental psychology have shown spending time in Nature can have physiological and psychological benefits including relieving stress and alleviating diagnosed psychological disor-

ders (Berman *et al.*, 2008, Berman *et al.*, 2012, Ward Thompson, 2011, Wilson, 1984, Keniger *et al.*, 2013, Logan and Selhub, 2012, Cervinka *et al.*, 2012, MacKerron and Mourato, 2013, Gehl *et al.*, 2006).

Despite long standing recognition and recent scientific evidence that the relationship between humans and Nature is beneficial and vital, there remains a lack of consideration for how this relationship interacts with architecture. Movements such as Organic Architecture recognise the need to integrate landscape with design, and Biomimicry takes design and technological inspiration from natural systems, but thus far architecture has tendency to approach the boundary between built and natural from an angle of aesthetics, with little research carried out on the influence Nature can have on a building's occupants. One study focussed in health care architecture discovered that a view of a natural environment reduced surgery recovery times (Raanaas *et al.*, 2012); other studies have focussed on the benefits of introducing natural elements such as office plants to internal spaces (Brown and Bell, 2007); beyond this, the potential to utilize the innate human connection to Nature within architectural design is all but overlooked. With the world's global urban population already exceeding 50% and with this due to increase to 70% by 2050 (W.H.O., 2012), there is both a need

to understand how Nature and architecture can co-exist, and a potential for architects and planners to explore built environments which nourish humanity's seemingly biological need for proximity to Nature.

### Arcology and Arcosanti

Arcology, a concept fusing architecture and ecology, was first proposed by architect Paolo Soleri in 1969, as the antithesis to the state of development of most modern US cities. Soleri saw the reliance on vehicular transport as generating massive urban sprawl and decentralisation away from the city centre to never ending suburbs. Soleri stated that these suburbs not only obliterated the ecology of the land they spread over, but that they also obliterated human connections and the ability for personal and collective growth. He proposed an alternative to this kind of living: an arcology would be a compact city, bringing people and services back to a centralised location, while the city would be tightly restricted in terms of horizontal growth thus leaving the surrounding natural environment untouched and in a state of wilderness. (Soleri, 1969, Soleri *et al.*, 2011) In addition to providing a model for energy and resource efficiency, Soleri emphasised the potential for arcologies to provide a unique boundary between built and natural; *"The structure of the habitat is intentionally putting nature at our fingertips"* (Soleri, 1993); a point expanded upon by Grierson; *"the drawing together of diverse city functions into mixed use, self-contained arcologies would encourage cultural intensification and social integration within their boundaries, while freeing up the surrounding hinterland to remain natural."* (Grierson, 2003) In 1970, Soleri and a group of his students formed the Cosanti Foundation and began construction of Arcosanti, a new city presented as an "urban laboratory" and prototype arcology located in the high Sonoran desert of Arizona, USA. Arcosanti aims to explore high density, mixed use design built on a pedestrian scale, while leaving hundreds of acres of surrounding land as natural environment, allowing its residents to be both "city and country dwellers" (Soleri, 1993). At Arcosanti, the boundary between built and natural is immediate; a person can be in untouched



Figure 1. Aerial image of Arcosanti. (Source: Ernie Silva, May 15 2009).

Nature moments after leaving the density of the city. Soleri repeatedly stated that he could not, and would not, predict the social dynamic of an arcology: *"What the project wants to avoid is planning the lives of its residents. They are offered a specific grid of environmental resources (the instrument) within which to act and play out their lives (the music)."* (Soleri, 1993) Soleri believed that the social identity of an arcology would and should develop naturally, and the continued inhabitation of Arcosanti gives an opportunity for the social outcomes to be investigated. This work focusses on the effect this unique proximity to the natural environment has on activity within the built environment at Arcosanti.

Building on the proven cognitive impacts of Nature, this research work is interested in the resultant behavioural impact, specifically how the view of a natural environment from within a built social space affects social interaction within that space. Space Syntax has been used in architecture and urban design to analyse built forms and make empirically based design decisions on how spatial connectivity can influence social interactions. In this work, a Nature Syntax is being developed to explore if and how visual connectivity to Nature has this same influence. Does strong spatial connectivity affect social interactions more than visibility of Nature? Do users plan movement routes to include views of Nature, or do they focus on the fastest, most accessible routes regardless of view? Are users more likely to plan activities in the most easily accessed space, or does the view of Nature prove more influential in this decision? These are the types of questions this work is interested in exploring. Using Arcosanti as a development and testing ground, the work develops a Nature Syntax methodology to statistically quantify the naturalness of a view from within a built space – named in this study as the Visibility of Nature (VN) value. Space Syntax and Nature Syntax analysis for 15 social spaces at Arcosanti was completed, before onsite observations were carried out to document the usage patterns of each space. Correlations were then calculated, which suggest where relationships exist between spatial connectivity, Nature connectivity through visibility, and social interaction. It is proposed that the Space/Nature Syntax can be used to inform future design, firstly at Arcosanti then in other built environments, by using the correlations, relationships and patterns observed to predict how future design interventions could alter the existing spatial and natural connections and change interaction within an existing space. This paper details the development and initial application of this Space/Nature Syntax methodology, and outlines future steps in the work and future potential applications of the method for design.

### DEVELOPMENT OF SPACE/NATURE SYNTAX

It is important to clarify what qualifies as a social space for the purpose of this study. The majority of buildings are Arcosanti are mixed use, containing spaces which are completely private (bedrooms, private living rooms), other spaces which are only open



Figure 2. Arcosanti from the South. (Source: Author, September 13 2013).

within certain time parameters (public visitor centre) and others which are open and accessible for the use of Arcosanti residents at all times. Therefore, for the purpose of this study, a space is classed as a social space and analysed in the research if it is an interior or exterior space available for use by Arcosanti residents at any time of the day or night. There were 15 such spaces identified which were then analysed according to the methodology to be described in this paper.

### Space Syntax

Space Syntax was introduced by Bill Hillier and Julienne Hanson and has been developed through numerous publications since 1976 (Hillier *et al.*, 1976, Hillier and Hanson, 1984, Hillier, 1999, Hillier, 2007). Space Syntax is a method for the analysis of spatial configurations (Jeong and Ban, 2011) which gives statistical value to spaces within buildings and cities, allowing them to be analysed, adapted and planned. Space Syntax is commonly used to determine areas within individual buildings or the wider urban environment which have the potential for high social interaction (Campos and Fong, 2003) and has therefore been used in this study to analyse the social spaces at Arcosanti in order to determine which, at least according to spatial analysis, should be the most and least lively. There is a great deal of terminology associated with Space Syntax; those which are relative to this work are defined as thus:

– **System** – the building/area being studied; in this work, the Arcosanti site is the System. *N* is used to represent the number of spaces in a System; *N* = 227.  
**Root Space** – the space that is being analysed.

– **Depth (D)** – the number of spaces between the Root Space and another space. A new Depth is reached when a threshold (an opening or junction) is crossed.

– **Total Depth (TD)** – the sum of all spaces at all Depths from the Root Space. The Total Depth is calculated by multiplying the amount of spaces at each Depth by the value of the Depth itself.

– **Mean Depth (MD)** – the average Depth from the Root Space to all other spaces in the System.

$$MD = TD / N - 1$$

– **Connectivity (C)** – a measure of the number of immediate spaces adjoining the Root Space. The C value is between 0 and 1, with a higher number indicating fewer immediately adjoining spaces. It is achieved by dividing 1 by the number of spaces at one depth from the Root Space.

$$C = 1 / \text{No. of spaces at Depth 1}$$

– **Integration/Integrated** – a measure for the connections between the Root Space and all other spaces within the System.

– **Relative Asymmetry (RA)** – a measure of Integration for Systems of comparable size. The RA value describes the mean Depth of a space as a fraction of the maximum possible Depth for that System (Bafna, 2003). RA values always range between 0 and 1, where 0 is a strongly integrated space and 1 is a weakly integrated space. In practice, an RA value of closer to 0 would indicate a centrally located space.

$$RA = 2 (MD - 1) / N - 2$$

– **Real Relative Asymmetry (RRA)** – a measure of Integration for Systems of drastically different sizes; as with the RA, the lower the RRA value, the more accessible a space is. This is the key term used in this paper when discussing spatial connectivity. The value is achieved by dividing the RA of the System by the average RA of a System of that size (*D<sub>k</sub>*). A list of *D* values was published in (Hillier and Hanson, 1984); the value for this System is 0.047. Unlike the RA value, the RRA value can range above 1; spaces with RRA figures from 0.4 to 0.6 are considered to have very strong integration in the System. (Bafna, 2003, Hillier and Hanson, 1984) The RRA allows a System to be easily compared with any other regardless of size and was therefore used in this study to give values which could be easily compared to other Space Syntax studies in future.

$$RRA = RA / D_k$$

– **Integration Value (IV)** – the inverse of the RRA; therefore the higher the IV, the more integrated the space is and more likely to be a lively space.

$$IV = 1 / RRA$$

(Hillier and Hanson, 1984, Klarqvist, 1993, Jeong and Ban, 2011, Bafna, 2003)

### Nature Syntax

This section will describe the development of the Nature Syntax method, which is being established through this research work. Nature Syntax analysis produces a value named the Visibility of Nature (VN) value, which is between 0 and 1, where 0 is no visual connection to Nature and 1 is complete, 360° visual connection to Nature. The VN value represents the ratio of the visibility of the natural environment out of the total external visibility from that space.

### Calculating the Permeability

The first stage was to calculate how visually permeable each social space was. Permeability in the context of this paper refers to the area of building envelope of a space which is either open (e.g. an archway) or transparent (e.g. a window or skylight) – any opening through which the environment external to the space is visible. In order to calculate permeability, the area of building envelope which is permeable was calculated as a percentage of the total area. Internal drawings were produced of North, East, South, West, and Above for each social space, and sizes of openings and ceiling heights were verified on site at Arcosanti (Figure 3). The area of permeability in each of the 5 directions was then totalled and divided by the total surface area to achieve the percentage of total permeable surface area. This value was then divided by 100 to produce a figure between 0 and 1, where 0 is a social space which is completely visually enclosed to its external environment, while 1 is a social space which is completely visually open to its external environment.

$$\text{Permeability} = \frac{\left( \frac{\text{Total Permeable Surface Area}}{\text{Total Surface Area}} \right)}{100}$$

### Calculating the Naturalness of View

The next consideration was how to classify if a view was built, natural or somewhere in between. The solution was derived from the U.S. Geological Survey Land Cover Institute National Land Cover Database (NLCD) 2006, which documents land cover type according to well defined criteria, covering wide variants in both

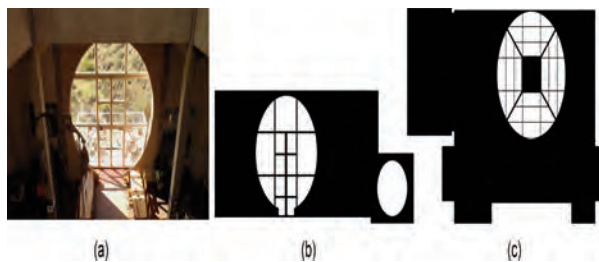


Figure 3. South façade of Arcosanti's Café (a); permeability diagrams for South façade (b) and Ceiling (c) where black indicates a solid area and white indicates a permeable area. The permeable and total areas were calculated using inbuilt AutoCAD tools to maximise accuracy. (Source: Author).

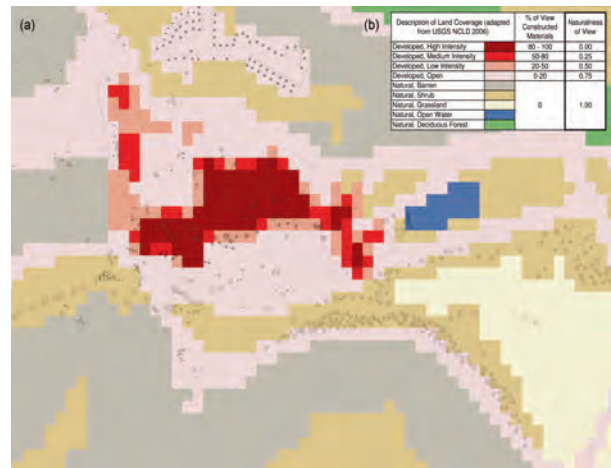


Figure 4. Arcosanti Land Cover Site Plan (a) and Land Cover Key (b) (Source: Author, derived from USGS LCI NLCD 2006 (US Department of the Interior and US Geological Survey, 2015, Anderson et al., 1976))

built and natural land cover (US Department of the Interior and US Geological Survey, 2015, Anderson et al., 1976). The NLCD 2006 consists of 20 categories of land cover, including 4 levels of built environment from “Developed, Open” to “Developed, High Intensity”. The levels are defined by the percentage of material on an area of land which is constructed material. For the development of the Nature Syntax, the non-built categories of the NLCD were amalgamated into one “Natural” category, while the 4 built categories remained as defined in the NLCD. A plan of the Arcosanti site was overlaid with a 10m<sup>2</sup> grid which was then in-filled with the colour representing the relative land coverage; producing Figure 4a. Values between 0 and 1 were assigned to the 5 land cover classifications (Figure 4b). As “Natural” land coverage was the focus of the study, this classification was given a value of 1, with “Developed, High Intensity” receiving a value of 0, and the intermediate classifications given values in intervals of 0.25.

In order to determine the Naturalness of View from each space, field of vision studies were carried out in both plan and section for each of the 15 social spaces. The foveal and peripheral fields of vision (based on (Gehl et al., 2006)) from a centre point in the space were drawn for each direction (North, East, South, West and Above) and overlaid onto the Land Cover plan in Figure 4, producing an image such as the example in Figure 5a. The type of land cover which was predominantly covered by the field of vision was taken to be the type of land cover most visible for that direction, and the associated value between 0 and 1 was documented. This process was then repeated in section for each space and direction to take into account the three-dimensionality of both the structures and Arcosanti site, and confirm the results found on plan (Figure 5b). Finally, the values documented were confirmed visually at the Arcosanti site by the researcher. The final value for Naturalness of View for each space is the sum of the value for the five directions, divided by 5.

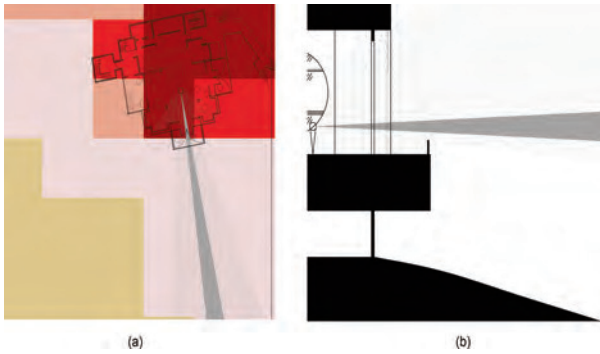


Figure 5. Field of Vision diagrams for Arcosanti Café's South façade in plan (a) and section (b) (Source: Author)

The final Visibility of Nature Values (VN) represents the ratio of total view from the space which is of the natural environment and is calculated as:

$$\text{Visibility of Nature (VN)} = \left( \frac{\text{Naturalness of View}}{\text{Permeability}} \right) \times 100$$

### Observation Studies

With the Space Syntax and Nature Syntax analyses complete, the next step was to carry out observational studies on site at Arcosanti. The method was developed through background research into the observational methods commonly used in environmental psychology (Thwaites, 2007, Golnik and Ward Thompson, 2010, Costa, 2011, Gehl, 2011, Gehl, 1987, Gehl, 2010, Liu and Sibley, 2004, Moirongo, 2002, Simpson, 2011, Zhang and Lawson, 2009). Over a 3 month period, from 17 February to 12 May 2015, each of the 15 social spaces at Arcosanti was repeatedly observed for 30 minutes at a time within 5 time frames: 0600-0900, 0900-1200, 1200-1500, 1500-1800, 1800-2100. A total of 107 observations were carried out, with the following behaviours being noted:

#### Type of Space Use

"Active" – space being directly used for an activity; space is the end destination.

"Inactive" – space being used inactively; as a through route to elsewhere.

#### Level of Planning

"Planned" – a predetermined activity taking place at an agreed time e.g. an arranged event; a work task; a meeting; a guided tour group.

"Unplanned" – a spontaneous activity undertaken e.g. a social interaction; informal/impromptu meeting; non-essential use as through route.

#### Visual Interaction with Natural Environment

A user observed displaying behaviour which facilitates a visual interaction with environment e.g. looking out window; positioning body towards natural environment; pointing; drawing; photographing.

The behaviours were noted, by hand, separately for each observation on a printed plan of the social space being analysed before data for each space was digitally compiled into one image, colour coded for time frames; examples of these resultant images will be seen in the next section of this paper.

Social Space	Total Depth	Mean Depth	Connectivity	RA	RRA	Integration Value
Vaults	1125	5.0	0.17	0.0354	0.7523	1.3292
Community Room	1161	5.1	0.20	0.0368	0.7824	1.2780
Library/Rec Room	1367	6.0	0.50	0.0449	0.9548	1.0473
Amphitheatre Seating	1403	6.2	0.17	0.0463	0.9850	1.0153
Ceramics	1519	6.7	0.33	0.0509	1.0820	0.9242
Sky Theatre	1522	6.7	0.50	0.0510	1.0845	0.9220
Vault Roof	1580	7.0	0.50	0.0533	1.1331	0.8826
Roof Patio	1587	7.0	0.33	0.0535	1.1389	0.8780
Amphitheatre Stage	1664	7.4	0.20	0.0566	1.2034	0.8310
Café	1676	7.4	0.20	0.0570	1.2134	0.8241
Music Centre	1684	7.5	0.33	0.0573	1.2201	0.8196
EC Roof	1771	7.8	1.00	0.0608	1.2929	0.7734
Classroom	1828	8.1	1.00	0.0630	1.3406	0.7459
Red Room	2063	9.1	0.33	0.0723	1.5373	0.6505
Office	2103	9.3	0.25	0.0738	1.5707	0.6366

Figure 6. Results of Space Syntax Analysis at Arcosanti, ordered from most spatially connected to least. (Source: Author).

### Correlation Analysis

Finally, the results of the Space Syntax, Nature Syntax and observations studies were entered into the statistical analysis software Minitab, and Pearson correlations were calculated, which allowed an initial understanding of where the data is suggesting relationships between the variants.

### RESULTS OF SPACE/NATURE SYNTAX METHODOLOGY IN USE AT ARCOSANTI

The method was applied to the Arcosanti site, for the purpose of both initial testing of the current methodology and further development. Space Syntax analysis was completed off site using floor and site plans provided by the Cosanti Foundation, before being edited and verified on site by the researcher. The Space Syntax results for the Arcosanti site are displayed in full in Figure 6; the Vaults returned the lowest RRA thus suggesting it as the most central and connected space on site, while the Office returned the highest RRA.

Next, the VN value for each of the 15 social spaces was calculated by the process described in the previous section; the results can be seen in Figure 7. The space which returned the highest VN value and thus has the highest visual connection to Nature was the East Crescent Roof, while both the Community Room and Library/Rec Room had a VN value of 0.

Social Space	RRA	TV	Permeability (%)					Total	Ratio	Naturalness of View					Visibility of Nature (VN) Value	
			N	E	S	W	Average			N	E	S	W	Average		
East Crescent Roof	1.2203	0.7728	91	87	92	90	100	91.8	0.9	0.3	1	1	0	1	0.7	0.64
Vault Roof	1.1331	0.8825	100	100	100	100	100	100	1.0	1	0	1	0	1	0.6	0.60
Sky Theatre	1.0845	0.9221	100	100	100	100	100	1.0	0.23	0	1	0	1	0.45	0.45	
Roof Patio	1.1389	0.8760	96	82	91	90	100	91.6	0.9	0.25	0	0	1	0.23	0.23	
Amphitheatre Seating	0.9850	1.0152	100	100	100	100	100	1.0	0	0	0	0	1	0.2	0.20	
Vaults	0.7523	1.3292	42	30	100	33	47.4	0.5	0	0.75	0.75	0.25	0.35	0.17		
Ceramics	1.0820	0.9242	12	65	100	65	74	63.2	0.6	0	1	0	0.25	0.25	0.16	
Amphitheatre Stage	1.2034	0.8310	100	46	42	43	38	33.6	0.5	0	0	0	0.75	0.15	0.08	
Rec Room	1.5373	0.6505	15	19	28	12	6	16	0.2	0.5	0.75	1	0	0.25	0.5	
Café	1.2134	0.8241	0	25	27	33	15	20.2	0.2	0	0.25	0.75	0.5	0.5	0.4	
Office	1.5707	0.6366	0	33	26	0	9	13.6	0.1	0	0.75	1	0	0.35	0.65	
Classroom	1.3406	0.7459	0	30	0	29	0	11.9	0.1	0	0.75	0	1	0.35	0.64	
Music Centre	1.2201	0.8196	33	0	94	0	0	23.4	0.2	0	0	0.75	0	0.15	0.04	
Community Room	0.7824	1.2780	0	34	0	0	0	10.8	0.1	0	0	0	0	0	0.00	
Library/Rec Room	0.9548	1.0473	0	0	0	0	0	0	0.0	0	0	0	0	0	0.00	

Figure 7. Results of Nature Syntax Analysis at Arcosanti, ordered from most visually connected to Nature to least. (Source: Author).

The data from the observation studies of all 15 spaces was then compiled in order to investigate if this initial study at Arcosanti was suggesting existing relationships between RRA, VN, and social interaction. First, the usage patterns for the highest and lowest VN values were examined: the East Crescent Roof has the highest VN value, at 0.64 while the Community Room and Library/Rec Room both have VN values of 0. The observed activity for the East Crescent Roof, Community Room and Library/Rec Room can be seen in Figure 8. Unsurprisingly, the East Crescent Roof had the highest proportion of people displaying a Visual Interaction with the Natural Environment, with 84% of all such interaction observed across all observations on all sites occurring on the East Crescent Roof. The Community Room and Library/Rec Room both had 0% of Visual Interaction with Natural Environment, again unsurprisingly as they have no visual relationship to Nature. There were marked differences in how the spaces were used; the East Crescent Roof was observed to have 18.7% of Total People over all observations, significantly higher than the Community Room (8.1%) and the Library/Rec Room (0.8%). The most interesting outcome from the observational data is that the East Crescent Roof experienced a completely different type of social interaction from both the Community Room and the Library/Rec Room. The East Crescent Roof saw 23.7% of total Active use, and 0% of Inactive, compared to the Community Room which only saw 4.8% of Active Use, but 20.1% of Inactive use. The differences in social interaction were less significant for the Library/Rec



Figure 8. Social space usage pattern diagrams for the East Crescent Roof (a), Community Room (b) and Library/Rec Room (c), based on observations carried out at Arcosanti site in early 2015. (Source: Author).

Room, but were still greater for Inactive (1.6%) than Active (0.6%). Additionally, the East Crescent Roof was the location for a higher percentage of all Planned social interaction at 22.8% when compared to Unplanned Use at 2.8%, again contrasting with the Community Room which had only 4.8% of Planned Use, but 20.6% of Unplanned Use, and the Library/Rec Room which saw 0% of Planned Use but 3.9% of Unplanned Use.

The highest and lowest RRA values were then compared; these were for the Vaults (lowest RRA at 0.7523) and the Office (highest RRA at 1.5707). The observation study results for these spaces can be seen in Figure 9. According to the principles of Space Syntax, the Vaults should be a more lively and used space as they are more centrally located and accessible. However the observation studies found that the difference in activity in these spaces was not hugely significant when compared with the percentage differences for the highest and lowest values of the VN value; the Vaults had a 7.9% share of Total People, while the Office's share was 5%. These slight differences are consistent throughout all categories of activity observed in the observation studies. The Vaults has only marginally more a percentage of total Active use than the Office (7.2% compared with 4.7%); total Inactive Use (10.9% to 6%); Planned Use (7.8% to 5.7%); and Unplanned Use (8.3% to 2.2%).

A brief analysis of the results of the Space Syntax, Nature Syntax and observations suggests a number of initial findings. The most significant of these is that there seems to be a relationship between visibility of a natural environment and how space is used. The East Crescent Roof, with the highest VN value appears to be a location for Active, Planned use

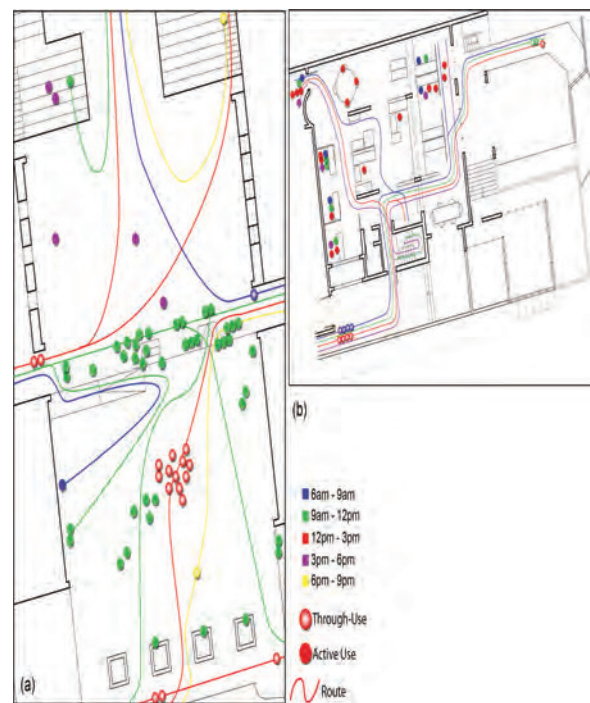


Figure 9. Constance Region based on the intensity of network connectivity.



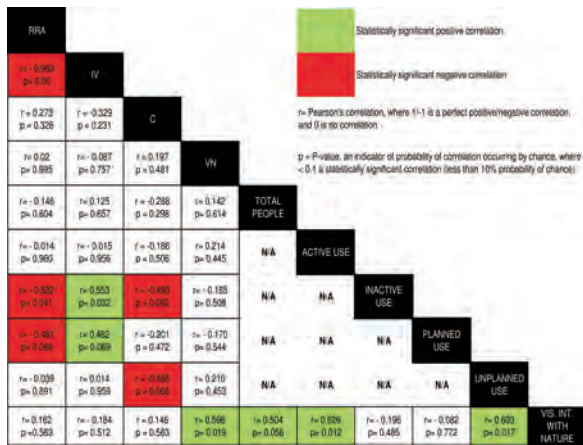


Figure 10. Constance Region based on the intensity of network connectivity.

while those with lowest VN values are used more for Inactive, Unplanned use. Another suggested finding is that, at the Arcosanti site at least, the spatial connectivity of a space does not influence its level of use as much as one might expect; the spaces which are at opposite end of the Space Syntax analysis results do not have as significant a distinction in use as those which are at the opposite ends of the Nature Syntax results, suggesting that the visibility of Nature from a social space does indeed play a role in how the space is used. While this paper only briefly discusses 5 of 15 spaces, these initial findings seem to be somewhat implied within the correlation data produced for all observations in the study. Figure 10 shows how there are significant correlations between RRA value, and Inactive Use and Unplanned Use. However, the correlations suggest relationships between VN value, and Active Use and Planned Use are less significant than the initial analysis of individual spaces implied. Finally, the correlation data seems to support the finding that the RRA value may not be as singularly influential in determining how a space is used as it would be expected, as the correlation between the two factors is not strong, as was also suggested in results of the observations.

The purpose of this paper was to present the development of the Space/Nature Syntax methodology within its academic context, and investigate its usefulness as a tool for determining how designing to maintain a human-Nature relationship can inform social interaction. The methodology takes into account both spatial connectivity and natural connectivity, through visibility of Nature, and its initial application at Arcosanti has produced both promising results and raised interesting issues for further investigation.

There are a number of future steps for this research work identified. Additional observational studies would strengthen and confirm the initial findings suggested in this paper, particularly with regards to the strength of the implied relationships between RRA and VN values, and types of social interaction; these additional observations have been carried out at

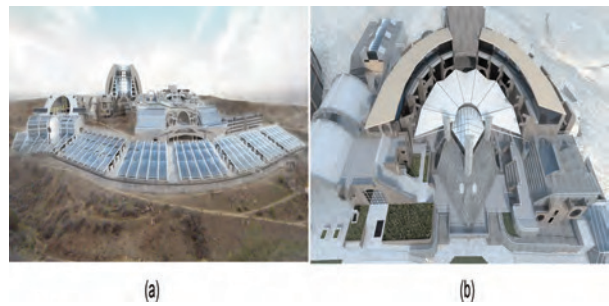


Figure 11. Constance Region based on the intensity of network connectivity.

the Arcosanti site during 2016 and initial analysis confirms the findings presented within this paper. The method will also be repeated for an existing theoretical next stage of development at the Arcosanti site; the completion of the East Crescent, which will see an additional floor being constructed as well as a theatre filling the currently vacant “Keystone” unit (Figure 11). The purpose of this is to explore, according to the correlation data for the existing site design, how future development at Arcosanti alters spatial connectivity and natural connectivity of the existing social spaces, and how these alterations could theoretically affect how social interaction in existing spaces. Finally, while the Space/Nature Syntax methodology has thus far been developed and tested solely on site at Arcosanti, it is intended to be a methodology which can be applied to any built environment. The possibility of applying the methodology to another site will be explored, which will assist in both the development of the methodology and ensuring its validity and relevance as a design and analysis tool.

There is a wealth of evidence to suggest that Wilson’s Biophilia Hypothesis is indeed correct and the human-Nature relationship is innate, essential, and beneficial to us. There is an irrefutable connection between humans and the natural environment, one which has been shown to inspire, teach and help heal the human mind. However the migration from a rural civilisation to urban civilisation witnessed in recent human history continues at an ever increasing rate, and within 35 years the significant majority of the world’s population will be urban dwellers. If the link between humans and Nature is accepted as essential, then the field of architecture, as the craftsman of the new human environment, has a significant role to play in creating built environments which nurture and maintain this relationship – arguably, they have a responsibility to do this. The development of the Space/Nature Syntax methodology aims to provide a tool which will help architects and designers to make informed design choices, and create built environments which both provide the benefits of city living that continue to attract so many people, while allowing the evolutionary connection with Nature to survive.

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# ARCOLOGY, ARCOSANTI AND THE GREEN URBANISM VISION.

Ruth A. Rae

## Abstract

*Arcosanti is a prototype city being built based on the visionary architect Paolo Soleri's principles of Arcology which integrates architecture with ecology. Arcology proposes a compact three-dimensional urban form to provide a lean alternative to the unsustainable urban sprawl city form found in most of America. In its reduction of dependence on the automobile, reliance on pedestrian transportation, proximity to nature and proposal to have agriculture integrated into the city, Arcology is a vision of Green Urbanism. The design of Arcosanti incorporates Biophilic principles that preserve the biodiverse natural landscape, has a compact organic form, and functions with a circular metabolism that is analogous to nature when complete. Arcosanti, located in central Arizona, was begun in 1970 as an urban laboratory, and has been constructed by over 7,000 workshop volunteers over the past 45 years. Following Soleri's death in 2013, the Cosanti Foundation has established a Strategic Planning Steering Committee to help guide the continued development of Arcosanti as a prototype Arcology. The Strategic Plan will provide a framework for future organization and development. This article examines how the concept of Arcology and the development of the Arcosanti prototype encompasses principles of Green Urbanism and sustainable development.*

**Keywords:** Arcology, Arcosanti, Green Urbanism, Soleri, Sustainable Development.

## INTRODUCTION

Arcosanti is a place that is inspirational, even 45 years after its inception. It is a prototype of what a city could be and is the only physical manifestation of an Arcology that exists today. Arcosanti has a dramatic location on top of a mesa in the high desert of central Arizona, in the midst of a beautiful landscape surrounded by a spacious vista of nature. Although only 70 miles north of Phoenix, as one approaches the Arcosanti site the land rises and opens up, and when the city still in construction appears it is immediately clear how different this place is from the suburban sprawl that is Phoenix.

The Arcosanti site covers only 15 acres and is surrounded by approximately 4,000 acres of open undeveloped land which will retain its natural biodiversity.

The following figures offer views of the approach to the Arcosanti site on the local road (Figure 1), a view of Arcosanti (Figure 2) and the surrounding landscape (Figure 3).

Arcosanti's compact city design is based on the visionary architect Paolo Soleri's principles of Arcology, which fuses architectural and ecological principles. Its creation utilizes innovative design and incorporates ecological accountability, with a goal of creating a lean alternative to urban sprawl. Arcology proposes a compact three-dimensional urban form which is the opposite of the unsustainable urban sprawl found in most of America. Arcosanti's structures when complete will rise up and contain the mixed

uses to supply the cultural, economic, social and housing needs of its population. The design of Arcosanti incorporates Biophilic principles that preserves the biodiverse natural landscape, has a compact organic form, and functions with a circular metabolism that is analogous to nature when complete. In its reduction of dependence on the automobile, reliance on walking as primary form of transportation and proximity to nature, Arcology is a vision of Green Urbanism.

## ARCOLOGY, ARCOSANTI AND GREEN URBANISM

Green Urbanism emphasizes the ecological dimen-



Figure 1. Approaching Arcosanti (Source: Author).



Figure 3. Surrounding Landscape (Source: Author).



Figure 2. View of Arcosanti (Source: Author).

sions of cities in a way that goes beyond discussions of sustainability alone to incorporate Biophilic principles (Beatley, 2011). According to Wilson (1993) Biophilia is the innate need that humans have to connect with nature, and the intrinsic interdependence between people and other living systems. Biophilia recognizes the essential need for daily human contact with nature and the many environmental and economic values provided by nature and natural systems (Beatley, 2011). A Biophilic city is one where abundant nature and natural systems are available to urbanites. It is a place where residents feel, see and experience rich biodiverse nature in the normal course of everyday life, work and play (Beatley, 2011). Arcosanti is surrounded by a beautiful and immediately available natural landscape. As stated by Stein (2014) "A citizen of Arcology can be both a city person and a country person at the same time, part of both an intense urban experience and able to enjoy quick access to the immediately surrounding wild landscape" (p. 13). Arcosanti has remained an important model of what a

compact pedestrian city looks like that has an intimate connection to its natural surroundings (Beatley, 2009). The integration of nature and wilderness into urban areas is a primary component of Green Urbanism (Beatley, 2011).

Biophilic cities also exhibit and celebrate the shapes and forms of nature. Soleri's aesthetic is a kind of modular organicism or super-organic expressiveness (Busbea, 2013) that is present in both his structures and solar apses, and the design of his famous craft objects and windbells. Paolo Soleri reimagined cities as growing organic entities and this organic urbanist perspective is reflected in his design of Arcosanti. Soleri's natural organic shapes are apparent not only in the structures of the buildings and windbells but also in their details. Even Soleri's construction techniques, in particular the silt casting of concrete in which large piles of silt were built up by hand or heavy equipment and concrete poured over them leaving an open apse shape, brought colorful natural elements into the city. Soleri was able to achieve complex and dramatic forms using this rudimentary method (Busbea, 2013).

Biophilic cities tie the argument for Green Urbanism more directly and specifically to human well-being than to energy or environmental conservation alone (Beatley, 2011). Yet Green Cities should also be understood as living entities with a complex and interconnected metabolism that has systems of material and resource flows and a sustainable urban metabolism (Beatley, 2012). Green Urbanism is also a conceptual model for urban design used to promote compact energy-efficient urban development (Lehmann, 2010a). Lehman's (2010b) holistic concept of an Eco-City would respond well to climate, location, orientation and context optimizing natural assets such as sunlight and wind flow, and use deep green passive design strategies and solar architecture concepts. A core element of the Green Urbanism concept would be to eliminate the concept of waste based on a closed loop ecosystem with significant recycling, reusing, remanufacturing and composting (Lehman, 2010b). Beatley's (2000) Green Cities also strive to achieve a circular rather than linear metabolism.

Arcologies have a blend of energy conservation and land use efficiencies as well as waste recycling systems that place fewer demands on the environment (Grierson, 2003). Soleri explored methods of both generating and harvesting energy from renewable sources so that living, working and learning are integrated with food and energy production. Some of the Arcologies Soleri designed gave greater priority to renewable energy and ecology, and reinforced the relationship between architecture and ecology through an energy concept where the entire settlement is seen as an instrument for energy conservation and environmental sustainability (Grierson, 2003).

All of Soleri's designs of Arcologies explore methods of generating and harvesting energy from renewable sources with the aim of transforming the urban structure into an energy machine (Grierson, 2003). Soleri's solar architecture designs include built apses that optimize solar capture in the winter and

provide shade in the summer in response to the sun's trajectory. The concrete apses also act as heat-sink devices that collect warmth during the day and release it at night. In his Two Suns Arcology concept, food and radiant energy are produced within south-facing greenhouses located within the city which are designed to support the city's population at a minimum level. The city is conceived as complex where living, working and learning are integrated with energy and food production. Large expanses of greenhouses would be attached to the city and used to generate heat and electricity as well as to grow food, so the city itself is both the consumer and producer of energy (Grierson, 2003).

Green Urbanism describes a more ecologically responsible form of living and settlements for cities that live light on the land and reduce environmental impacts (Beatley, 2000). Environmentalists have questioned whether the rapid growth of cities can be sustained, especially in the pro-growth paradigm that currently exists in American cities. The sustainable development of urban areas is not just important but essential. As of 2008, 50% of the world's population now live in cities, and that percentage is projected to increase to 70% by 2050 (Beatley, 2012). There must be a change in attitude and a prioritization of life that is in balance with renewable resources of the ecosystem and biosphere (Grierson, 2003). Arcology recognizes the need for a radical reorganization of sprawl into integrated dense urban structures with material recycling, waste reduction and the use of renewable energy sources as a strategy to reduce the flow of resources and products through the urban system (Grierson, 2003).

Cities have traditionally evolved in America based on consumption instead of sustainability. Arcosanti and Arcology in contrast define a radical revision of the idea of what a city is or should be. The Arcology ideal advocates that cities, like organisms, be contained, especially when trying to solve issues of energy. Arcology is not just a reform of existing cities, but a reformulation of how we make entire cities (Stein, 2014).

## ARCOLOGICAL DIMENSIONALITY AND URBAN DENSITY

Arcology is the fusion of the discipline of architecture with the science of ecology and implies that the design of buildings and cities affect the earth's ecology (Stein, 2014). Soleri believed that the architect's task of ecological design through the creation of Arcologies should be directed toward the progressive transformation of human existence, and would be instrumental in human evolutionary terms. The proposition is that people living within an Arcology, by adopting a frugal lifestyle, would have the potential to develop themselves spiritually as well as do less harm to the planet (Soleri, 1983).

A core of Soleri's (1983) paradigm, and the premise for Arcosanti, was the Complexity-Miniaturization-Duration principle which saw urban places as capable of the same type of expansion and

growth as organic nature. Cities and communities were seen as complex in both form and function, and could expand in all directions simultaneously in a pattern of interconnecting space and forms (Busbea, 2013). Miniaturization was mandated by complexity and part of the process that led to a rigorous utilization of all resources. Duration was that any process requires extension into time, and was enlivened by activity (Soleri, 1983). As in nature, as an organism evolves it becomes more complex and tends toward a more compact form so that sustainability, in Arcological terms, is part of an evolutionary process (Grierson, 2003).

Soleri's Arcology ideal recognizes the necessity for the radical reorganization of the sprawling urban landscape into dense integrated, three-dimensional towns and cities. In Celada (2013) Soleri stated the "All organisms are three-dimensional and cities need to adopt that fundamental tenant of organic life. They need to reject the gigantism that is killing them, starting with the cars that push them into absurd horizontal dimensions" (p. 30). Soleri was a proponent of density in the land of sprawl. The development of American cities is an urban explosion that creates sprawl across the landscape. In comparison Arcologies are more of an implosion, where cities would be built up instead of out (Grierson, 2003; Stein, 2014).

Density may be a necessary element of sustainable urbanism, but it is not commonly embraced by the public, particularly in the United States. The America dream is still of a private single family home with a large private lawn. The average density of development in the United States is roughly 2 dwelling units per acre (Farr, 2008). Soleri's original idea for Arcosanti is that it would eventually house approximately 5000 people on only 15 acres which would result in a density of about 350 people per acre which is ten times the density of New York City (Grierson, 2003). It is a working prototype for another kind of city that will be built as a highly compact three-dimensional urban structure, that would stretch no more than a quarter mile in each direction, and could be 30 stories high (Grierson, 2003)

Sustainable urbanism emphasizes the appeal of living in areas that integrate compactness, connectedness and Biophilia (Farr, 2008). In today's world that necessitates sustainable urban development, recommendations for the increased urban density are also found in the principles of Smart Growth and New Urbanism as well as Arcology. Although there are similarities in these approaches, Smart Growth and New Urbanism involve the retrofitting of existing cities or suburbs and the development of new places that are constructed and developed in traditional ways even though the designs can be innovative. In contrast, Arcology involves the creation of a new urban form that is transformative and unique in its development. The Arcosanti prototype is not located within the traditional horizontal rectangular urban grid, and preserves the open land around it, even though it is not intended to be completely self-sufficient.

Both Smart Growth and New Urbanism are planning strategies to mitigate urban sprawl, but despite their similarities there are differences between them. Smart Growth was launched by environmentalists and policy planners whereas New Urbanism was more influenced by architects and physical planners. Smart Growth attempts to preserve open land, design pedestrian friendly environments, do compact building design, create walkable neighborhoods and encourage community while New Urbanists focus on physical form, arguing that changes in physical form are precondition for urban economic, social and ecological change (Knaap & Talen, 2005).

Smart Growth is an approach to urban planning that emphasizes compact development in order to result in more socially, economically and environmentally sustainable communities (Cohen & Robins, 2011). It is endorsed by the United States Environmental Protection Agency, and is intended to counter some of the negative environmental and social effects of suburbanization that were driven by the automobile in the United States. New Urbanists believe that social change can be brought about by architectural design and planning, but even the best New Urbanist towns have failed to reduce dependency on cars (Jr., 2010). In contrast the design for Arcosanti would allow for cars only on the periphery of the city to be used for travel outside the city. This total elimination of the automobile within the city opens up space usually reserved for cars and allows for such a compact and tall city design. The primary mode of transportation would be pedestrian based, supplemented with lifts, escalators and moving walkways. The scale is human even within the transportation networks, and the air quality is not affected by the hazards of automobile emissions.

## ARCOSANTI

Arcosanti began its construction in the 1970s during a time of heady environmentalism in the United States. Several articles published by the New York Times during that time reflect popular opinions ranging from enthusiasm for the vision to architectural critique. Paolo Soleri was referred to as the "Prophet in the Desert" by Ada Louise Huxtable (1970) who noted he was beginning a labor of love on a town he called Arcosanti with some tools, little funding and a handful of dedicated students and volunteers. She saw Soleri's book, "The City in the Image of Man" which was just published, as offering "environmental perceptions that offer a sudden, stunning pertinence for today", and his Arcology as showing that "architecture and ecology are two sides of the same thing, and inseparable in their effect on human beings" (Huxtable, 1970). Dunphy (1976) described how the "Dream City" of Arcosanti that rises in the desert had initial structures and site workshops that drew buildings, planners and students from all over the world, even though conventional architects saw the project as realistically improbable and technically impossible. In "A Desert Vision Takes on Shape as Builder Seeks New Society", Nordheimer (1975) noted that although some saw

Soleri as more of a social visionary whose sweeping vision was to restructure society via the redesign of cities, the architect's appeal has been to environmentalists who believe restructuring is desirable in order to avoid ecological disaster. Although the architectural critic Goldberger (1989) felt Soleri was truly successful only as a visionary, he did acknowledge that "Arcologies, as single structures capable of housing thousands of people...are perhaps the ultimate answer to urban sprawl, for by condensing all the life of a huge city into one immense structure Soleri allows most of the land to remain untouched".

Arcosanti has been in construction for about 45 years, yet is only about five percent complete. This place has been built primarily by the over 7,000 volunteers who participated over the years in its construction workshops and had an experiential learning experience. Progress is slow in part due to construction being financed primarily from workshop fees and the sale of Soleri windbells over the years. But it is also slow since Arcosanti is not a for-profit endeavor being created by a developer for profit, a planned development with marketing in mind, nor did it originate based on a government urban planning document. Arcosanti is instead a prototype being build based on a concept of Arcology and as such is an urban laboratory.

The approximately 35,000 visitors that come each year have not only experienced Arcosanti but have also been helping to finance its construction. Sometimes these are people drawn to the idea, or want to see the beautiful architectural and natural reality of the place, but many others are tourists just passing through. Guided tours that introduce visitors to the history, planning and ongoing construction of Arcosanti are available daily, as are meals in the café and even overnight stays. Participation in five week immersive educational workshops is still being offered, and there are numerous art and performance events a year (see [www.arcosanti.org/arcosanti\\_today](http://www.arcosanti.org/arcosanti_today)). The trademark bronze and ceramic Soleri windbells (see Figure 4 and the Cosanti Original website) are avail-



Figure 4. Soleri Bronze Windbell (Source: Author).

able for sale, and these have been a primary source of income for the Cosanti Foundation which owns and administers Arcosanti.

Arcosanti is officially listed as a town in Arizona and even has its own exit from the interstate highway though a journey down a dirt road is still required to get to the site. It has residential housing and guest units as well as a campground and a swimming pool. There are offices for planning, information and administration, educational classrooms and conference spaces as well as a greenhouse, gardens and olive orchards. Arcosanti has a restaurant and community café in the same Crafts III building as the visitor center and the gallery that sells Soleri windbells which are produced in a bronze foundry and ceramics studio on site. There are also a multitude of cultural and artistic events that happen in a variety of public performance spaces, including a public area under the Vaults, and the Colly Soleri Music Center which contains an amphitheater, stage and smaller music center lounge. Access to nature is immediately available with hiking trails and riverbeds just off the mesa that Arcosanti is located on since the site is surrounded by approximately four thousand acres of undeveloped land.

Arcosanti is designed to contain homes, offices, parks and a cultural center and has a mixture of uses so that people work, live, play, and learn in spaces adjacent to each other. Yet despite these various facilities Arcosanti could not yet be considered the urban area it aspires to be but is rather more like a village. There is not yet the complexity or range of services, or the economic and social opportunities found in an existing city, nor is there extensive ethnic or class diversity. Yet living there can feel akin to being in a neighborhood where everything is close by and available by walking. Public spaces are plentiful with adjacent zones of private, semi-private, semi-public and public space that create complex, lively neighborhoods (Stein, 2014). Arcosanti is a pedestrian place which can be seen in Figure 5, and is also surrounded by stunning landscapes that can be viewed every day from the Crafts III restaurant and community café



Figure 5. Arcosanti Pedestrian Way (Source: Author).



Figure 6. Arcosanti Crafts III Restaurant and Community Café (Source: Author).

as seen in Figure 6.

Arcosanti houses a community that is usually between 50 to 100 people composed of residents, workshop participants and visitors. Residents are primarily people who took a workshop and then decided to stay on for a while to continue to live at Arcosanti and work on building a sustainable Arcology. There are a variety of interesting housing spaces of various sizes and shapes tucked into or around the edges of more commercial and public spaces. Unit selections are based on availability and seniority and are inexpensive. Residents must generally work full time to live on site but the jobs are limited, the majority provided by the Cosanti Foundation which manages the operation and development of Arcosanti. Work assignments can include the visitor center or café, windbell production foundry, construction, maintenance and landscaping as well as public relations, planning, research, archives, teaching, hospitality and communications. More permanent residents have established a community council with rotating members that democratically creates rules and initiatives. Community planning goals include a desire to enhance education, increase population and develop economic opportunities and agriculture.

## COSANTI FOUNDATION AND STRATEGIC PLANNING

For many years Paolo Soleri was the head of the Cosanti Foundation that he created, a non-profit educational organization. Their mission is to promote the concept of Arcology as a viable adaptation of urban form through educational programs, exhibits and the ongoing development of the Arcosanti Urban Laboratory. The Cosanti Foundation has four stated Core Values that guide the development and execution of its mission: Ecological Accountability is to develop human habitat that protects its surroundings, Limited Footprint to use urban density to allow for more activities in less space and to provide access for the social and economic essentials of city life, Resourcefulness is having a careful thoughtful approach to planning and building daily life that is

experientially rich and materially frugal, and Experiential Learning demonstrates the power of a dynamic, grounded educational experience (Arcosanti: A Project of the Cosanti Foundation, 2016).

In 2012, at the age of 92 Paolo Soleri retired from the Foundation and passed the baton to Jeff Stein and the Cosanti Board. After Soleri's death in 2013, the Cosanti Foundation Board assembled a Strategic Plan Steering Committee to advance the development of Arcosanti and Arcology. The volunteer Steering Committee and the Board is guiding the development of a Strategic Plan that would provide a comprehensive plan for the development of Arcosanti using a multidisciplinary approach to urban planning, land use, mixed use community development, agriculture, infrastructure and resource management (Arcosanti: A Project of the Cosanti Foundation, 2016). Comprised of Arcosanti alumni participants and current residents, the Strategic Plan Steering Committee represents professional experience in architecture, engineering, education, planning, business management and law. The subcommittee has participated in visioning workshops, created a scope of work that includes a strategic analysis and begun an environmental scan of the site to collect information in preparation for the hiring a planning consultant and project management team to conduct the multi-dimensional strategic plan.

Since the Arcosanti master plan has undergone numerous design changes the Cosanti Board is undertaking a critical review of the original 1970 Arcosanti design concept. They will update it based on direct experience and in light of the technological advances that have occurred in the last 50 years. This will include a review of construction materials, the circulation of people and materials, urban neighborhood and human scale development, food production on and within the structure, waste and water management systems and the preservation of the surrounding environment. The Arcosanti master plan projects a city of 5,000 inhabitants, with an incremental critical mass concept of 500 people. An increase in population to 500 residents will require additional infrastructure to be built, including housing units, and will bring in additional economic, social and educational opportunities for residents. Arcosanti will continue to be an urban laboratory as it grows guided by principles of Arcology while testing real world functionality, and the concepts and core values that guide its design.

## CONCLUSION

Arcology as a concept contains many tenets that are in line with the current and timely understanding of the need for urban sustainability that is embedded in societies today. Climate change is real and the increasing urbanization around the world is making sustainable development at a global level a necessity. The environmentalism of the 1970s has been transformed to the sustainability and resilience concerns of 2015.

Soleri's proselytizing for dense pedestrian cities that are in harmony with the natural world is

contained within principles of Green Urbanism and sustainable development. His beautiful and organic looking architectural design of buildings captures the imagination still. Ecology has become more important and it is now studied in its urban context. Soleri's understanding of the connection between architecture and the built environment with the ecological or natural world was prophetic.

It is precisely Paolo Soleri's vision of what the future could be that led to his trying to turn that dream into a reality on a mesa in Arizona. Through the years over 7,000 people attracted to his ideas were inspired enough to come do the hard physical work to construct Arcosanti, and thousands of others who passed through during the last 45 years were exposed to the ideas embedded in the place. Hundreds of articles have been written about his ideas and Arcosanti internationally. A great many more people have heard about Arcology or Arcosanti even though they have never been there.

Yet there is the perception that Arcology is an old idea of a visionary now gone who never managed to get the entire Arcosanti prototype actually built. But that is missing the point. Arcosanti is a physical place that embodies some of these ideas, and has turned at least part of a vision into a reality, and is being developed as a prototype of Arcology. It is an urban laboratory that through the process of being built continues to provide experiential learning opportunities for people who, young or old, will remember the experience of being there and doing that. People continue to be drawn to the idea, which they can experience in the reality of the place.

Arcosanti is a place to test architectural and engineering concepts beyond just a model but also in physical space, and learn about how they actually work. But an unfinished Arcology, that is just a small percentage of its intended scale, will not be able to adequately test either the physical, social or economic aspects of its premises. The time has come to incorporate new technologies, and financing strategies, into a creation of a complete Arcology. The critical mass plan to have 500 residents on the way to a much larger population will be the next step. Some things will need to be negotiated, from housing tenure forms to food production to school types and governance structures, and could be piloted on a smaller scale. Arcosanti already contains many elements of Green Urbanism and sustainability and is essentially a blank slate waiting to be filled in and finished, which is different that the retrofitting of most urban areas that are trying to become green cities. The fuller development of Arcosanti as a prototype Arcology will be possible with the development of funding and a strategic plan.

Paolo Soleri was the founder of Arcology and Arcosanti who has left behind a legacy. The Cosanti Foundation Board and Strategic Plan Steering Committee are aiming to bring these ideas fully into the future and integrate them with current global concerns. The Cosanti Foundation's Core Values of Ecological Accountability, Limited Footprint, Resourcefulness and Experiential Learning will help to focus these efforts. It is time to bring Arcosanti and



Arcology back into the mainstream with the recognition of how relevant this model of urban life it is to the concerns and sustainability issues of today.

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# UNFINISHED BUSINESS AT THE URBAN LABORATORY - PAOLO SOLERI, ARCOLOGY, AND ARCOSANTI.

David Grierson

## Abstract

*This paper reviews the prospect of a radical redefinition of the relationship between society, technology, and Nature as posited within Paolo Soleri's Arcology theory, and anticipates a transformative social order and environmental setting in support of sustainability as demonstrated within the urban laboratory Arcosanti. It locates the roots of Soleri's ecological architecture within a rejection of urban sprawl emerging from his early apprenticeship with Frank Lloyd Wright at Taliesin West in Arizona, and argues that his own theoretical model, in presenting a fusion of architecture and ecology, prefigures a utopia of transcendence and offers a more rational planned response to the challenges of our age, while offering environmental movements a vision of what a sustainable urban future might look like. The paper argues that the positive utopian tendencies in Soleri's work should be reaffirmed and, at the same time, it underlines an urgent need for multi-aspect and multi-disciplinary research, and postgraduate education, to be undertaken at Arcosanti, to test the parameters of micro- and macro-structures within alternative models of ecological design. In concluding the paper gives acknowledgement to the ongoing work of the Cosanti Foundation's Board of Directors and its new Strategic Plan Steering Committee, and their commitment to attract renewed levels of financial and human resource in support of the urban laboratory's unfinished business.*

**Keywords:** Arcology, Arcosanti, Ecological Design, Urban Sustainability, Utopia.

## INTRODUCTION

This paper has been prepared since March of this year while I was working in the cities of Glasgow, Dubai, Doha Delft, Rotterdam, Xia'an, Hohhot, and Belfast. I've taken this opportunity, since things have changed, to reflect on themes that I first presented at a conference in Manchester almost twenty years ago (Grierson, 1997), and to support a recent renewed engagement with Arcosanti, the unique laboratory located in the Arizona desert, where I lived and worked some years before that. The paper is about architecture, ecology, sustainability, and utopia.

Across the planet, in our 'traditional' cities, and more recently in the emerging 'global' cities of a new knowledge economy, an enlightened culture has gradually polished the essential achievements of our modern civilisation such that today our urban centres converge on the demands and preoccupations of a mobile, connected, largely consumer society, and in so doing seem to struggle (some more than others) to retain within their blurred boundaries a sense of cultural identity. Each in their own way contain distinctly beautiful and vibrant places, but they each also have a darker side, one that fills the long shadows that extend ever outwards from the metropolis with anonymity. And it's here, not in the bustling street cafes and old market squares, nor in the regenerated docklands and artistic quarters, or even in the energy sapping shopping malls and office complexes, but in

the designed sprawl of the endless suburbs of Europe, the Middle East, and China, and right across the developed world, that these cities collectively contribute to a built environment that, by distancing itself from Nature, has become insensitive to environmental and ecological limits. Limits that we now understand have been surpassed.

During the last century, as the global population has effectively exploded around the world, incremental progress has been achieved by extracting more and more non-renewable resource from the natural environment. The continuation of these levels of extraction is unsustainable. We have taken more than the planet can afford and have reached a crossroads. Which path we choose will depend upon what value we are willing to place on future generations and, almost of equal importance, on the kind of living environment we are bold enough to imagine. If we are to confront the most pressing social, environmental, and economic challenges of our age, architecture, ecology, and urban design must be directed, in the utopian tradition, towards the forging of radical new cities that can, not only house our aspirations for an enhanced human culture, but offer opportunities for a new social contract in equilibrium with Nature. Time is precious. The watchman on the hill is calling just beyond where the majority of us now live. His is a shrill cry, echoing across the hinterlands of a seemingly unstoppable 'process of urbanisation' that speaks, not so much



Figure 1. Business Bay, Dubai, UAE (Source: Author, Thursday 17 March, 2016).

about a city's evolutionary potential and predominance (its transformative capacity), but its increasing lack of identity. When a formless urbanity sprawls out across endless landscapes of development, devouring energy and resources and destroying people and land in its wake, we might be forgiven for feeling that today we actually live nowhere.

Since the 1950s a new form of semi-urbanised space, forged by the mass mobilisation of the human population across Europe and the United States, has eroded our sense of organic community and of place. 'Urban sprawl' has become the transitory habitat for a new global nomadic society shifted from place to place, sometimes in flight from conflict, but more often under the directive of transnational corporations (or governments) who seek to sustain the growth machines of a slick economy that determines the new spatial order. But as the tax base has increasingly relocated to the suburbs, across the world our gigantic 'two-dimensional' cities are struggling simply to survive. As the urban core becomes starved of the financial and human capital that has helped sustain their industrial base many cities are now in danger of becoming extinct, while others compete for a niche in the global market. Alongside an accelerated process of urbanisation, the last fifty years has been marked by an intensification in our awareness that environmental problems arise within the context of a complex interrelationship between ourselves, our resource base, and the social and physical environments that we occupy. Consequentially questions about the objectives and strategies of conventional growth policies have been brought to the forefront of our public debates, and into the research agendas of our academies.

Lewis Mumford, in *Technics and Civilization*, advocated a new culture in which, rather than simply shaping our lives, a new form of humanistic technology, immersed in the social milieu, would become an evolutionary instrument enabling a better quality of life by actively enhancing our environmental setting. Mumford believed that mass communication, in better connecting us, would allow us to share our, "wishes, habits, ideas, and goals", and so build "a



Figure 2. Faculty of Islamic Studies, Education City, Al Rayyan, Doha, Qatar (Source: Author, Thursday 24 March, 2016).

better world for all" (Mumford, 1934). For our technology to be durable, effective, and efficient, he argued, it has to be fused with the kind of human spirit and creativity that will ensure that the message is more than just the media. Mumford's concept sanctions a transition towards an ecological view of the world that today's advances in communication technology have tantalisingly placed within our grasp (Grierson, 2014). A new knowledge-based economy and information order is emerging and is changing, not only the way many people work and how they spend their time, but transforming our collect consciousness. Simultaneously, in opposition to a mechanistic paradigm that has, until now, infused all aspects of our modern lives with a predominantly instrumental view of Nature, we are witnessing a fundamental shift in our shared thinking towards a more ecological, holistic, organic, or systemic view of the world (Capra, 1982).

Lovelock's Gaia hypothesis sees the Earth as a self-regulating system which is impacted upon by humans but cannot be controlled by them. Conditions suitable for life are maintained by feedback processes involving both living things and the non-living part of the planet (Lovelock, 2009). In seeking homeostasis this complex system can adjust, within certain limits, to large-scale human technological interventions. But the current pattern of urbanisation, resulting as it does in energy-intensive, highly-pollutant, forms of human settlement represent interventions spiralling out of control, causing levels of environmental degradation and social disruptions that threaten the planet's equilibrium. As the mechanical paradigm recedes, and future technological developments become aligned with ecological values and the practice of sustainability, the search is on for a new form of settlement appropriate to the needs of a post-Fordist political economy, one that can respond to the demands of global, rather than national, modes of high-tech production, and simultaneously to a contemporary discourse upholding the belief that social and environmental problems arise largely from seeing ourselves as separate from Nature. Theories, ethics, and practice concerning sustainability indicate



Figure 3. Floodwaters from Hurricane Katrina fill the streets near downtown New Orleans. (Source: AP/David J. Philip, 30 August, 2005).

an increasing concern that our conventional models of urban development are insufficient to respond to this new ecological world view (Grierson, 2003).

In provoking the prospect of a radical redefinition of the faltering relationship between society, technology, and Nature, we now anticipate a transformative economy, social order, and environmental setting in support of a new form of equilibrium, what we now commonly refer to as 'sustainability'. Sustainability, in its widest sense, involves a move from a current condition of unsustainable activity towards a process of improvement and increased quality. Essentially the term is used to indicate a change of attitude prioritising ways of life that are in balance with the current renewable resources of the ecosystem and the biosphere. Although we are unclear about how much damage has already been inflicted on the biosphere the thesis proposes a precautionary approach as a practical way forward. The view is that, in the face of inherent uncertainty, risk is deemed inappropriate, since failure to maintain a viable biosphere will be catastrophic and irreversible (Grierson, 2003).

## THE ARCOLOGY THEORY

In his Arcology theory Paolo Soleri has proposed a different way of life within a new kind of city ("arcology" - an urban structure planned to exhibit the fusion of 'architecture' with 'ecology'). Rather than accept the inevitability of decentralisation and sprawl, Paolo envisaged a re-orientation of life through a process of urban implosion, wherein the city is planned in such a way as to conserve the Earth's energy and resources, designed to be compact and three-dimensional. His version of the city imitates evolution via an intense miniaturisation process by becoming a single recycling organic structure. Citizens would occupy the outer skin of a complex structure that faces toward a Nature which is 'allowed', once again, to be natural. The surface is a membrane and not a wall, the interior contains the truly civic space, surrounded by real wilderness. The city turns inward for the concerns of people, society, and culture (Thompson, 1973). The theory refutes the Arcadian view that by moving to the

wilderness we can escape the 'degradation of the city'. Rather Paolo foresaw that a truly urban response to providing shelter lies in recasting the relationship between architecture and ecology so that the integrity of the environment is preserved because quality of life is kept intact (Skolimowski, 1971). While Arcology offers a methodology for the reorganisation of urban sprawl into dense, integrated, compact city structures that contain the promise a renewed social and cultural intensity, two aspects fundamental to Paolo Soleri's work; the idea of planning and the notion of structuralism were rejected during the 1970's and 80 's in favour of the Postmodern notion that we might choose to live our lives wherever, and however, we pleased. Today we understand that ecological limits are predicated on technological and social problems manifest in the built environment, and that defining a more sustainable society will require that we address these through designed alternatives. The critical voices from the past that denied the certitudes that Soleri based his ideas upon, and decried his utopian tendency, are today giving way to a new generation of architects who are embracing the need to deploy integrated renewable energy systems within large-scale, high density, urban agglomerations designed to respond to the need for sustainability in the built environment. Some, like Kevin Schopfer, describe their proposals as "arcologies". For them, Soleri's fusion of architectural technology with ecological conviction, offers a more rational planned response to the challenges of our age [note 1].

## PAOLO SOLERI (1919 – 2013) The Apprentice

Paolo Soleri was born in the industrial part of Turin, Italy, on June 21 1919. Between 1941 and 1946 Paolo studied at the Turin Polytechnical Institute, where he graduated with highest honours taking a doctorate in architecture focused on 'human ecology'. Soleri's early architectural studies in Italy were influenced, like many of his contemporaries in Europe, by the work of Le Corbusier, Mendelsohn, Gropius and Aalto (Stanishev, 1993) but "suddenly this little booklet comes out in Italian on Frank Lloyd Wright with a photo of the desert thing. And it threw me" (Ostler, 1994). After a brief exchange of letters with Wright, Soleri joined an expanding group of post-war foreign apprentices who were then converging on Taliesin to hear at first hand Wright's radical views on the new architecture of American democracy.

It was traditional for apprentices around this time to give Wright a gift at Christmas and on his birthday. The 'Box' contained the students own architectural projects and offered an otherwise rare opportunity to obtain direct feedback from the 'master architect' on their own imaginative terms. Wright put great emphasis on this event and his comments were seen as "the greatest architectural critiques any apprentice would ever receive" (Pfeiffer, 1982). Paolo, one of Wright's 'most brilliant students' (Blake, 1969), presented his box in the summer of 1948. In his letter of response Wright wrote that:



Figure 4. The Beast Bridge, Paolo Soleri, 1947-1948 (Source: Atlas Cement Corporation).

"Paolo really went to town on his. His passionate rendering had a painter's virtuosity and technique... The plateau he mounted his well conceived building scheme upon was richly decorated by his buildings. But again they seemed to me all on the plateau, not of it. And there again even in scheme Paolo seemed more the brilliant painter than the Architect. But there are many roads to Architecture and he may find one of them if he is patient enough (Pfeiffer, 1982)."

Less than a year later, the young Soleri's apprenticeship was abruptly terminated with a polite letter of dismissal from Wright. He had not, it seems, been patient enough. He had asked Wright's permission to establish another Taliesin in Italy and, although initially enthusiastic, Wright had become upset to discover that a group of Paolo's fellow apprentices were keen to join him in Europe, and when he discovered that Soleri's design for a bridge had been published in Mock's *The Architecture of Bridges* (1949) alongside his own, and had attracted better reviews, Paolo was on his way out of Taliesin.

Wright's decentralised view of American society, expressed through his life's work on Broadacre City was based on the general mobilisation of the individual through the widest possible use of the motor car. For Paolo the car came to represent, "...the



Figure 5. Damage caused by Hurricane near downtown New Orleans. (Source: Newsweek, 2005).

great villain of the century, and quite possibly the great villain of all time...an apocalyptic example of mindless logistics and technological slavery" (Soleri, 1973).

The arcological alternative, in the centrist tradition of Sant'Elia (1914), Garnier (1917) and Le Corbusier (1922), brings people and their activities back together, and his approach was firmly rooted in a form of ecological design that would minimise environmentally destructive impacts by integrating itself with living processes (Van Der Ryn and Cowan, 1995). In promoting reductions in energy and material flows through the urban system, and allowing communities to be re-integrated within their surrounding ecosystems Soleri collocates architecture with ecology, and offers to the city an opportunity to be part of Nature, rather than be imposed upon it.

## UTOPIA Change is 'on the way'

The issue of Green social change is dogged by the necessity to distinguish between various manifestations and scales of the 'environmental crisis' (in reality a crisis of the spirit). Although we can, and should, 'act locally' there are clearly problems of a global nature that require a different response from those of a personal, immediate, and local nature.

The scale of our global (and necessarily urban) social and environmental problems is such that bringing about a sustainable society is an infinitely more complex and difficult task than simply placing environmentalism on the political agenda.

To build a better world for all we need visions of what a sustainable futures might look like, in effect to reclaim the utopian tradition.

"...the utopian vision provides the indispensable fundamentalist well of inspiration from which green activists, even the most reformist and respectable, need continually to draw. Green reformers need a radical alternative picture of post-industrial society, they need deep ecological visionaries, they need the phantom studies of the sustainable society, and they need, paradoxically, occasionally, to be brought down to earth and to be reminded about limits to growth" (Dobson, 2007).

Whereas much attention over the last 30 years (since the WCED in 1987) has focussed on the development of local environmental policies and in devising concrete solutions for highly specific problems, there is now a recognised need to find holistic visions, and evocative images of what a sustainable society might be like, particularly in an age when we appear to have lost faith in the future.

In an address to the Fifth Alvar Aalto Symposium in 1991, the architect, Juhani Pallasmaa contrasted the optimistic spirit in the artistic and cultural avant garde within La Belle Epoque, Art Nouveau, and De Stijl of a hundred years ago with our modern pre-occupation with 'endism' [note 2]. Now, he said, "...we simply do not know what to expect and what to hope. We have lost sight of our



Figure 6. Streetscape, Xi'an, Shaanxi, China. (Source: Author, Sunday 29 May, 2016).



Figure 7. Bicycle Park, Delft Railway Station, Netherlands. (Source: Author, Wednesday 11 May, 2016).



Figure 8. School of Architecture, Inner Mongolia University of Technology, Hohhot, China. (Source: Author, Monday 30 May, 2016).

horizon and our curiosity about the future. Instead of being excited we are worried" (Pallasmaa, 1991).

### City of the Mind

Karl Popper, in his critique of utopia spoke of 'aestheticism' as a deep longing to imagine a society that is not only more rational, but one that has been relieved of all ugliness and constitutes a truly beautiful new world (Popper, 1995). The vision of the Renaissance ideal city with its basis in rational order and geometric purity, offers the classical model of the urban utopia as essentially a 'city of the mind', a

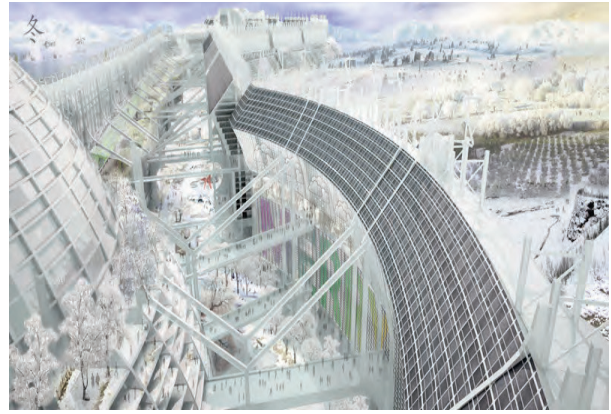


Figure 9. Paolo Soleri's Lean Linear Arterial Arcology model (Source: Cosanti Press/ rendering by Youngsoo Kim, January, 2012).

reference point for the promise of perfection. Although utopianism has been rightly criticised for attempting to subordinate political activity in conformity to a blueprint for the 'Ideal State', the appeal of utopia remains intact, in part, because it allows us to fantasize about the possibility of achieving Mumford's "better world for all". From Plato's Republic and Lao Tzu's Tao Te Ching, utopias have had a long history in art and literature, and as political practice aiming at vast social transformation. In offering alternative visions of the future, many architects and planners have approached the problem from a physical, rather than an ideological, base. During the twentieth century architects such as Tony Garnier (Une Cité Industrielle, 1917); Le Corbusier (La Ville Contemporaine, 1922 and La Ville Radieuse, 1933); Frank Lloyd Wright (Broadacre City, 1934), Constantin Doxiades (Ecumenopolis, 1969) and Paolo Soleri (Arcology, 1969) were inspired by a universal rational morality steeped in the utopian tradition (Rowe and Koetter, 1978).

Soleri's own form of aestheticism is guided by his belief that, 'life is in the thick of things' and it aligns well with Lovelock's Gaia hypothesis. The living process is immensely complex and ever intensifying and creates conditions in which particles of physical matter, in the right setting, can act in ways which are organic and living, and eventually instinctive, self-conscious and spiritual (via what he describes as the "complexity-miniaturization-duration" paradigm). Soleri argued that, in the transformation of the organism from the simple to the complex, matter is becoming spirit (Soleri, 1973). Here he prefigures a utopia of transcendence wherein architecture speaks of the "supremacy of aesthetics over structure and technology" (Moholy-Nagy, 1969). For Soleri it is essentially something 'on the way'. His anticipatory model promises the emancipation of the human spirit via metamorphosis, wherein ecology and architecture are conjoined pieces of both theology and technology, and when designed well the city becomes an instrument for the human evolutionary process. But, despite its theological dimension, it is in the re-casting of the relationship between society and Nature that the Arcology theory conforms to the classical utopian



Figure 10. George Best Belfast City Airport, Northern Ireland. (Source: Author, Wednesday 15 June, 2016).

typology. And here, the positive utopian energies of Paolo Soleri's work need to be acknowledged and affirmed. In the face of economic, social and technological uncertainties, he dared to paint a futuristic picture of new kind of society and offer us a glimpse of an alternative future. He stimulated us to think in a participatory way by encouraging our reflection. We were forced to take a stand and critically reconsider our own opinions on how the economy, society and the State should be organised. Utopias, in this sense, act as a 'critical norm', with a potential to develop criteria with which to measure our current social development and environmental setting. They can stimulate theoretical experiments, encourage attempts to break through fixed patterns of thinking, and test unorthodox combinations of ideas. Perhaps Paolo's most important contribution is in encouraging us to rethink human ecology and re-conceptualise the true extent of human impact on the natural environment.

### Two Suns - utopia is for everybody

Paolo was awarded a special prize by the Congress on Utopia in Italy in 1989 [note 3]. His response was to write a paper on why he rejected utopia. He wrote "utopia is for everybody or it is nonsense" (Soleri cited in Zelove and Cousineau, 1997). Nevertheless his early propositions from 1969, when examined through a utopic lens present ideological narratives that confront the myths of the then present social order. Although described as examples of 'miniaturisation' these thirty early projects, were designed for the efficient and rational restructuring of economies and societies on such a massive scale that, to the thousands who flocked in 1970 to the Corcoran Gallery in New York to see them exhibited, they appeared shocking and alien. They nevertheless demanded attention and reflection. In the tradition of megastructural solutions like those of Buckminster Fuller, the Japanese Metabolists, and Archigram, Paolo's early proposals were founded on a spectacular degree of faith in technological progress, seemingly offering a technocentric path towards society's ecological salvation. But by 1975, with the development of the Two Suns Arcology proposal, he had fully endorsed an ecologically-based morality encompassed an integration of five related 'passive' effects:

► 68

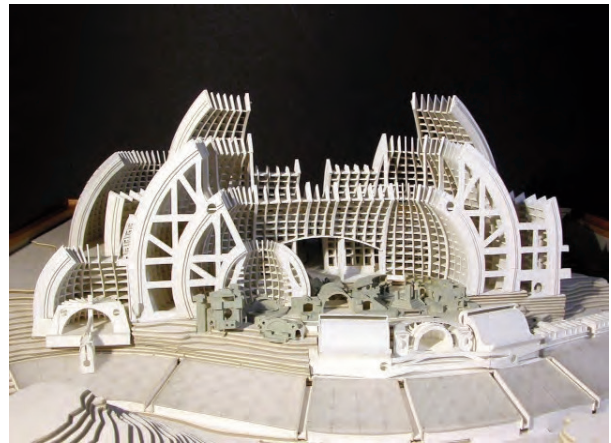


Figure 11. Arcosanti 5000 model (Source: Paolo Soleri/Cosanti Foundation).

The Urban Effect represents the fundamental drive of life. The evolution of the city is the process by which the 'non-living' is infused with life, and the 'living' becomes inventive, conscious, anticipatory, thinking, creational. The Urban Effect is the bridge between matter and spirit and is linked functionally to the four other effects:

- The Urban Effect represents the fundamental drive of life. The evolution of the city is the process by which the 'non-living' is infused with life, and the 'living' becomes inventive, conscious, anticipatory, thinking, creational. The Urban Effect is the bridge between matter and spirit and is linked functionally to the four other effects:
- The Horticulture Effect has ancient origins in the management and cultivation of vegetation.
- The Greenhouse Effect enables the gathering of heat from the sun within a defined and controlled space. When combined with the Horticulture Effect this provides a natural agricultural base.
- The Chimney Effect is the system by which collected warm air is passively channeled as it rises.
- The Apse Effect describes a quarter-sphere structure facing South and thus acting as a sun collector in the cold season and as a sunshade in the warm season. It is a passive "energy machine" running solely on how it displays itself to the varying trajectory of the sun ([www.arcosanti.org](http://www.arcosanti.org)).

The aim of this integration is a more effective habitat, responsive to the needs of society, and sensitive to the environmental and ecological limits. Two Suns focuses on the development of the central system for the efficient collection, transmission, and consumption of solar energy to support a town or city population. This is to be achieved through the use of terraced greenhouses on the south slope of the city. Solar heat from the greenhouse collectors is redirected to meet basic heating and cooling needs of the entire city, while food for the city's inhabitants is provided by the greenhouses.

The approach encompasses a sense of respect for Nature in its own right as well as for instrumental and functional reasons. It exhibits a concern with ends (an eschatology of decentralised communities) and the proper kind of means (in the 'soft' tech-

nology of transcendence) and can be viewed as both environmentally benign and democratic. Two Suns aims towards an urban system based on the ecological principles of diversity and homeostasis. Despite many obstacles, rejections and disappointments Paolo tenaciously held to his philosophy until his death in 2013 at the age of 93. In attempting to build a better urban alternative his work straddles conventional values and radical methods associated with various shades of environmentalism. Although his fundamentally human-centred outlook upholds aspects of a fairly traditional (conservative Green) approach to environmental issues his support of the Romantic rebellion against the utilitarian, materialistic values of the 'American Dream', and his advocacy of a more frugal alternative, within self-reliant urban communities modelled on natural ecosystems, prefigures the realisation of a 'neonature' predicated on radical social and environmental reconstruction. If achieved, this would redefine all that, until now, has been considered 'normal' and 'usual'. By envisioning the possibility of re-naturalising the natural environment Paolo's work has contributed to radical ecology's mission of world disclosure.

### ARCOSANTI: AN URBAN LABORATORY

In *Virtual Light* Gibson describes the 'Bridge' as a place within which a whole range of social experiments can take place (Gibson, 1993). He raises the tricky question of how to imagine alternatives to current urban trends which appear to lay the dead hand of 'zero tolerance' on any form of difference from prescribed social norms. An overemphasis on the social rather than the physical landscape of the city makes vision, in the sense of what can be seen, difficult. A social vision for the city has to have some sense of its physical sites, how they might look and what they might symbolise. While most governments acknowledge that environmental problems are serious and numerous, and that policies must urgently address sustainable development, the concept has a variety of meanings and divergent interpretations, and research has tended to focus on restructuring existing



Figure 12. Arcosanti today (Source: Author).

cities and conurbations, and on individual parts of the problem (e.g. energy, density, transport, containment, green space, and sense of place), rather than taking a more holistic and systemic approach to new urban development appropriate for an expanding world population.

The problem remains one of the proper evaluation of alternatives and gathering evidence. There is an urgent need for multi-aspect and multi-disciplinary research here, since the complex issues will not become tangible unless we can develop laboratories to test micro- and macro- structures of alternative models and test their parameters through critical evaluation (Munro & Grierson, 2016). Without such centres of investigative research the complex issues of seeking urban sustainability will continue to rely on assumptions.

On top of a low mesa above the Agua Fria river, in the central Arizona desert 70 miles north of Phoenix, Arcosanti, a unique laboratory has been developing slowly since 1970. A project of Soleri's Cosanti Foundation, Arcosanti, has attempted to test and refine the basic physical and cultural tenets of the Arcology, largely aligned with the Two Suns approach, through architectural, environmental, and social research on a micro-level. Described as a "permanent experiment in urban intensity" (Altman and Chemers, 1980) when complete it will house an environmentally benign "learning/doing" community of five to six thousand people, occupying only fifteen acres of land in the midst of an 860-acre nature preserve containing orchards, agricultural fields, canyons and high desert hills. The compact structures of Arcosanti will stretch no more than quarter of a mile on any one side face the Sun to gather its energy. Inside, when complete, the structures will contain the economic, cultural, and social infrastructure normally scattered around a modern city, while providing citizens with up to two thousand square feet of living space per family. A series of orchards will line the North side of the structure, creating a unique fusion of urban and agricultural environments. Outside there will be expansive views of another three thousand acres, leased from Arizona State, to be kept as undeveloped open space.



Figure 13. Arcosanti 5000 model: completed buildings (Source: Paolo Soleri/Cosanti Foundation).



An integral part of the design will be five to seven acres of south-facing sloped greenhouses, an "energy apron" acting as a central system for producing food and collecting energy to support the community.

Arcosanti (meaning 'architecture before things') was the 30th, and last, of the designs to be presented in the book, *Arcology: the City in the Image of Man* where it was described as a "self-testing school in urban studies" (Solieri, 1969). Paolo advocated the investigation of new urban patterns and structural systems within the construction of a complex that would apply and test these at the modest end of the urban scale (Creagh, 1983). While Arcosanti follows in the tradition of a multitude of experiments in libertarianism, from the Owenite and Fourierist experiments of the early nineteenth century to the counter-cultural communes of the 1960s [note 4], to the profusion of ecovillages, organic farms, and cohousing communities around the world today, the stated priority for the work at Arcosanti, during Solieri's lifetime, lay in the definition of a physical structure, which would be indispensable for the "social organism" that would inhabit it. While the slow pace of construction was a source of frustration (not least to Paolo himself), the 'small experimental' nature of Arcosanti is in keeping with the contemporary Green movement's idealist strategy of change through 'force of example'. From the Centre of Technology (CAT) in Wales to the New Age community at Findhorn, Scotland, much of the practice of much Green politics takes the form of a series of small experiments. Creagh argues that there are problems that can only be faced through investigation on the micro-social level (Creagh, 1983) since intentional communities confront a multitude of questions related to interpersonal relations and everyday life. But this also raises the problem of persuasion that confronts the entire environmental movement. People are required to think in global terms and with respect to events that may, or may not, take place in the future. Porrit (2013) suggests that although Green strategies for change have not yet brought about the fundamental shift that might have been expected, positive visions for change are achievable "if we play our cards right". In terms of the questioning of current social and political practices and the presentation of alternatives, the growing global middle class may well have a central role to play here in being more receptive to new forms of prosperous, healthy, and exciting urban living. But the political economy of democratic capitalist societies, particularly in Western societies, have until now lacked support, and any real encouragement, for implementing models of communal living, since the practical exploration of this means going against the grain. Life at Arcosanti is the antithesis of modern suburban living (lacking mobility, luxury, consumerism) so while it may offer in time what an ecological society needs it hasn't yet been what the consumer wants. The myths of modern life may be full of false promise, but if Arcosanti fails to be persuasive as a feasible living alternative, its ultimate misfortune may be to stand as tangible proof that an ideology of frugality is what most of today's suburbanites fear most.

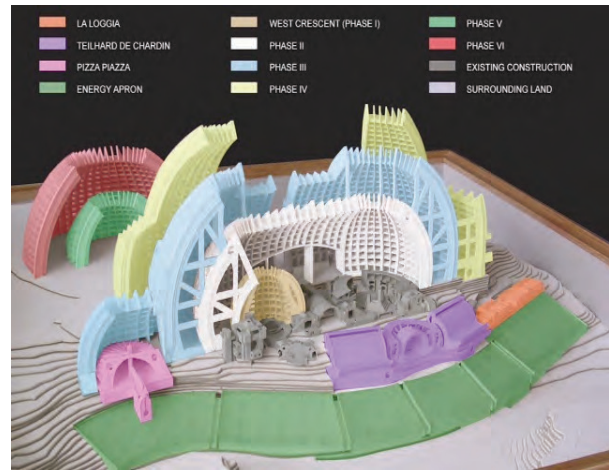


Figure 14. Arcosanti 5000 model: proposed phased development (Source: Paolo Solieri/Cosanti Foundation).

### Directing and Steering Progress

In the decade preceding his death in 2013, Solieri expressed view that Arcosanti is largely an informational construct (Solieri, cited in Mayne, 1993) was perhaps born of necessity rather than desire. While Arcosanti today retains an influential presence in academia and on the internet ([www.arcosanti.org](http://www.arcosanti.org)) it continues to be built by unskilled volunteers, and today the limited progress in construction is being largely funded through the sale of the wind bells made there, and at Cosanti in Scottsdale. Currently, a lack of resources hinders attempts to achieve progress. While the slow pace may demonstrate the "small is beautiful" and "voluntary simplicity" ethos that allowed Paolo to keep a close control of design developments, such independence has come with a price. In the post-Solieri era Arcosanti continues in its struggle to become economically self-sustaining. French sociologist, philosopher, and cultural theorist Jean Baudrillard (1988) wrote of Arcosanti that it "gathers together all the 'soft' technologies in the heart of the desert" (Baudrillard, 1988). It certainly aspires to this and by attempting to do so over a period of almost fifty years, the project already offers tried and tested potential solutions to the wider challenges of urban sustainability. The urban laboratory has involved the creation of an environment where the social, cultural, agricultural and industrial processes, and the associated production of energy, are being intensified while, at the same time, limiting the impact of the settlement on the natural environment, and minimising its consumption of natural resources. It represents an attempt to address questions of the sustainability of cities, while demonstrating a deep and long-held commitment to ecological ideas. However the future development of Arcosanti, as a viable alternative, now requires private and/or public agency to raise the capital, labour and materials that would allow it to demonstrate, on a larger scale, the ecological principles inherent in the concept. Under previous conditions, neither Paolo nor Arizona State were willing to allow this to happen. Those conditions have now changed not least through a renewed

commitment to achieve progress on its core mission.

There are some recent positive signs that the non-profit educational organisation, the Cosanti Foundation's goal to actively pursue lean alternatives to urban sprawl, based on the Arcology theory, can still be achieved. The Foundation's Board of Directors has recently established (in 2014) a Strategic Plan Steering Committee, comprising of residents and alumni participants that is now working with the Foundation, to attract renewed levels of financial and human resource to support construction and secure Arcosanti's future. Among the Steering Committee's goals, as part of program development, is to establish partnerships for global initiatives, and to engage in critical inquiry with educational partners. One such initiative is the recent collaboration with the Department of Architecture at the University of Strathclyde Glasgow in Scotland which has seen the launch of a new postgraduate course, the MSc Sustainable Engineering: Architecture and Ecology [note 5]. The new course, delivered within the University's renowned Faculty of Engineering, provides students with a unique opportunity to study for a Masters degree while living and working at Arcosanti. Students on the course spend one semester studying at the city centre campus in Glasgow, completing classes in a range of topics from sustainability and urban theory to energy resources and project management. They then travel to Arizona to complete a second semester consisting of a theoretical class on Arcology and a practical interdisciplinary group project working closely on the current research needs, allowing them to apply knowledge and theory to real life problems at the urban laboratory. Thus with a first hand experience of both the idealism of Arcology and the pragmatism of Arcosanti, they might be better placed to unite desire with analysis [note 6].

While Arcosanti's orientation should continue to be towards transcendence and the achievement of an end in "a fully conscious Universe" it is not countercultural, sectarian or religious. Neither is it a meditation centre or a neo-monastic retreat. Rather, as an urban laboratory, Arcosanti should keep its ear to the ground physically, theologically and aesthetically as it attempts to define and critically evaluate a working prototype, that can be influential in changing the social and environmental conditions of the present while aiming at an ideal and unknowable society that might inhabit it in the distant future. Arcosanti, in Umberto Eco's terms might be seen to exhibit the symbolic importance of architecture by accommodating both its "variable primary functions" (its conventional use as living/working/learning community) and its "open secondary functions" (symbolically as a prototype of Arcology) (Eco, 1990). In Soleri's own words Arcosanti is "a quest for what it does not have" (Soleri, 1986). In this way the laboratory becomes both the 'media' and the 'message'. While it fulfils the secondary function of architecture in acting as a symbol Arcosanti is also a real place where people will have a future because they are building one (Grierson, 1997). This is the flesh on the utopia of transcendence. Those who live, work and learn at the labora-

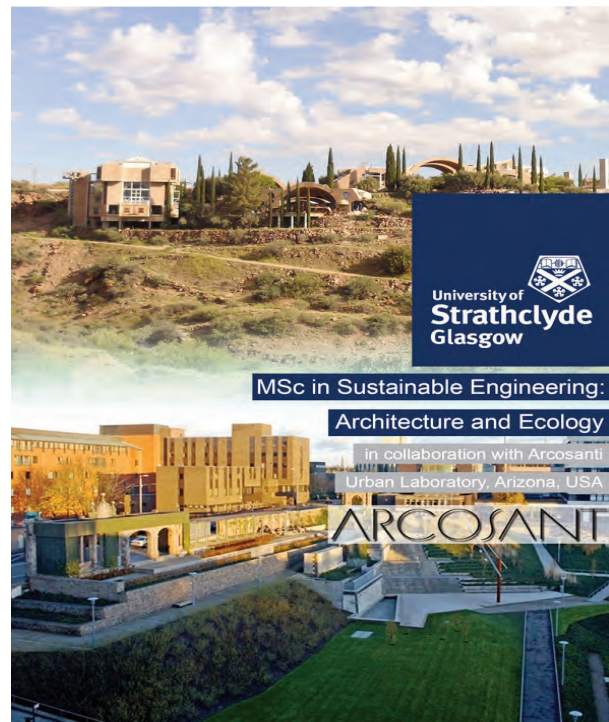


Figure 15. MSc Sustainable Engineering: Architecture and Ecology course leaflet (Source: Author).

tory know that they are in the middle of something that is essentially 'on the way'. Almost fifty years after the first stone was cut at Arcosanti volunteers are still there, and on good days still pouring concrete. Yes, time is precious but then the challenge is immense. There's still no desperate rush. There's no real evidence of a bandwagon of environmental despair, just a daily work schedule, an educational program, and a quiet pervasive hope. The business of the urban laboratory will never really be finished but the last few years seem to have brought renewed focus, and a determination to demonstrate why it is that the work there can support a better alternative, and in time a better world for all.

## Notes

[1] Schopfer Associates have produced a concept design for the NOAH (New Orleans Arcology Habitat) in 2009 and a floating arcology for Boston harbour (BoA) in 2010.

[2] American philosopher Arthur C. Danto, in 1990, announced "the end of art". Hans Belting has spoken of "the end of art history". In 1990, Alvin Kernan, the American professor of the humanities published *The Death of Literature*. In 1967 the French composer and conductor Boulez said, "Blow up the opera houses." More recently, in 1989, the American political historian Francis Fukuyama brought the notion into a wider context in a controversial essay, *The End of History*.

[3] The Utopus Award was presented by the Third International Conference of Utopian Studies at the Università Degli Studi di Genova in Reggio Calabria, Italy.

[4] Such as Drop City, Colorado and The Farm in Tennessee.

[5] [www.strath.ac.uk/courses/postgraduate/taught/sustainableengineeringarchitectureecology/](http://www.strath.ac.uk/courses/postgraduate/taught/sustainableengineeringarchitectureecology/)

[6] I am indebted to Jeff Stein, Tomiaki Tamura, Roger Tomalty, Mary Hoadley, and Scott Riley for their support and encouragement in establishing and significantly contributing to the new MSc, and to fellow members of the Steering Committee for (hopefully) understanding that valid contributions to the work can take many forms.

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# ASSESSMENT OF INTEGRATED PERFORMANCE AND ROOF GEOMETRY FOR SOLAR ENERGY.

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## Abstract

The roofs of houses located at middle latitudes receive significant solar radiation useful to supply their own energy demands and to feed back into the urban electricity network. However, solar panels should be properly integrated into roofs. This study analyzed roof geometry and integrated solar performance of Photovoltaic, thermal-photovoltaic, and hybrid solar collection technologies on dwelling cases selected from a sample of recent housing developments in Concepción, Chile. Hour-by-hour energy generation estimates and comparisons with demand levels were calculated for representative days during seasons of maximum, minimum as well as mid-season. These estimates took into account the roof tilt and orientation effects also. Trnsys@ software was used to determine electricity supply and F-Chart tool for thermal energy supply. The results show five times more panels can be placed on the largest and most regular shaped roof sections than on those with the smallest and most irregular shapes. The house model with the largest roof section can provide up to six times more energy than the model with the smallest second roof section in different seasons and systems. This paper thus provides new findings on the performance of solar technologies when related to home energy demands and roof geometry.

**Keywords:** Solar Energy; Architectural Integration of Solar Collectors; Thermal Solar Collectors; Photovoltaic Solar Collectors; Housing.

## 1. Introduction

Single-family homes have growing energy consumption, but they also offer roof areas with significant incoming solar radiation, especially in low and middle latitudes where the greater part of the world population lives. However, domestic solar collection requires a specific relationship between the requirements and the architecture of the house where the technologies are to be applied (Wall, Munari Probst, Roecker, Dubois, Horvat, Jørgensen, Kappel 2012). Integrated solar capture involves the installation of devices on the building envelope and consequently the shape, size and orientation of each surface determines the capacity to hold collectors and hence to produce energy. This study reviews the potential to integrate solar collectors on the roofs of recent housing developments in Concepción, Chile. It establishes the relationship between roof geometry and its capacity to hold collectors with different technologies to provide energy for home demand. The main objective of this study is to provide estimates of energy supply for single-family housing developments with different roof configurations, while also reviewing the performance of different technologies for representative days over the course of the year. Collection areas are calculated to provide maximum production of useful energy both for home consumption and for feeding surplus back into the urban electricity supply. The consequences of roof design in terms of its shape, size, slope and technological possibilities are revealed. In order to maximise

domestic energy generation potential both thermal and electrical requirements must be considered, so solar PV and solar thermal technologies are analysed as complementary technologies.

This research was carried out in Concepción, the largest urban area in the centre-south of Chile, located at 36.48° S latitude. It has an oceanic climate with daily and seasonal temperature variations and an average annual temperature of 12.4°C. Such a climate has high thermal space heating needs (DiCatri, Hajek 1976; Celis, Garcia, Trebilcock, Escorcía, Diaz 2012). When comparing the energy demands of Concepción with northern hemisphere cities at similar latitudes in southern Europe, such as Seville (38°N) or Barcelona (41°N), higher average temperatures are detected in the latter. Hence, the resulting differences in energy requirements limit the possibility of adopting measures and solutions arising from foreign studies. Peter Lund (Lund 2012) proposes that cities must be sectorised to balance energy production–demand mismatches in different urban zones. Through this process, it is possible to trace a functional network between supply from on-site renewable sources, local energy demand and storage requirements. Recent studies measured large urban areas of roofs from aerial scans to calculate solar irradiation availability (Lukač, Žalik 2013). Other works have proposed a design methodology for dwellings considering the solar potential of diverse roof configurations (Hachem 2012). However, these processes do not select the best roof section according to solar orientation; nor

do they examine its geometrical characteristics or potential to accommodate solar collectors. Several studies estimating domestic energy and exergy have been made in order to compare the performance of photovoltaic (PV), thermal liquid type (Tw) and hybrid Thermal-Photovoltaic (PVTw) (Chow 2010; Zondag 2008) in supplying potential residential energy demands (Pathak, Sanders, Pearce 2014). However, we found no studies matching the different solar panel technologies, shapes and dimensions, their installation possibilities and the available roof surfaces against residential energy demands.

A new challenge for architecture is to resolve the technical implementation of on-site solar collection. This arises from a lack of products for building integration and/or limitations in tools for solar design. However, there is increasing research and product development within the industry (IEA SHC Task 41 2012). Many guidelines for solar energy building integration are still emerging (Kaan, Reijenga 2004; Munari 2009; Basnet 2012).

In countries of similar latitude to Concepcion (such as Greece or Cyprus), recent research on solar collector devices on existing building envelopes in traditional neighborhoods shows a reduction in energy output when collectors deviate 45° and 15° from true north. However, such deviation results in only a 6% to 7% reduction in annual electricity output; even with a 90° deviation energy output is still high, at 80% of optimum output (Bougiatioti, Michael 2015).

In Chile, two studies have been found on the solar potential of roofs according to irradiation in Valparaiso and Concepcion respectively, both of them on residential buildings. In Valparaiso, a methodology to measure housing roof availability from aerial pictures has been developed. An estimate of instant and monthly solar irradiation capability was then determined for the overall roof area (Araya-Muñoz, Carvajal, Sáez-Carreño, Bensaid, Soto-Márquez 2013). The study in Concepcion took a further step forward by determining characteristic indicators for roofs, using the most suitable roof section for each house model, taking into account its habitable floor area. The implications of the respective orientations and roof tilts were considered and information compiled on the various appropriate solar capture technologies according to the available roof area. The analysis examined recent housing developments and estimated their potential energy production with BIPV and BIPVTa technologies relative to monthly domestic demand. However, these procedures did not take into account the geometry of roof section for implementing regular-shaped solar panels with specific dimensions and the subsequent implications for energy production (Zalamea, García Alvarado 2014).

## 2. Materials.

### 2.1 Sample selection and case studies.

An universe of 2,100 units with 33 housing models of recent housing developments were geometrically analysed. Their annual combined energy demand and potential for energy self-generation were measured

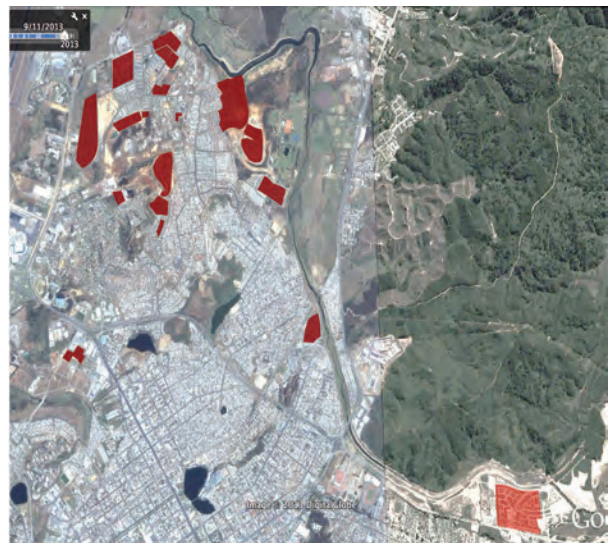


Figure 1. Housing developments since 2006 (in red) located in the central commune of the metropolitan area of Concepción, Chile..

statistically (Zalamea, García Alvarado 2014). Two of these housing models were then selected for a comparative study. The two units shared similar sizes and material specifications but represented the optimum and least favourable conditions for roof-level solar potential respectively. The unit with optimum conditions, called Model A and replicated in 110 identical houses, had a habitable floor space of 72m<sup>2</sup>. Its roof was divided into five sections: two large and almost rectangular sections and three smaller ones, with the highest solar potential on its Largest Roof Section (LRS). Model B, the second house studied, had a floor area of 79m<sup>2</sup> and was replicated in about 70 units. It had a roof with six irregular (trapezoidal or triangular) sections. This model showed better solar potential on its Second Largest Roof Section (SLRS), thus offering lower potential due to both its shape and surface area. The floor area of both case studies was similar to the residential average for the city (Observatorio Habitacional 2015). The models had similar building systems: brickwork load-bearing walls on the ground floor, concrete floor slabs and light-weight timber structure for the first-floor walls, faced with plaster-



Figure 2. (a) On left: roof geometry analysis to identify the model with higher LRS (Model A) and lower SLRS (Model B). On right: photographs of Model A and Model B.

board on the interior and and fibre-cement boards on the exterior with insulation in between. Both cases had timber and light steel roof structures covered with corrugated metal sheeting. This description coincides with typical single-family housing in the centre-south of Chile (Celis, Garcia, Trebilcock, Escorcía, Diaz 2012). The house specifications suggested similar electricity and space heating demands for both house models, while the same average number of inhabitants indicated similar hot water supply needs. Figure 2 shows three-dimensional roof diagrams of all the housing models studied with the selected case studies and photographs of Models A and B.

## 2.2 Solar active technologies

This research contemplates the use of three different solar panels: Photovoltaic (PV), Solar Thermal liquid fluid collector (Tw) and hybrid photovoltaic-thermal liquid fluid collectors (PVT). Rectangular solar panels are chosen for integration into the building architecture; these are considered to be the most common commercially available shape. The relationship between the absorbent surface available with the feasible number of collectors and the resulting energy available according to residential energy demand levels is analysed. In some cases, there is an energy surplus or deficit on representative summer and winter days due to an imbalance between incoming radiation and changing demand levels. The PVT collectors combine the Tw and PV technologies in one single device, providing cooling to the PV cells in order to avoid overheating and consequent reduction in energy efficiency. The thermal surplus taken in by the cooling fluid is stored and used in a similar way to the typical flat thermal collector.

The proposed PV and Tw collectors are technologies that are widely available on the market. The efficiency of PV collectors depends mainly on the type of solar cell technology used. The environmental conditions and method of installation are also important factors affecting performance. The situation is similar for thermal collectors but the literature shows the performance to be more consistent between the same types of collectors (flat-plate, evacuated tube, etc.) irrespective of manufacturer. Hybrid collectors are not common. A range of efficiency is observed depending on: whether they are liquid fluid or air fluid, the trial used, storage, forecast demand and other factors (Zondag 2008). The performance of hybrid air-cooled collectors was analysed previously for residential buildings in Concepción (Zalamea, García Alvarado 2014). Hybrid systems with liquid cooling fluid offer superior thermal performance compared to air systems due to the higher specific heat of water so this technology is analysed in this research. Table 1 compares published data for performance levels of the different models available of PVTw. It shows hybrid liquid fluid collectors to have efficiency levels of between 40% and 59%. A comparison of the thermal performance of the hybrid collector and the flat panel Tw collector shows the latter to have 29% less efficiency than the former with a low cooling volume and up to 50% less efficiency with a high cooling volume.

Author	Technology	Thermal Efficiency $\eta_t$ (%)	Electrical Efficiency $\eta_e$ (%)	Comments
(ZONDAG H.2008)		40,0 - 59,0	7,5 a 8,9	Glazed solar collectors
(ZONDAG H.2008)		0,0 - 52,0	8,5 a 9,7	Unglazed solar collectors (0 % thermal efficiency with increased cooling.)
(TONUI G. & TRIPANAGNOSTOPOULOS Y.2007)	PVTw	52,0	9,0 y 10,0	Glazed collectors comparative study
(CRISTOFARI C., et al, 2009)		55,5	12,7	Polycarbonate Absorber
(LAZAROV V. et al, 2005)		48,3	11,7	Glazed Collectors with polycrystalline cells pc-S
(TRIPAGNASTOPOULOS Y., et al, 2002)		55,0	10,0 a 12,5	Monocrystalline Cells. Unglazed

Table 1. Comparison of thermo-electricity efficiency of different hybrid collectors [8,18–21].

## 3. Methods.

After the case studies were determined, the area of the roof to be occupied by rectangular solar plates was defined to provide maximum and minimum potential capture. This was done under the hypothesis that PV, Tw and PVT panels have the same dimensions and can thus be easily combined during architectural integration. These were virtually located on the optimum and least favourable roof sections of the best and worst cases (Model A and B) respectively. Then the roof area available for solar capture and the resulting feasible number of solar panels were calculated. Thermal energy capture is calculated according to domestic energy needs without producing surpluses, since these are difficult to store efficiently without a seasonal storage network (Gajbert 2008), which is not likely in Concepcion. However, a final alternative analysed a possible heat surplus use for alternative purposes. Electricity production aims to achieve a maximum possible production both to cover domestic needs and feed surplus energy into the urban electricity supply. The first possibility to be analysed was the placement of only PV panels, which offers the potential for full domestic electricity supply. The second study was a combination of Tw panels to cover domestic hot water needs and the remaining surface area used for PV panels to achieve maximum possible electricity production. The third option was to use PVT collectors alongside PV panels, again to supply hot water demands and achieve maximum electricity production. The final possibility was full roof occupation with hybrid PVT panels to supply hot water and space heating needs, with thermal surpluses in summer estimated for heating a swimming pool.

The performance of the hybrid collector was calculated based on a simulation carried out for the city of Concepción, resulting in an electrical output efficiency of 8% over the available radiation (Campos 2015), congruent to the minimum range expressed in literature (Table 1). The F-Chart calculation method is used to estimate thermal efficiency according recommendations by the Chilean Energy Ministry (PNUD, MINENERGIA 2014). The F-Chart is an equation-based spreadsheet aimed to estimate hot water and space heating requirements with a margin of error of between 1.1% and 4.7% for complex dynamic simulations and up to 15% for measurements taken from real situations (Haberl, Cho 2014). Efficiency ranges reported for the Wunder CLS 1808 Solimpeks@ model were used for the case study with thermal collector. The thermal efficiency of the aforementioned device are:  $\eta_0 = 0.763$  with a coefficient of heat loss,

$\alpha_0 = 3.514 \text{ Wm}^{-2}\text{K}^{-1}$ . The shape for all the collectors is defined according to the dimensions of the Solimpeks® PowerTherm M 175 / 680 hybrid panel. The hybrid and thermal panels thus measure 830mm x 1660mm x 105mm, while the PV panels are 830mm x 1660mm x 45mm. Incoming and outgoing electrical conduits are assumed to coincide for thermal and hybrid collectors and are located along side of each panel. A lateral separation gap of 150 mm is calculated between each hybrid and thermal panel to allow for connections of fluid pipes necessary in this type of collector. PV collectors are located side by side.

The photovoltaic system is simulated using a constant efficiency of 12% for PV, considering a cell efficiency of 16%. There is a statistically possible reduction from inverters, maintenance or shadowing losses (Pelland, Poissant 2006). An 8% efficiency for PV production on hybrid collectors is considered according to simulation carried out in Concepcion with a Solimpeks® hybrid collector as mentioned (Campos 2015). The incoming solar radiation with the corresponding tilt and orientation is determined from TRNSYS 17.0 by using its METEONORM weather database. Even the PV technology and inverter do not show an exact linear efficiency corresponding to direct and indirect irradiation. This study focuses on geometry comparisons, so low variations for these reasons were dismissed in order to simplify the analysis.

Heating and domestic hot water provision were analysed using the *f*-chart method (Haberl, Cho 2014), which calculates the percentage of thermal demand supplied by the solar panels. The *f* factor method is determined by the expression:

$$f = 1,029 \cdot Y - 0,065 \cdot X - 0,245 \cdot Y^2 + 0,0018 \cdot X^2 + 0,0215 \cdot Y^3$$

where:

$$Y = \frac{\text{Solar energy absorbed by the collector}}{\text{Monthly thermal demand}}$$

The thermal energy absorbed by the collector is given by:

$$\text{Solar energy absorbed through collector surface} = F_a \cdot (\tau \cdot \alpha) \cdot \frac{F_c}{F_a} \cdot \frac{(\tau \cdot \alpha)}{(\tau \cdot \alpha)_a} \cdot \bar{H}_i \cdot N \cdot A_c$$

$F_a \cdot (\tau \cdot \alpha)$  Optical efficiency factor of the solar collector.

$\frac{F_c}{F_a}$  Correction factor gauge-exchanger set. A value of 0.95 is recommended.

$\frac{(\tau \cdot \alpha)}{(\tau \cdot \alpha)_a}$  Incidence angle modifier. Generally this is taken as a constant (0.96 for single glass and 0.94 for double glass).

$\bar{H}_i$  Daily average incident irradiation in a month over solar capture surface area. ( $\text{J/m}^2$ )

$N$  Number of days in the month.

$A_c$  Collector surface area [ $\text{m}^2$ ]

$$\text{Monthly energy demand} = Y \cdot c \cdot N \cdot (t_m - t_{in})$$

$Y$  Hot water average daily consumption [ $\text{l/day}$ ]

$c$  Water specific heat, 4180 [ $\text{J/kg} \cdot \text{K}$ ]

$t_m$  Hot water supplied temperature [ $^{\circ}\text{C}$ ]

$t_{in}$  Water inlet temperature [ $^{\circ}\text{C}$ ]

$$X = \frac{\text{Energy losses by the collector}}{\text{Monthly thermal energy demand}}$$

The collector energy losses are given by:

$$\text{Collector energy losses} = F_p \cdot U_L \cdot \frac{F_c}{F_a} \cdot (100 - t_a) \cdot \Delta t \cdot A_c \cdot K_1 \cdot K_2$$

$F_p \cdot U_L$  Slope of the characteristic curve of the collector.

$t_a$  Monthly average air temperature [ $^{\circ}\text{C}$ ].

$\Delta t$  Time variation [s].

$K_1$  Storage correction factor.

$K_2$  Correlation factor between minimum temperature of domestic hot water, public network water, and ambient temperature.

$$K_1 = \left( \frac{\text{Liquid Storage Kg}}{75 \cdot A_c} \right)^{-0,25} \quad ; \quad 37,5 < \left( \frac{\text{Liquid Storage kg}}{\text{Collector area m}^2} \right) < 300$$

$$K_2 = 1,16 + 1,18 \cdot t_m + 3,86 \cdot \frac{t_m - t_a}{100 - t_a}$$

Residential demand is estimated by surveys of electricity bills, while space heating needs are based on simulations carried out in a previous study (CON\*FIN Research Group 2015). Hot water needs are calculated for each home at 240 litres for four inhabitants, a statistical average in the zone according to MINVU 2002 (MINVU 2013). Demand is estimated for typical average days in the highest and lowest irradiation months and hourly consumption rates are established according to a likely use profile for a family of two adults and two student offspring. Although current demand is used to calculate updated supply, adopting passive energy-saving measures such as insulation, direct solar capture and efficient installations are also recommended to minimise energy needs (Hastings, Wall 2007; Charron, Athienitis 2006; Cuchi, Díez, Orgaz 2002).

## 4. Results.

### 4.1. Integration of PV panels.

The maximum available space for PV collectors is found on the LRS of Model A (with 49° tilt) and the SLRS of Model B (with 27.2° tilt). These results are close to average measurements for LRS and SLRS of these typologies (26.8° and 43.7° respectively) (Zalamea, García Alvarado 2014). Thirty-four PV panels fit on Model A, leaving space for one skylight; only seven fit on Model B. The resulting percentage of occupation for the roof section is 89.3% on Model A, compared to 60.3% on Model B, and collector area against housing floor area relationships are 0.61m<sup>2</sup> and 0.12 m<sup>2</sup> respectively (Figure 3).

Supply and demand are expressed in Figure 3

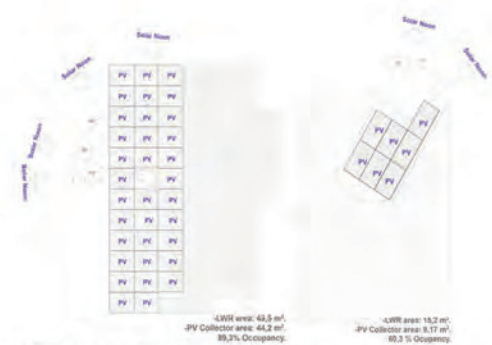


Figure 3 (a) Capacity of PV collectors in Models A y B

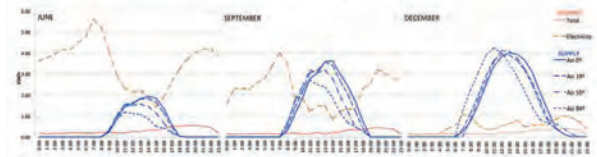


Figure 3 (b) Supply and demand curves for Models A on representative days in December, June and September.

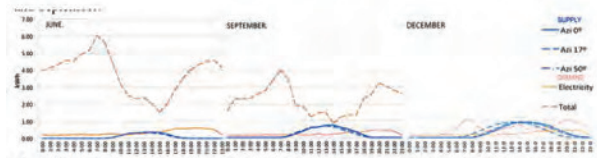


Figure 3 (c) Supply and demand curves for Models B on representative days in December, June and September.

Figure 3. a-b-c

and Table 7. These are calculated incorporating deviations from the north or solar azimuth of 0°, 19°, 56° and 94°, which are the angles calculated in the previous study (Zalamea, García Alvarado 2014).

Model A, on a winter's day, can supply between 92% and 163% of the electricity demand, although this represents only a 7.9% to 14.0% of total energy needs. A heat pump with high performance level (COP > 4) is an alternative to reduce emissions in the zone. However, using solely PV electricity production does not cover the high daily demands in June (winter). A summer's day produces up to six times the electricity demand and 2.4 times total energy needs. Annual net production is estimated from 8907.96 kWh to 7624.66 kWh/year, according to azimuth.

Model B can accommodate 9.17m<sup>2</sup> of PV capture net area, which would produce 143% of average daily electricity needs in summer and only 24.8% in winter. Deviations from the azimuth have no effect on production in the summer and cause only a minor reduction in the winter. The low production in winter would only cover electricity needs around midday with no surplus to the urban electricity supply. With an azimuth of 0° the estimated production is 1,848.10 kWh/year; while a 50° deviation, falls by only 4.7% to 1,760.64 kWh/year (Figure 3).

#### 4.2. Integration of PV plus Tw panels.

The results using thermal collectors (Tw) with PV are analysed. The percentage of solar absorption area in comparison to total roof section is reduced to 83.2% for Model A with 31 panels (28 PV and 3 Tw). In Model B, with only a minor drop in available capture area, the same total number of panels is used but thermal collectors replace two of the PV panels. The required number of thermal collectors for a fixed demand varies according to roof tilt; the more vertically tilted the panels (for Model A), the lower the surplus summer production levels, thus allowing one more panel to be installed without the risk of overproduction. This tilt effect has been described in detail by Gajbert (Gajbert 2008). The efficiency used was that specified for the Wunder CLS 1808 model by Solimpeks<sup>®</sup> with demand set at 240 litres of hot water supply or 2,959kWh/year, with three collectors covering 77.8 % of demand; in Model B, two collectors supply 59.6% of demand. Figure 4 (a) shows the possible layout of collectors in both cases.

The hour-by-hour energy balance for Model A is shown in Figure 4 (b).. This supplies 56.2% of the annual demand of 17,200 kWh (including space heating) with a high surplus for the urban electricity supply in summer .

The following analysis considers Model B with PV plus Tw capture with a 50° azimuth deviation. F-Chart calculations recommend using no more than two thermal panels. These figures give a net supply of 16.4% of annual residential demand, if space heating is included in total demand levels. A comparison of supply and demand is displayed in Figure 4(c) and total energy and exergy estimates are seen in Figure 8.



Figure 4 (a) Capacity of PV and Tw collectors in Models A y B.

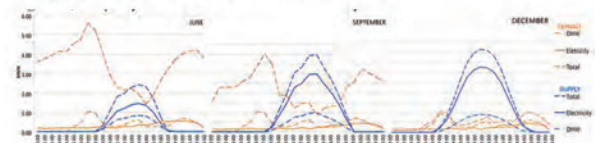


Figure 4 (b) Supply and demand curves for Models A on representative days in December, June and September with PV plus Tw technology.



Figure 4 (c) Supply and demand curves for Models B on representative days in December, June and September with PV+Tw technology.

Figure 4. a-b-c

#### 4.3. Integration of PV plus PVT panels.

PVT panels with PV units on remaining roof space are forecast to cover hot water demand, based on efficiency data for the Solimpeks<sup>®</sup> PowerTherm collector from simulations by Campos (Campos 2015) and aforementioned literature. Five hybrid collectors have an optimal storage volume of 250 litres, a figure almost concordant with daily requirements. In the summer period, there is no surplus thermal energy produced; Model A supplies 77% of demand and Model B 82%, because its inferior roof tilt of 27° (Figure 5).

Model A produces 1,885 kWh, equivalent to 64.0% of annual hot water demand and 7,394 kWh of annual electricity needs, corresponding to 300.1% of annual electrical demand. It supplies 53.9% of total energy demands, which is almost the same as the PV and Tw collectors previously described. This is a good option in terms of the exergy balance, although margins are minimal. A comparison between daily average demand on months with the highest, lowest and intermediate levels of sun irradiation is shown in the second part of Figure 5b.

By integrating PVT collectors together with PV panels in Model B with an azimuth deviation of 50°, total estimated production comes to 1,260 kWh/year for electricity, and 1,817kWh/year for thermal energy, giving an overall supply of 17.9% of annual demand, including space heating. The final part of Figure 5c shows a comparison between daily production and demand for Model B.

#### 4.4. Integration of PVT panels.

The installation of PVT collectors over the whole roof





Figure 5 (a) Capacity of PV and PVT collectors in Models A y B.

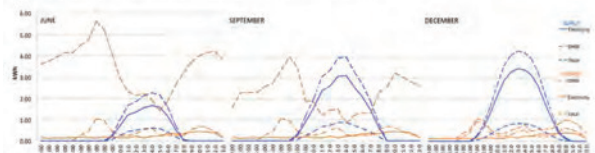


Figure 5 (b) Supply and demand curves for Models A on representative days in December, June and September with PV+PVT technology.



Figure 5 (c) Supply and demand curves for Models B on representative days in December, June and September with PV+PVT technology.

Figure 5. a-b-c

section is analysed for the preferred roof sections in both case studies, examining the potential of this technology for space heating and hot water supply with Combisystem technology (IEA SHC Task 26 2000). Summer energy surpluses are quantified for potentially heating a swimming pool or seasonal storage may be possible using geothermic technology for district heating as mentioned previously (Wang, Zheng, Zhang, Zhang, Yang 2010). A separation gap must be left between hybrid panels when they are installed, as mentioned, so, in Model A, 75.1% of the roof section can be used as capture area. Model B uses 56.6% of total roof section for the capture area, lower than the area available for PV panels alone, although the difference is minimal.

When comparing production and demand in Model A, in the month of June, the energy generated fully covers hot water needs, but with only 9.1% contribution to space heating demands despite the large solar capture area. Annual thermal energy production is in the order of 14,833 kWh/year with 4,474kWh/year of electricity generated. This production level supplies 112% of total demand but there is a 285% thermal surplus in December, a wide margin that cannot be used for typical domestic demand, as seen in Figure 6(b). For December, hot water demand is fully covered with daily thermal surpluses of 39 kWh and daily electricity surpluses of over 10kWh. These surpluses could be used to heat a swimming pool, providing a daily temperature increase of 1 °C for a 43 m<sup>3</sup> pool. However, extending the F-Chart analysis to the month of January, increased air and water temperatures means thermal production is 71% higher



Figure 6(a) Capacity of PVT collectors in Models A y B.

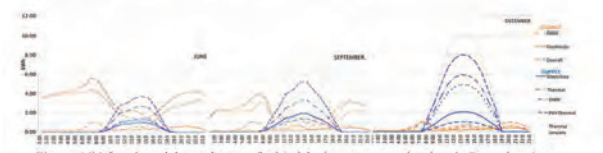


Figure 6 (b) Supply and demand curves for Models A on representative days in December, June and September with PVT technology.

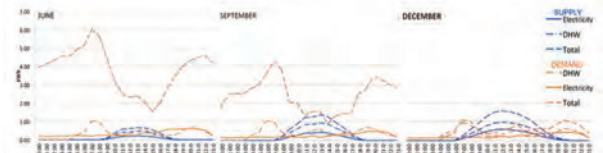


Figure 6 (c) Supply and demand curves for Models B on representative days in December, June and September with PVT technology.

Figure 6. a-b-c

than in December and this situation continues through till March. Figure 6(b) compares demand, production and surpluses for December as well as production increases in January.

Seven hybrid PVT panels fit on the SLRS of Model B. This requires a 400-litre storage capacity to avoid loss of efficiency, an excessive volume for the hot water needs of the four inhabitants but a useful contribution to space heating when using Combisystem technology. However, seven collectors create minimal thermal surpluses that could only provide 4% of annual heating demands, making this option undesirable. Annually, 2,106 kWh of thermal energy is produced and 1,102 kWh of electricity. This would account for 18.7% of domestic thermal energy needs and 44.2% of annual electricity needs.

### Comparison of useful energy production and supply between different systems.

This research revealed the superior energy supply potential of Model A in comparison to Model B; generating capacity of the former is between two-fold and six-fold greater depending on the technology used and energy type supplied (Figure 7). This suggests that roof geometry has a strong influence on solar energy collection. When comparing technologies, installing PV panels alone offers the highest electricity production levels, while PVT panels perform the worst, with between 40% and 50% less production. Other options lie between these two, providing between 65% and 85% of electricity production compared to solely PV installation. Thermal supply is far higher with PVT panels, although part of the energy generated is surplus to

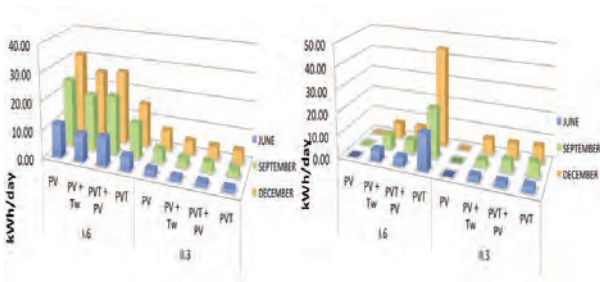


Figure 7. Constance Region based on the intensity of network connectivity.

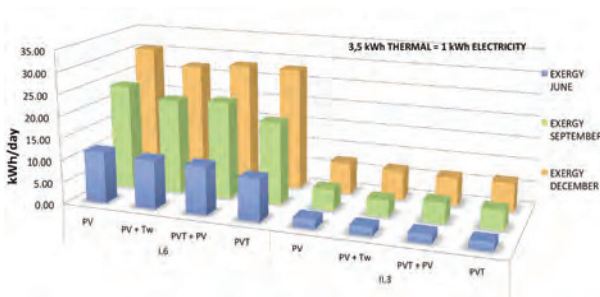


Figure 8. GConstance Region based on the intensity of network connectivity.

typical domestic needs.

With regard to exergy, the systems are remarkably similar. Performance is slightly better for PV technology and lower for PV plus Tw. The other two alternatives, PV plus PVT and PVT alone, demonstrated in-between performance. However, in this aspect once again Model A proves to be five times better than Model B (Figure 8 and Table 2).

Table 2 shows size and geometric shape indicators of roofs for houses A and B. Both cases have similar habitable floor areas and numbers of roof sections. However, the LRS roof section for solar capture in Model A is three times greater than the SLRS on Model B. Also, the perimeter wall under the capture roof section is 2.7 times longer in Model A than in Model B, a similar proportion to that of the capture areas. Additionally, the greater size and regularity of the roof shape in Model A increases the capture surface between 4.0 and 4.9 times, depending on the technology used. Thus, Model A can supply between 2.9 and 5.0 times more energy than Model B.

Model	Geometrical parameters				# Collectors capacity by wing surface				% Cover demand			
	Built area	# Wing Roof	Collector area	Wall Length under Collector Wing Roof	PV	Tw+PV	PVT+PV	PVT	Only PV	Tw+PV	PVT+PV	PVT
A	71,9	5,0	45,0	9,3	34,0	3+28	5+26	28,0	99,2%	105,5%	106,8%	185,0%
B	79,0	6,0	15,2	3,4	7,0	2+5	5+2	7,0	21,8%	34,9%	36,7%	36,7%
Index (A/B)	0,9	0,8	3,0	2,7	4,9	4,4	4,4	4,0	4,5	3,0	2,9	5,0

\* Thermal overproduction for domestic demand, for alternative use.

Table 2. Comparison between geometric shape of roof sections and average supply in Models A and B.

#### 4. Conclusions.

This study estimated the energy supply of integrated solar panels in two examples of recently built single-family homes in Concepción, Chile. The calculation related energy demands and roof conditions for implementing integrated solar systems onto the roof section offering best production potential for each house. The houses were selected due to their different roof geometries but similar floor areas and construction systems. Three solar technology alternatives were analysed to provide electricity and hot water supply without generating thermal surpluses, and a fourth hybrid alternative was considered to supply space heating as well (with thermal surplus). Comparison was made between two house models from housing developments built over the last five years in the central commune of the metropolitan area. Both models shared a similar overall roof area but one (Model A) had the most regular and largest roof section while the other (Model B) had the most fragmented and consequently smaller roof section. Analysis was performed hourly for representative days at the hottest, coldest and intermediate seasons of the year.

The roof design of Model A could hold up to 34 solar panels on the roof section that was most favourable to solar collection, while the most favourable roof section in Model B had space for only seven panels. Model A is able to accommodate almost five times as many panels as Model B since the most favourable roof section in the latter model is only its second-largest section and is irregular in shape. In contrast, Model A offered more capacity for integrated solar panels due to a more regular shape and strong size variations between its roof sections. In both cases, the need for separation gaps between thermal and hybrid panels for connecting fluid pipes led to reductions in surface area available for panels of approximately 43.4% of total roof section surface.

In energy production, both cases offered a substantial electricity contribution during the year, reaching between one-and-a-half and six times the demand in the warmest month, between 435% and 83% in the mid-season and between 163% and 28% in the coldest month. The thermal contribution was more restricted to avoid surpluses in the summer period. In Model A, the hybrid PVT system achieved a 21% contribution to space heating in winter and 45% contribution in the intermediate seasons, but with surplus production in summer. Also, it must be made clear that these systems are still experimental.

Analysis showed that the exergy of Model A had four times more potential in summer and five times in winter in comparison to Model B. Previous studies (Chow 2010; Saitoh, Hamada, Kubota, Nakamura, Ochifuji, Yokoyama, Nagano 2003) have suggested greater exergy with PVT technology. However, in our case studies, including the necessary separation gap between the Tw and PVT solar panels meant fewer panels fitted on each roof section. This penalised the net solar capture compared with options involving PV panels.

The different results between the models demonstrate the important role played by roof design,

including roof section size and shape, when implementing integrated solar panels. Energy production is greater for roofs with larger and more regular-shaped sections with good solar orientation. Integration of panels is more straightforward for rectangular-shaped roof sections, offering greater adaptability in both constructive and visual terms thanks to the geometric parallelism of panel modules with the roof edges. In contrast, there is more leftover unused space on irregular roof sections. In terms of house layout, in the models studied longer perimeter walls provided larger roof sections. This study therefore suggests that designing a house with an extended shape and regular roof with good solar orientation and tilt could allow the integration of enough solar panels to meet total domestic energy demand and provide surplus energy to feed back into the urban electricity supply.

This study confirms the understanding of the city as a system of energy production and consumption that requires integrated planning and development. The extensive growth urban of Latin American cities, is a very demanding soil model and it has since been repeatedly questioned by their functional inefficiency and high environmental costs. However, their morphological potential to integrated solar collection can act as a supplier of parts of the city that have high density with concentrated demand and low solar potential. Then, the compact downtown could cover its energy needs and improve sustainability if it can import power from residential low density areas. This condition suggests that could be possible to balance the ratio between areas of high and low density in the city. Then, each city could be find the right distribution between the two morphological forms of land occupation, and thus define the extent of growth in low density and level of densification to ensure its energy sustainability.

A verification of the technological performance and financial behaviour of the systems proposed would help refine the implications of this study. A technical study of the constructive integration and the architectural variations between different models is also needed to review possible installation options. Additionally, it is important to examine the resulting visual appearance and spatial quality of the houses with integrated solar panels.

### Acknowledgments

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# ENVELOPMENT: A METHODOLOGICAL APPROACH IN STRUCTURATION OF URBAN DIALECTICS.

Resmiye A Atun

## Abstract

The visualisation and the level of abstraction of complicated organic relations within an urban setting still remains a major problem with regard to urban discipline. This paper captures the dialectic relation within the urban network, in which the interaction between the spatial process of becoming and the temporal state of being is fundamental. 'Envelopment' is developed from and based upon Giddens' structuration theory. It enables visualisation of 'relations' and, as problem-setting matrices, allows the fundamentals of the urban network to be itemised within forms of relationships: modalities. Deleuze and Guattari's philosophy of deterritorialisation is also adopted into urban studies to support further investigations in respect of decoding and Translating 'modalities' as fundamentals in achieving continuous reproduction of Envelopment-as a topological space. Generally, topological space is defined in terms of processes and relations, Vocabularies are accepted as essences of urban dialog embodied in the system, needs to be visualised and meanings to be assigned according to their role and position in the system. In envelopment, system will be considered as macro-scale, multi-scalar topology, where all other modes of relations (amongst people, space and time) can be elaborated. The language game of Wittgenstein, as a metaphoric tool allows us to explore and group the modes of relations as vocabularies; "set of modalities", enabling dialog upon their role and position in the system. Although the approach of Envelopment can be used as a tool, in enabling the representation of the equilibrium of state and process characteristics of system; it also helps as a tool in enabling the representation of macroscopic space-time scale; enabling representation of urban development and enabling representation of change in urban narrative. The various implementation of the Envelopment will be represented as a final discussion of the paper.

**Keywords:** Urban Assemblage, Envelopment, Structuration, Modalities, Topological Space.

## INTRODUCTION:

The question of how the urban setting is structured, organised and animated became at the centre of many debates in different disciplines. Each has a different attitude in respect of exploring the city by referring to a system: either from a more spatially oriented perspective (see Dupuy, Hillier, Alexander, Bourne, and Rowe) or a more social/analytical perspective (see Giddens, Castells and Lefebvre, Harvey, De Certeau, Ash & Thrift, Latour, and De Landa). In these approaches, time-space interaction is either considered as a pause, embodying temporality, or as a process, embodying spatiality. The idea that a city can be conceived as a complex self-adapting system, or even a living ecosystem, is a shared key point for urban research (Pulselli R.M, et.al.2006).

In order to clarify the issue, it is important to explore what it is meant by city as a system from different perspectives. Maturana, describes structure as a combination of the 'components of the system' and how they must 'fit together' in order to become the 'entity' that is the system (Maturana H. 1978). Accordingly, organisation is described as the fundamental aspects of the entity that identifies the system as belonging to, and a recognisable member of, a particular type, to an urban setting. At broadest sense, 'organization emerges on a macroscopic space-time

scale that is many times bigger than microscopic interactions between the elements' (Nicholis G. 1989). Regardless the scale, both the microscopic and macroscopic space has to be considered upon time-space interaction to be able to understand the operation of system. The capacity of complex structures to self-order and maintain themselves in time is equivalent to conserving a stable state and/or to maintain minimum "mode of relations" for enabling similar further interactions within system (Tiezzi, 2003).

Although different approaches with different philosophical positioning elaborate the structure and behavior of systems' upon perspective of time-space interaction, a unified spatial theory upon shared meaning of space. Lefebvre, for example, sets up The Production of Space (1991) to redress what he sees as the gap between how social scientists and planners work with social space and how mathematicians and philosophers have theorized the "truth" of space (Lefebvre 1991:94-95). Epistemology, which is known as emergentism, is regarded as the philosophical level of the new sciences of complexity (Goldstein J. 1999), argues that, 'the qualities that result from temporal and spatial differentiation of a system are not reduced to the properties of its components; it is maintained that the interactions between the components result in new properties of the system that cannot be fully predicted and cannot be found in the qualities of the

components' (Fuchs, 2003). Also, for Wittgenstein, language was conceived as a living organism (1922, 1953). Instead of mentioning the components and the system in general as a complementary part of a completed whole, it refers to the overall interaction, the relation between components in itself and within the system that can be potentially supported, differences. However, the visualization and the level of abstraction of complicated organic relations within an urban setting still remains a major problem with regard to urban discipline.

The main aim of this paper is to create a new approach of Envelopment, a metaphoric language, for exploring urban dialogue based upon constituents; organic relations embedded in the system. System is accepted as topological space, in which topological space can be defined in terms of processes and relations, while discrete points, regions, or territories are seen as temporary stabilizations of such spatializing processes (Murdoch J. 2006). Envelopment, elaborates 'relations' within urban system where the structure, its constituents and overall organization of them becomes determinant in producing the organic relations; vocabulary of the language. It enables manifestation of organic ties amongst components of urban structure and revealing the organic meaning derived from the overall organization of its components as a form of topological space, which in process produces an 'urban narrative'.

As a form of structuration, 'Envelopment' is developed from and based upon Giddens' theory, in which 'the smallest scales and/or units in the structure can be accepted as system enablers and are intimately related to the largest scales in the structure, one cannot be changed without changing the other' (Bryant C. 1991). Envelopment enables the visualization of these existing and/or emerging organic relations and, as problem-setting matrices, allows the fundamentals of the urban network to be itemized within forms of relationships: modalities. Therefore, Modalities can be considered both as an individual entity, an 'autonomous being' and as an 'interactive structural tool' operating within the system. Deleuze and Guattari's philosophy of deterritorialisation is also adopted into urban studies to support further empirical investigations in respect of decoding and translating 'modalities' as fundamentals (vocabularies) in achieving continuous reproduction of Envelopment.

Vocabularies are accepted as essences of urban dialogue embodied in the system, needs to be visualized and meanings to be assigned according to their role and position in the system. In envelopment, system will be considered as macro-scale, multi-scalar topology, where all other modes of relations (amongst people, space and time) can be elaborated. Structuration as a sort of metaphoric tool, allows us to explore and group the modes of relations as vocabularies; "set of modalities", enabling dialog upon their role and position in the system based on a topological space. Although Deleuze makes frequent reference to topology and to topological operations (e.g., Deleuze G. 1987, 1993), how components come to signify meaning within Envelopment is a metaphorical 'language game' embodied in Wittgenstein (1953,

1958, 1980). Game theory substantially was the conspicuous shift from the pictorial metaphor of the language to tool metaphor of the language (1922, 1953). "Game theory is not a theory which has as output a set of refutable statements, but merely a syntax articulating the vocabulary of interdependent rationality" (Bianchi M. and Moulin H. 1991). The essence of the theory was the words gain meanings both from the structure of the language and the context in which they are occupied. It provides a fuller understanding of planning not just as a language game but as a behavioural game more widely (Lord A.D. 2012). Deleuze thinks of language as a particular kind of being, however, upon Wittgenstein, a philosophy based on the production of concepts, by contrast, would seek to create rather than discover, to make rather than find. In the approach of Envelopment, to discover and create, to find and make is a matter of being and becoming needs to be considered dialectically; it is the idea of Envelopment itself. Therefore, Deleuze, helps to formulate the form of concepts, where these vocabularies contribute to the construction of further states and/or process of the system, it is also needed to understand the grounded/organic meaning of 'relations'. The originality of the proposed method derives from its multi-scalar and multi-disciplined framework, enables us to understand the essences of any system and providing case-specific variables to be considered for promoting further projections for its improvement. The context, the limitation of the research and constant measures can be decided upon "system variables" extracted from the inner ties, forming the essences of the system. Envelopment helps us to understand and sustain the urban dialogue, where its vocabulary embodies and/or emerges within the structure and organization of urban topology. It also enables us to develop a diagnosis by analysing the systems failure, and enable any case-specific intervention for further improved continuation of system.

## URBAN ENVELOPMENT:

Envelopment as a method embodies modules and elaborates the role and position of modalities, both in regard to temporality and to spatiality within the operation of the system. The interaction between modalities supports a pulse to be considered in continuation of the system. Therefore, pincers' forces amongst modalities, (tiding and/untying capacity enabling the territorialisation/de-territorialisation and/or reterritorialization of relations in the form of structuration) becoming determinant in assigning values to the modalities (M1/M2/...). Deterritorialisation of modalities through their rearrangement in the system helps to define their 'value': the ability of an urban network to absorb change without altering its organic meaning as urban assemblage. These can be referred as constituent forces embedded in the structure, which is in general, can be measured through the entropy of organization. Entropy is a measure adopted from evolutionary physics, refers to the number of specific ways in which a system may be arranged, supporting the quantitative measure of the existing and emerging relations. This is to decide maximum form of relations

<sup>1</sup>'Pincers' is Deleuzian terminology used to describe an inner force that anchors ties. 'Every stratum operates this way: by grasping in its pincers a maximum number of intensities or intensive particles over which it spreads its forms and substances, constituting determinate gradients and threshold of resonance.' (Deleuze and Guattari 1987:54;Parr:2005)

in which no other entropy-producing process can occur (Prigogine I. 2003). Instead of measuring the number of specific ways in which a system may be arranged, the abstracted representation of this arrangement will be used as a tool to diagnose systems' state and process characteristics, enabling itemised interventions instead of deep interventions. This requires taking into account the stability of the system as the capacity to turn into equilibrium derived from systems own network and defined as a measure to understand the tendency of change. In approach of envelopment this is the interactive, dynamic substance; 'pulse' to be considered. It enables an urban setting to be explored, not as a structure but as a form of structuration, embodying constant change (Giddens A. 1984; 1989; 1994). At the same time, this helps us to understand and elaborate on the essence of urban development, not as sequential or individual entities made up of modules but as interactive emergences or modalities. In this approach, the main determinant in sustaining pulse is accepted as the presence and/or absence of 'differentiated modalities as vocabularies enabling urban dialogue. While referring to 'differentiated modalities', Deleuzian terminology of difference and/or event has to be considered. The event is the constituent element of an urban narrative (Prince G. 1987) which corresponds to modality in the idea of Envelopment. Based on Whiteheadian notion of process philosophy, the ontology of becoming, Deleuze developed the theory of event which helps us to elaborate the elusive complexity of organic relations with regard to the changing city. Events are the temporal aspect of development, a noticeable happenstance that is one of the central concepts in Gilles Deleuze's work (Badiou A. 2007). It establishes a metaphorical urban language in exploring the organic relationship between the 'constituents' of urban setting (Rajchman J. 2000). Deleuze (1990) affirms that events do belong to language (Deleuze & Guattari, 1987: 399), where in this paper; language is structured in the form of Envelopment. Modalities are the resultant vocabularies of 'contextualised relations' in regard to interaction between time, space and people. Actually, events elaborate the notion of dwelling as accumulated 'socio-spatial happenstances' or modules supporting urban assemblage. As Tschumi (1983) has written, there is no space without event. Franco Ferrarotti proposes that the contemporary city can be understood, not just as a material structure, but also as a 'collection of messages, a world of meanings, a grid of communications' (Ferrarotti F. 1995); an urban assemblage with a narrative.

In order to expand urban assemblage (figure 1), accumulated modules have to be considered, in the form of relations – modalities – with pincers, enabling the territorialisation/de-territorialisation and/or reterritorialization of relations in the form of structuration. The accumulation of modalities creates layers: strata. Strata are explained by Deleuze as temporal formations such as junctures in the process (Deleuze, 1990: 41). They are structural layers of the system, allowing the formation and accumulation of new emergences: 'modalities'.

The emergent and/or emerging events come together through forms of modalities and their accu-

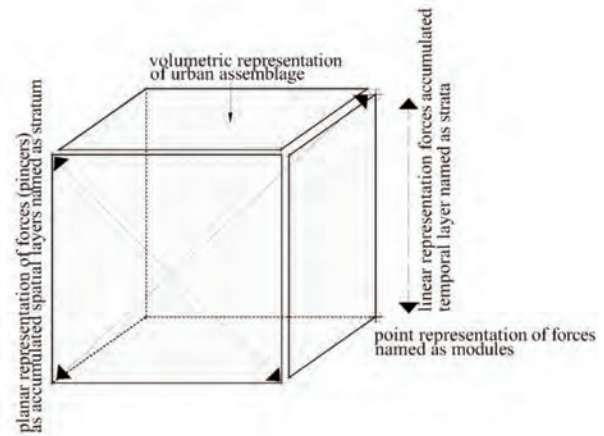


Figure 1. Geometric Abstraction of Urban Assemblages exemplifying the symbolic role of modalities in the volumetric system as linear, planar and point values.

mulation, as tempo-spatial layers or strata, interacts through ties to form a stratum (figure 1). This subsequently-assembled stratum contains urban assemblages. It is the container of 'relations' in a form of structuration. The system of Envelopment operates as a structuration, allowing new narratives to be developed and accumulated. Therefore, it is important to consider the transcendental relationship between associated agents (ties) when exploring the system, to develop an understanding of ongoing urban development and/or be able to intervene in urban transformation. So far, decontextualisation (also referred to as deterritorialisation) of a set of relations from a given stratum allows identification of pincers, becoming determinant in their role and importance within the system. According to Deleuze, deterritorialisation can be applied to any process that decontextualises a set of relations constituting the essence of stratum in the system of Envelopment. In the approach of Envelopment, deterritorialisation will be used to identify the ties within and in between modalities, in order to distinguish their role and importance as forces (pincers) achieving integrity. Therefore, they may have a 'concrete value', as stabile-ties to be kept. Also, they may have an 'exchange value' as flexible-ties to be replaced.

#### ENVELOPMENT AS A TOOL ENABLING REPRESENTATION OF MACROSCOPIC SPACE-TIME SCALE:

Deleuze described matter as always in motion (Deleuze G. 1991). Urban beings, as temporary states, are then defined by the constant swirls of matter in real time and on space, defining and/or defined by 'presences'. Halewood (2005) explained that objects (folds or entities) in the form of urban beings are 'to be defined in terms of [their] processes' (p. 63), which embodies 'continuity'. It is possible to develop relations between urban being and urban becoming as 'continuity of the presences' in regard to time and space. The absence in return creates a break in the system of Envelopment. Also, Halewood (2005) explained that each subject (or fold/unfold) is a social, physical and historical rendering: social, in that it

incorporates elements of the public into a singular entity; physical, in that it is an actual rendering of elements of the universe; and historical, in that its formation arises from the prior and particular arrangement of previous folds/unfolds, and problems within which it is situated. Halewood (2005) explained further: 'There is hence no distinction between the material and the social, between subjects and objects: all existence is a complex combination of the two' (Halewood, 2005: 74). Therefore, the object-subject is intimately linked to the event at micro-level and to Envelopment at macro-level. Deleuze (1994) wrote, 'But possibility remains, because you never realise all of the possible, you even bring it into being as you realise some of it'. New sentences of object(s)-subject(s) and event(s) can always be created in different times and spaces. In this way, meaning-making never ceases — a new sentence (events/urban happenstance) can always be reinvented within a different interpretation and with various meanings but where the essence is kept. In Envelopment, space, time and people practices are accepted as fundamentals where constants of each system emerged upon defined research question. The overall operation of system is the continuous form of structuration appeared through territorialisation/de-territorialisation and reterritorialization of modalities in regarding to defined constants. In order to be able to elaborate the role and importance of modalities, the constants amongst time and/or space and/people are exemplified upon macroscopic time-space scale, which is defined in figure 2. Time exists in space as temporality; People exist in space as movement; People exist in time as the continuity and/or discontinuity of 'stays'. Territorialisation of urban practices is achieved by TSP, which relates to the permanent stay of people, and continuity in existence of artefacts allowing repetitive visits of people (see, Rossi, 1982; Low, 1996; Relph, 1976: 8; Tuan, 1977: 12; Bourdieu, 1977).

ST – Space/Time interaction – embodying historical time-spans (ties, enabling continuity of nodes through artefacts)

SP – Space/people interaction – embodying socio-spatial approaches (ties, enabling experiences between nodes)

Time, space and people interaction territorialises urban practices according to ST, TP, SP, as flexible-ties, enabling continuity and/or movement and/or stay through replacement of relations within the system. STP is accepted as supporting stabile-ties, providing the essentially non-replaceable feature of the system. The role and importance of ties in regard to time, space and people interaction is considered

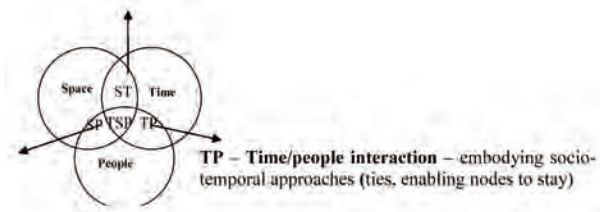


Figure 2. Ties allowing time, space and people interaction-contextualisation through modalities.

according to indicators appearing through subset intersections.

Deterritorialisation, as a method of assessment, is achieved by removing one constituent in the equation from the system and by elaborating the gap with its presence and absence in order to define its value. It may either refer to stabile-ties (to be protected) and/or flexible-ties (to be exchangeable). Therefore, equilibrium among:

- SP – flexible-ties, exploring space/people interaction (differences can be supported by repetition: repetitive/non-repetitive urban practices),
- TP – flexible-ties, exploring time/people interaction (differences can be supported by continuity in people's daily practices: continuous/non-continuous), and
- TSP – stabile-ties, exploring contextualisation of urban practices through space/time interaction (embodying difference in itself) is accepted as the determinant of the equation, providing urban resiliency (also referred to as balance).

Abstract equilibrium can be identified in accordance with real experiences acting on decided indicators, sustaining integrity. Table 1 below exemplifies abstract typologies: 'modalities' in real time/space and/or people interaction upon defined constants.

Using the above table, it is possible to define four possible typologies (SP/TP//TS/TSP), according to the possibilities of interaction among time, space and people, connected together with 'ties' in a form of envelope.

The first supports the existence of stabile-ties, where TSPT allows continuity in spatial development and permanency in temporal transformation through repetitive urban practices in the process of Envelopment. It supports stabile-ties in socio-spatial development and continuity throughout the time-line by connecting space, people, and time.

Different forms of relations (modalities). Coordinates (X,Y,Z) representing contextualised modules upon Space/Time/People interaction (STP)	Parameters valuing the modules in regard to People/Space interaction (SP)	Parameters valuing the modules in regard to People/Time interaction (TP)	Parameters valuing the modules in regard to Time/Space interaction (TS)	Symbolic formation of modules in strata (TSP)	Evaluation of ties through contextualisation of Modules	STRATA (various combinations of modalities)
Modality 1 Modality 2 Modality 3	Movement of people in space Repetitive visit = 1 Non-repetitive visit = 0	Existence of people in time Context-free staying: temporary = 0 Context-dependent staying (permanent) = 1	Continuity of space in time Continuous = 1 Non-continuous = 0	Modules of: M1 – (1,0,0) M2 – (0,1,0) M3 – (0,0,1)	Flexible-ties	Point presence in strata (Exchange Value)
Modality 7(M7)	Repetitive in space (XYZ) = (1-0-0)	Permanent in time (XYZ) = (0-1-0)	Continuity within tempo-spatial layer (0-0-1)	X<Y<Z M7(1,1,1)	Stabile-ties	Volumetric presence in strata (Concretised Value)
Modality 4 Modality 5 Modality 6	Non-repetitive in space (0-0-0) M1- M2- M5-	Temporary in time (0-0-0) M1+ M3- M6-	Discontinuous within tempo-spatial layer (0-0-0) M1+ M2- M4-	M4 – (1,0,1) M4 – (1,1,0) M5 – (0,1,1)	Flexible-ties	Volumetric presence in strata (Exchange Value)

Table 1. Exemplifying micro-scale abstract urban typologies: modules coming together to form modalities, which create strata with different roles and positions



TSPT supports temporal and spatial continuity by connecting time within space through spatial distance (repetitive practices) and supports connections between them as the existence of time-lines. Instead of supporting replacement among layers by promoting exchange value, the idea of Envelopment supports and sustains the continuity of context- dependent concretized value, enhancing authenticity.

The second supports the existence of different forms of flexible-ties where TST, connects space and time; within the sphere of socio-temporal urban practices (permanent/temporary). TSP connects space and urban practices, where flexible-ties exist in the continuation of time (continuous/discontinuous). TTP connects space and time through flexible- ties in urban practices considering the movement of people (repetitive/non- repetitive). The assessment will explore the abstract ties among typologies, define them concretely, and provide an input for further studies in sustaining 'authenticity'.

**ENVELOPMENT AS A TOOL, ENABLING REPRESENTATION OF THE EQUILIBRIUM OF STATE AND PROCESS CHARACTERISTICS**

Envelopment can be abstracted as a form of cube (Figure 3), to represent integrity and stability, with the configuration being composed of fundamental parts and their relationships, to form a completed whole. The structuration of Envelopment supports the territorialisation of urban practices within a continuous act of folding and unfolding. Therefore, 'ties' are the determinants in the translation of urban narrative (see Figure 3 below) within each stratum and among strata.

The tempo-spatial layer, as one of the constituents of each stratum, resembles time-space interaction, metaphorically accepted as the x-y axis, allowing folding and unfolding of happenstances by applying 'horizontal and/or vertical extension of temporality (x) in space (y)' and/or spatiality in time. On the other hand, the outcome of the overall interaction of the tempo- spatial layer (the x-y axis) with the z axis, portraying the human dimension, is accepted as the other component of a stratum, conferring the integrity of 'urban being' (x,y,z). Therefore, it enables the sustaining of an organic 'being' in the process of 'becoming' by approving change in the tempo- spatial setting, but, at the same time, enabling resilience

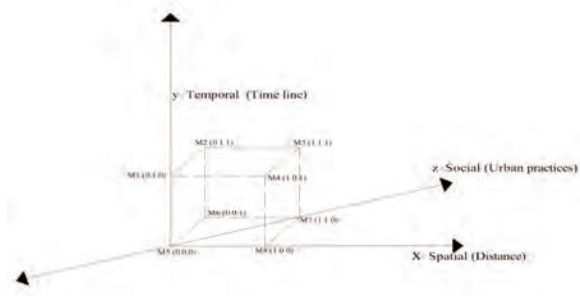


Figure 3. Abstracted Valuation of Modalities at Micro-Scale in the System of Envelopment.

against the transformation of that socio-spatial setting. Therefore, the concept of Envelopment supports equilibrium between 'temporality' and 'spatiality'.

Envelopment can be abstracted as a form of cube (Figure 3), to represent integrity and stability, with the configuration being composed of fundamental parts and their relationships, to form a completed whole. M1, M2, M3 etc. represent modalities embodying modules<sup>2</sup>.

**ENVELOPMENT AS A TOOL IN REPRESENTATION OF CHANGE IN URBAN NARRATIVE**

Envelopment embodies relationships – ties – as tools in achieving control over urban development where 'change' can be guided through the fragility of space-time interaction. As Ollman insists, given that change is always a part of what things are, dealing with change is accepted as the very essence of urban development (Ollman 1993, Murray 2005, Harvey 1989). The proposed model of Envelopment can be formulated as a form of non- equilibrium that its characteristics can only be understood through the "defect" (figure 4) of original equilibrium referring to the defined amount of maximum entropy. The typology of defect defines the changing characteristics of a system due to the organization of state variables and system enablers (figure 4).

The difference between, the existing equilibrium and defected cube, defines the characteristics where the change in character has to be considered accordingly. While equilibrium is the capacity amongst state and process to maintain a current state, transformation is the capacity to change to a new state. On the other hand, in system of Envelopment, in order to be able to maintain the current state, transformability is a must to cope with the 'change'. The critical issue is to define the organic relations to be sustained, should be stable and flexible ones that is allowed to transform within the system without disturbing the essences of the system.

**ENVELOPMENT AS A TOOL ENABLING REPRESENTATION OF URBAN DEVELOPMENT**

Envelopment also allows mezzo-scale consideration of urban relations. Even though it may work as a prob-

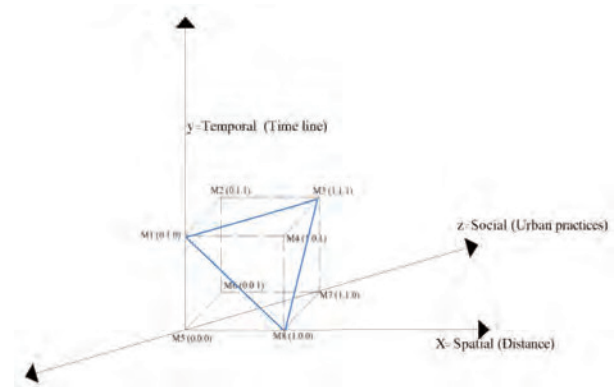


Figure 4. The defected cube refers structure of any organization where modalities identified according to their role and position in the system.

<sup>2</sup>Modules are described as events/hapenstances/act of dwelling etc by various researchers to elaborate similar concerns with different focus of concentration. In this paper, these terms are used intentionally in an interchangeable way in order not to refer to the various debates on the issue.

lem-solving matrix, it may also help to explore the role and importance of the urban development in supporting; exploring and contributing to the meaning within the process (see Table 2). Four types of urban structuration are possible: flat-horizontal, cubic/spherical, flat-vertical and vertical. Those classifications are used to exemplify mezzo-scale relations within/in between different layers of urban development. Cubic geometric abstraction resembles various forms of stratum, each containing various assemblages of strata. The symbolic representation of the plan of the abstracted cube organizes the tempo-spatial assemblages of strata; while the section organizes the socio-spatial ontological relations within the process of urban becoming (see Table 2).

## CONCLUSION:

In this paper, Envelopment is developed as a conceptual approach, and operates as a mechanism discussing time and/or temporality, space and/or spatiality and human dimension together in the form of identified relations: modalities. Ties are the enablers bringing modalities together, where the operation of ties supports territorialisation of urban practices, called 'events'. Events assemble together to form urban layering which unfolds on space, forming a stratum, and folds in time supporting urban assemblage: strata. Envelopment formulates a stratum, as an entity, integral to itself. It emerges through folding/unfolding happenstances on real time – 'being'. It also formulates multiple single stratum which come together to form urban assemblages, defined as strata. These in turn form the ontological organic 'becoming' of the city. The relationship between urban being and urban becoming is supported by ties as system enablers, also known as pincers, allowing the continuity and integrity of the system. Ties can be grouped into two: permanent enablers or stabile-ties, allowing the organic meaning to be kept through continuity and/or integri-

ty; and temporal enablers, flexible-ties, allowing transformation to take place without losing the very essence of urban becoming: the urban narrative.

In other words, the components of Envelopment can be considered both as an individual stratum, an 'autonomous being' unfolding in tempo-spatial layers, and as an interactive structural element, folding to form multiple strata, an 'urban becoming'. Ties are the determinants of this mutual relationship, where Envelopment operates and is sustained as a mechanism to achieve the continuity of urban narrative.

Envelopment and its founding(supporting) notion of structuration indicates the very idea according which the system should be taking into account as a whole which is more complicated than sum of its parts. This is exactly in line with the Wittgensteinian tool metaphoric comprehension of the language which based on the interrelation of the words with their context. That is, the preference of these theories upon the structure as interrelations (modalities) over the individual agency. Therefore, Envelopment prepares a representative tool which enables us to visualize the abstraction of complex organic systems based on complicated fluctuating relations. Accordingly Envelopment can be considered as a mechanism operates and is sustained to illustrate perpetual continuity of urban narrative. Also this approach has the potential to be developed with more advanced quantitative research methods.

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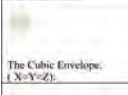

Classification of Urban Development within the forms of Envelopment:			
Geometric Representation of Envelopment in an Abstracted Cube:	Characteristics of Urban Development	The tempo-spatial form of relations, "State of Being", represented as plane:	The socio-spatial form of relations, "Socio-spatial Process of Becoming", represented as section:
The (x,y,z) coordinates defining the stratum as a container can be identified upon formal composition.		Organises/constitutes the tempo-spatial assemblages, Strata	Organises/constitutes the socio-spatial ontological relations, Stratum
	<b>The Historic City:</b> The specificity of this envelope category is an intense relationship between temporal/spatial and social determinations and performances.	<b>State Connected</b> There is a multi-directional orientation in the plan representing integrity within Stratum, and amongst strata.	<b>Predominantly Process-Connected</b> Vertical dimension, representing the existence of strata emerging on different time-spans.
	<b>The Contemporary City:</b> The specificity of this envelope category is weak relationship between tempo-spatial being and socio-spatial form of becoming.	<b>Predominantly State-Connected</b> Tempo-spatial state of being-dominated, flat-horizontal stratum represents the contemporary city, without having rooted on previous strata.	<b>Process Dis-connected</b> Tempo-spatial interaction and/or assemblage are considerably larger than the vertical, ontological becoming of the city.
	<b>The Balanced City:</b> The specificity of this envelopment is balanced relationship between tempo-spatial being and socio-spatial form of becoming.	<b>State Connected</b> The cubic envelope's dimensions (horizontal and/or vertical) are approximately equivalent to each other.	<b>Process Connected</b> This is the ideal form of envelopment where spatial, social and temporal dimensions are in balance.
	<b>The Disintegrated City:</b> The specificity of this envelopment is its fragmented actual development. It is generated by the horizontal displacement of a certain form of temporal relationship which, in order to support a specific relation in actual manner, focuses on certain parts and ignores the rest.	<b>State Dis-connected</b> Vertical dimensions, i.e. socio-spatial interaction and/or assemblage, are considerably larger than the horizontal, the temporal process of becoming. Therefore, it is not contextualised by means of supporting tempo-spatial emergences.	<b>Process Dis-connected</b> This is the fragmented form of development, disconnected strata cannot come together to produce integrated stratum.

Table 2. Urban Development as Tempo-spatial and Socio-spatial form of Relations.

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# NEW HOUSING TRENDS IN ISTANBUL .

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## Abstract

*Externalization that became prominent in 1980s with the globalization brought along dramatic changes in social and spatial areas. The social, cultural and economic events that took place on an international level thanks to globalization made the impact of change felt which was reflected on the urban space and, therefore, on the house, resulting in an increase in the importance of the residential sector. Externalization and developed economic structure enabled more investments into houses which introduced a concept of housing populated in urban fringes starting from the city centers. The housing concept which was shaped by the impacts of the urban transformation after 1980 turned into a new emerging lifestyle in Istanbul in 2000s. Accordingly, the study aims to establish the position of housing in Istanbul and new meanings formed by the socio-cultural changes. In this sense, housing before and after 1980, globalization, gentrification, urban transformation, spatial segregation, socio-economic and cultural aspects were discussed based on the structural benchmarks, and 4 different housing forms, namely the "Loft", "Residence", "Terraced House", and "Gated Communities", with individual structural examples. This study, thus, aims to question the form of tenancy of these houses created through varying concepts and concerns today. The results obtained showed that the housing as an indicator of cultural life in Istanbul has turned into a lifestyle that is shaped by similar aspects and commercial concern, despite different approaches or production forms, eliminating the traces of the cultural life of the society.*

**Keywords:** *New housing trends in Istanbul, Loft, Residence, Terraced House, Gated Communities.*

## Introduction

The house is an architectural product that represents the socio-cultural and political aspects as well as the cultural values of the period during which it is built and the area where it is located (Sormaykan 2008). This architectural product is also a kind of shelter whether for a single person or for a crowded family living in a sharing environment. It is an important sign of the culture and tradition of its tenants. Therefore, the development of the social, cultural and economic data requires a change in the housing. Accordingly, the impacts of globalization, one of the most important reasons for change, are reflected in Turkey like the whole world. In this period, the country tried to be integrated with the external world and experienced great social and spatial changes especially in 1980s, and the changing economic structure allowed more investments into the urban environment. Therefore, the globalization affected urban space and different production processes. Reasons including migration from rural areas to cities and increased population brought along problems in the uncontrolled development of Istanbul, and events like unplanned urbanization or squatting hindered the development of urban space. In 1990s, the housing production that started to be structured based on the concerns of urban sphere created a sort of alienation in the society. A new lifestyle has emerged with signs of socio-economic discrimination, isolated from the urban life with borders. While different house typologies come out due to the effects of urbanization, the spatial segregation reached peak levels as a result of various lifestyles iso-

lated from the social life completely. Small investors existed before 1980 opened the way for foreign investors in producing large scale housing in a setting of unearned income where the large capital was positioned after 1990. Thus, the residential sector stepped into a competitive environment shaped by commercial purposes in every field. A period has started in which housing shifted to the peripheries of Istanbul and triggered the construction of today's houses, particularly after the Earthquake of 1999. The swift increase in the housing production in 2000s directed investors towards different house types which resulted in customer-oriented house types lacking their primary purpose. In parallel to the tough competition in the residential sector, the modern house concept has begun to lose its primary meaning. Therefore, the study aimed to establish the emerging differences in the modern housing production in Istanbul. Accordingly, the purpose was to discuss the housing productions based on their value shaped by the socio-cultural changes and the form of tenancy as well as to explore the reasons behind this change and look into the new house types providing relevant examples. The first part addresses the development of the residential sector in Istanbul since 1980s to today, and the second part focuses on globalization, gentrification, urban renewal, spatial segregation, socio-cultural and cultural aspects based on the structural benchmarks, considering the reasons behind the emergence of new house types. Finally, the third part discusses different new house trends in Istanbul under four categories, namely the "Loft", "Residence", "Terraced House", and "Gated Communities". The housing types identified

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are Incity Loft, Eltes Gold , Akasya Terraced House, Ritim Istanbul and Narcity. The examples included in the study were preferred owing to the fact that they are among popular housing types from different districts and with different tenants. To conclude, it was determined that the residential sector shaped by the new house trends in Istanbul lacks a specific identity and that the housing types varying as an indicator of cultural life has turned into a lifestyle which is shaped by commercial concerns, rather than representing the cultural life of the Turkish society.

### 1. The Residential Sector in Istanbul since 1980s to Today

The globalization experienced around the world in 1980s also took hold of Turkey, resulting in dramatic changes in the social life. The transformation model adopted in the country, which exercised externalization, economic restructuring and attempts to be integrated into the world due to the impact of globalization, laid the foundations of new house typologies following the entry of foreign capital in the country. The economic impact on the urban space resulted in large companies, shopping malls, industrial zones shifting to the suburbs as well as different pursuits in qualified housing areas (Sarıkaya 2002).

After 1980s changes started to take place in Turkey following the adoption of the externalization policy. A development model based on externalized export was implemented; new authorities were incorporated in the cities in the areas of capital markets, liberal trade and manufacturing, and banking; telecommunication investments were prioritized in the infrastructure policies; and the telecommunication capacity of Turkey was increased (Tekeli 1999). The changing consumption habits resulted in the emergence of new service areas, and the social class division became more evident with the increased capital and events of migration to cities. The changing habits suggested the relocation of existing housing areas and resulted in a need to fulfill the housing requirement of the new population. In the period after 1980, the Turkish policies were shaped by the adoption of liberal economy and the housing construction prioritized following the acknowledgement of the fact that the residential sector is an industry creating employment opportunities (Bölen 2004). The construction sector which was dominated by the small contractors by 1980s was gradually invaded by the large capital, providing funds to afford the high costs in creating new improved lands and houses around the city and to utilize the technology required (Tanyeli 1998). The housing projects developed for the private sector in 1990s were gradually replaced by projects for high-income groups and the house areas in the city were replaced by houses in urban peripheries. Especially with the increased foreign capital and as Istanbul became a preferred location, several large scale houses were started to be produced. The developed residential sector resulted in changes in the house features, with house proposal types on a mass scale were accelerated. Three spatial options came to the fore for those emerging groups who earned fast money after 1980 and for those long-established rich urbanites. The first one included old central locations with a historical prestige, the second included tall building complexes built on former shanty settlements in the urban peripheries, and the third option included private sector-based gated communities developed outside the

city center with gardens for high-income groups (Şenyapılı 2003). The most important factor in the emergence of different house trends is the desire of people who adopt the same cultural environment and the same values to live together. This also demonstrates that social division is a determinative factor in the housing production based on the cultural structure.

The migration from rural areas to cities that continued from 1980s until 2000s, as well as the social class division and the development of new house areas at the transportation axis in the peripheries of the city, constituted reasons for the urban transformation with the purposes of renewal and reinforcement of the urban texture. The practices imposed by this transformation can be grouped under three categories: 1) Urban renewal at areas with reduced living quality and risks; 2) reinforcement and rehabilitation-urban planning works for improvement; 3) Protection and gentrification of areas with historical attributes (Ataöv and Osmay 2007a). The spatial and social structure played a substantial role in the transformation of urban environment in Istanbul starting from the 1990s. Particularly as the high-income group set clear, new living standards for themselves, the housing productions shaped as part of the urban transformation covering the city center and urban peripheries. Today, the investment into housing is increased thanks to the ongoing impact of the 80s and the improved economic structure. This turned the house trends in Istanbul that started in the city center and expanded to urban peripheries into a lifestyle shaped and accelerated by commercial concerns.

### 2. The New House Trends Emerged After 2000

After the Earthquake of 1999, a need arose to ensure healthier housing production structures, while Istanbul achieved an unstoppable growth momentum with the industrialization, population increase, urbanization, and the changing consumption habits. The competition in the residential market became fiercer particularly with the entry of foreign producers in the sector. Uncontrolled growth, unearned income from forests and water areas cleared the way for sheltered life expanding from the city center to urban peripheries. The increased population, changing economic balances resulted in a clearer division between the concept of urbanites and rural people which required change in settlement areas. Especially the houses populated on the forests and water basins of Istanbul became a living space labeled with the luxury concept. As the house turned into a lifestyle resulted in the emergence of three types of settlements.

First one is composed of distinguished houses located at the city center or near business centers; Second one covers houses located at the city center yet far from the relatively central business areas; and Third one includes private housing areas located at the urban peripheries (Taşar 2008).

The common purposes of these three housing model is security, privacy and to be located on the transportation axis. These safeguarded living standards offer a lifestyle with borders and therefore becomes a determinative factor for the new house trends.

#### 2.1. The Reasons behind the Emergence of New House Trends

The economic improvements in turkey, a country which was externalized and experienced changes in 1980s,

were reflected in the housing policies. The housing need arose after the 1999 Marmara Earthquake paved the way for the earthquake regulation and health urbanization and a trend emerged for low-rise housing productions in the northern parts of Istanbul. This also resulted in housing areas shaped by different concepts and standards after 2000. The development of the city and housing areas brought along a transformation in the social life as well as a spatial transformation due to the need for new housing areas. The urban transformation projects targeting low-middle income groups triggered a change in the private sector-based housing areas built in urban peripheries for high-income groups and the high-rise housing projects at the city center. The urban transformation, globalization, gentrification, and socio-cultural aspects play a very important role in the urban change. The housing projects in Istanbul are dominated by the housing areas designed with the same concept for the high-income group and delivered under the so-called urban transformation. In this respect, the current housing productions like loft, residence, or gated communities actually target luxury income groups and serve as houses formed in a way that fails to meet their purpose.

Therefore, globalization, gentrification, urban renewal, spatial segregation, socio-cultural and cultural aspects that influence the housing concept are discussed in this part based on the structural benchmarks and considering the reasons behind the emergence of the new house trends in Istanbul.

#### **2.1.1. Globalization**

The concept of globalization is about ensuring global integration and union in every aspect of life from economy and politics to social policies and culture and from environmental issues to social life (Kiper 2004). The multi-storey housing concept and similar architectural styles emerged as a result of the global urbanization efforts created cities looking alike. In addition, the globalization introduced different production styles with an influence on the urban space. The social changes experienced during the globalization period established a ground for events like gentrification, urban transformation, spatial segregation, and the transformation of social structure.

#### **2.1.2. Gentrification**

The spatial transformation after the economic and social changes that took place after 1980 is clearly followed by the settlement of the high-income group in the central districts, or in other words, by the "gentrification" process. Gentrification is defined as the process where the upper class start to settle down in the housing areas located in the slumier parts of the city and occupied by low-incomers (Islam and Ciravoğlu 2006). The unattended houses are renewed yet the old tenants are displaced in the districts affected from such circumstances. Three main drivers can be observed behind the development of gentrification process in Istanbul: First one is the capitalist contractors targeting unearned income; the second one is the government; and the third one is the gentrification process started by the new tenants (Keyder 2006).

#### **2.1.3. Change**

Change represents the development and progress of a society and its environment in every period. New social classes emerged and new types of houses and

housing areas were created as a result of the expanded city centers, transformed transportation systems and business relations as well as diversified and differentiated tenancies in the city center, particularly as part of the modernization efforts (Aksoylu 2003). This structural change showed itself in areas inside and outside the city in time. Change is usually followed by the transformation and when the change lays the foundation for transformation when it is delivered. Especially the concepts of globalization and urbanization introduced new house trends and lifestyles with the impact of change.

#### **2.1.4. Urban Transformation**

The urban transformation is the process of changing, developing, reviving and reproducing the old, unhealthily-structured city texture within a strategic approach that is created with and lives on social and economic programs (Özden 2008). The globalization that took hold of the entire world in 1970s increased spatial transformation and housing production and led to transfers in low-income districts. When the legal arrangements regulating the urban transformations are considered, it is seen that the urban transformation is defined as "renewal" yet it has evolved to attain new dimensions. While transformation formerly referred to demolition and reconstruction before, today it means reinforcement of physical attributes by protecting the current texture (Ataöv and Osmay 2007b).

#### **2.1.5. Spatial Segregation**

Big cities that changed by the influence of the urban transformation created social alienation in time. Especially the social change experienced in 1980s also resulted in segregation in the physical space. The new social class emerged between the low- and high-incomers was acknowledged as a symbol of status. Isolation from the city center was started to be observed as the new social class preferred a luxurious and peaceful life. As the population density increased and central urban areas became fully occupied, housing areas expanded to cover urban peripheries and inward, private settlements were created in the remaining urban areas (Kazmaoğlu 1998). The life that has changed since 1980s to today led to increased conflict between the social groups. The economic and cultural change play a great role in this conflict and the spatial segregation is sharply revealed by the fact that one side of the city is covered by slums while the other side is a home to luxury houses.

#### **2.1.6. The Socio-economic and Cultural Structure**

The culture is an important variable in the formation of environment and the primary determinative in the interaction between humans and environment (Rapaport 1969). The formation of an area is felt through its representation in the social structure of the area, or in the space. Upper class started to leave the cities beginning from the second half of 1980s across the world. The basic characteristic of this period in terms of settlement is the trend among upper-middle class escaping the metropolitans to live together with those who are like them in relatively more isolated spaces (Sürer and Sayar 2002). The accelerated social change in 1980s allowed a clear isolation between living spaces. The division between the urbanites and the rural people or the rich and the poor became clearer and the high-income group

began to prefer more safeguarded living spaces. Particularly the high-income group drove social alienation by preferring a more safeguarded life in the city centers and urban peripheries and increased class division by aligning their lifestyles with their statuses, accordingly.

## 2.2. New House Trends

The housing production in Istanbul that gained momentum after 1980 turned into housing proposal styles produced by different concepts and concerns after 2000. The primary reason for this is the current status of housing production which started with the globalization and was accelerated with the urban transformation and which was shaped by the socio-cultural structure. The class division created by the globalization on a social and spatial level led to houses built to serve mainly the lifestyle of the high-income group. Therefore, the modern housing proposals have turned into a market that targets the high-income group and is shaped by commercial concerns, and this market offered a great competitive setting in the residential sector which resulted in the introduction of misapplied, indistinguishable housing productions. Accordingly, the increasing numbers of lofts, residences, terraced houses and gated communities are in fact examples of housing styles produced through such concerns.

### 2.2.1. Loft

Loft is the understanding of natural space observed in the gentrification process resulting from the socio-cultural changes caused by the economic models and global policies in Istanbul after 1980 (Karagöz 2007). Shaped by the economic balances changed during the early 20<sup>th</sup> century and by the impact of the gentrification process, loft which has become meaningless and been altered to a great extent today has started to be formed by the modern architectural patterns in line with the luxury lifestyle demanded by the upper class (Özker 2014). Loft living is a lifestyle that features open plans, high ceilings, wide windows, naked structures while protecting the natural texture, and it is differentiated among regular projects. The modern lofts have turned into living styles similar to regular house typologies, as a result of the commercial concerns hindering their primary purposes. The loft living in Istanbul is seen mostly in historical districts like Galata, Beyoğlu, and Kuzguncuk, which have changed due to the impact of the gentrification process, as well as in city centers near business circles like Levent and Kozyatağı.

### 2.2.2. Residence

Residence is a housing style that is designed to feature multi-storey blocks with social and recreational functions placed at the bottom elevations to allow a self-sufficient settlement (Saygıcı and Esin 2004). Especially the desire for luxury lifestyles emerged in parallel to the development of social sphere after 1990 created an opportunity to form a residence living in areas near business centers for the high-income group. Residences incorporate many services and are preferred by the majority of the high-income group. It is different from the luxury building complexes as it offers a living alternative close to the center for urbanites who do not want to live far from the city center. They are built as multi-storey buildings to serve as sort of a residence-hotel on relatively smaller parcels com-

pared to luxury building complexes as there are no empty lands in the city center that is large enough to build a complex or as the available lands are highly expensive (Görgülü and Kaymaz Koca 2007). The modern residence projects offer its customers luxury and unlimited services. Residence-type housing settlements are mainly located in regions like Beşiktaş, Ümraniye, and Kozyatağı. The residence examples in Istanbul include Akmerkez, Metrocity, Kanyon, Elit, Palladium, Maya, and Sellenium.

### 2.2.3. Terraced House

Terraced house is a housing space placed vertical to the slope on an inclined land in a way that the roof of a house will serve as the terrace of another (Construction Dictionary). On the inclined land, green areas can be created in the living space without interfering with the private areas. In Istanbul, the housing projects built vertically or horizontally reduce the use of natural environment and increase the housing. Thus, the housing producers in the competition seek to produce a different housing model to be the front runner. The terraced house concept, which fails to meet its primary purpose, is offered to customers as large balconies of high-rise buildings in spite of its main function.

### 2.2.4. Gated Communities

Gated communities, which started to be developed as a new urban form after 1980, come across us as housing zones, examples of which are available in almost every country in the world. Gated communities, which are considered as a part of suburbanisation tendency, were previously expressed as protected settlements, protected encompassed zones, border cities, gated neighbourhoods (Alpaykut 2011). Gated Communities are residential areas, which offer a safe life to their consumers and which are limited high walls and protected by a security system. This type of settlements, which are generally away from city centres but located on transportation axis, are included in liberated areas within the indicators of luxurious life by clearly putting forward the life choices of the upper income group. Gated community settlements, which gained momentum as of 1999 Marmara Earthquake, today show themselves around the city while being produced in perimeters of Istanbul. Such settlements, which are generally turned into villa in city perimeter, take high block form at city centres. Gated communities have the concern of establishing small cities (suburb, satellite city) on vast fields. These settlements are expressed by town/city words, accommodate a population of at least 1500 people, contain house typologies from studio flat to apartment flat and villa (Gülümser 2005). Such buildings cause alienation in the community and thus class differentiation due to the fact that they fail to develop the senses of neighbourhood and belonging. Accordingly; in this study, the gated communities are considered in two forms, which are city centres and city perimeter.

#### 2.2.4.1. Gated community areas at city centres

Gated communities located at city centres are constructed both for upper income group and middle income group. In this sense; they are the examples of site-type house, covered with high walls, fences or barriers. House examples, which appeal the upper income group, contain all the services such as shopping mall, sports, etc., which answer all the needs of

the upper income group. They can be produced vertically or half-horizontally based on their field in the city. Dragos Royal Towers, Soyak Soho, Uphill Court, Almond Hill, Incity, Akasya, Uprise Elite in Istanbul are some of the examples for gated communities at the city centers.

#### 2.2.4.2. Gated community areas in city perimeter

Gated communities located in city perimeter are constructed for upper income groups. They can examples of villa type houses and have high walls, fences, barriers in addition to security and high-rise qualities. They are the house communities which contain all the services such as shopping mall, sports, etc., which answer all the needs of the upper income group. They can be produced horizontally, vertically or half-horizontally based on their field in the city. Kemer Country, Çekmeköy Villas, Ardıçlı Houses, Narcity, Evora, Dumankaya Konsept in Istanbul are some of the examples for gated communities in the city perimeter.

### 3. New House Tendencies Differentiating in Istanbul

House presentations, which gained momentum in Istanbul after 2000, put the house productions on the market by turning in to market with commercial concerns, which appeal the upper income groups. Loft, residence, terrace house, gated communities, which are swiftly constructed in Istanbul, are types of houses which are produced based on these concerns. Accordingly; different types of houses such as Incity

Loft, Eltes Gold Residence, Akasya Terraced House, Ritim Istanbul and Narcity were considered under the title of "Loft", "Residence", "Terraced Home", "Gated Communities", which are swiftly constructed in Istanbul. The reason why these houses are preferred within the scope of the research is that they accommodate different types of vicinities and house users besides being included among the popular house examples.

#### 3.1. Loft-"Incity Loft"

Construction Name: Incity Loft,

Construction Place: Kozyatağı

Construction Year: 2009

Producer Company: Dündar Construction

General Features of the Structure: Incity Loft is a house project, consisting of 11 blocks, 322 flats of 4 different types, constructed as an example for imitation of today's lofts. It contains not only loft but also features such as swimming pool, tennis court, basketball court, fitness centre, sauna, spa, etc. other than house options such as 1+1, 2+1, 3+1 (Duran 2012). Loft is a way of life where a free-planned, high-ceiling, wide window and bare structured natural structure is preserved. Accordingly; Incity Loft fails to meet the features such as historic texture, natural material, flexibility which are required to be available in a real loft (Özker 2014).

#### 3.2. Residence-"Eltes Gold Residence"



Figure 1-Incity-Plan



Figure 2. Incity Loft-outdoor



Figure 3. Incity Loft-indoor



Figure 4. Incity Loft-indoor





Figure 5. Eltes Gold Residence-plan



Figure 6. Eltes Gold Residence -outdoor



Figure 7. Eltes Gold Residence -indoor



Figure 8. Eltes Gold Residence -indoor

Construction Name: Eltes Gold Residence  
 Construction Place: Ümraniye  
 Construction Year: 2008  
 Producer Company: Ağaoglu Construction  
 General Features of the Structure: Eltes Gold Residence is a multi-layer residence project which includes social functions in its sub-branches. It contains 231 flats of 20 different types. It contains not only residence but also features such as indoor/outdoor swimming pool, tennis court, basketball court, fitness centre, sauna, spa, beauty saloon, housekeeping, valet, shopping mall, restaurant, cafe/bar, etc. other than house options such as 1+1, 2+1, 3+1 (eltesgoldresidence.com). Residences are, somehow low-cost, multi-layer buildings, which are close to business centres as house-hotel, and located on smaller parcels than the luxurious house sites. Accordingly; Eltes Gold Residence fails to meet the features such as low-cost, house-hotel concept, which are required to be available in a real residence.

### 3.3. Terraced House -"Akasya Acıbadem"

Construction Name: Akasya Acıbadem Terraced House  
 Construction Place: Acıbadem  
 Construction Year: 2010-2012  
 Producer Company: Sinpaş ve Akkök Construction

General Features of the Structure: Akasya Acıbadem is designed with a different concept with its floor gardens and terraces, which can be seen on each floor. Akasya Terrace Houses consist of 1580 houses, a tower of 40 floors, 15-floor horizontal habitation areas. Akasya has three different types of living options. Life in high blocks, life in horizontal blocks and Penthouse life. It



Figure 9. Akasya Acıbadem-plan



Figure 10. Akasya Acıbadem-outdoor

has features such as private security, pharmacy, baby sitting, dry cleaning, housekeeping services, gym and pool. Life in horizontal blocks includes garden, floor garden, duplex and terrace garden (ak-asya.com). Terraced houses are the type of houses, which provide green areas and obtained through the placement of the houses on a sloping land in such a way they do not block each other. The terrace concept, which has lost its main feature, is offered to the customers as wide balconies in high-rise structures. Accordingly; Akasya Acıbadem fails to meet the qualities, required to be



Figure 11. Akasya Acıbadem-indoor



Figure 12. Akasya Acıbadem-indoor

available in a real terrace house, such as provision of green areas in living areas, which do not prevent the private spaces, vertically to the slope in such a way one's roof functions as the terrace of the one above it.

### 3.4. Gated Communities

Gated Communities are protected living areas, which offer a safe life to its consumer and in which class differentiation is clearly put forward. Such houses, which are generally located to city perimeters, led the construction sector to city centres in line with the preferences of upper class. Such house units offers life styles for individual life contrary to the vicinity culture, neighbourhood, integrity concepts, which are included in social structure of Turkish society. Accordingly; in this study, the gated communities are examined under two titles, which are city centres and city perimeter.

#### 3.4.1 Gated community areas at city centre "Ritim İstanbul"

Construction Name: Ritim İstanbul  
Construction Place: Maltepe  
Construction Year: Estimated Completion Date: 2015

Producer Company: Dumankaya

General Features of the Structure: Ritim İstanbul is a multi-layer residence project which includes social functions in its sub-branches. It consists of 37, 33, 30 and 17-layer towers, 5 and 6-layer blocks and 1113 houses, 113 trade offices, 147 stores and in total, 1373 independent sections. In addition to special clubs, supermarket, offices, outdoor swimming pools, sports, health centre, foyer, conference hall, art gallery and culture centre, it also has recreation areas on interstages (dumankaya.com). Gated community areas at the city centres are types of house which are protected and covered with high walls or fence. They particularly have a tendency to be a new type of house, which meet all the needs of the upper income class, which drive apart the people from social environment, alienate them and which are private.

#### 3.4.2 Gated community areas in city perimeter "Narcity"

Construction Name: Narcity  
Construction Place: Maltepe, Başlıbüyük  
Construction Year: 2006  
Producer Company: Tepe Construction



Resim 13. Ritim İstanbul-plan



Resim 14. Ritim İstanbul-outdoor



Resim 15. Ritim İstanbul-indoor



Resim 16. Ritim İstanbul-indoor

General Features of the Structure: Narcity consists of row houses, changing between 5 and 9 floors, and two 15-30 layer towers and 1414 flats. Narcity houses are planned in such a way no flat prevents the privacy of another. It has social areas such as garden, pedestrian paths, tennis court, volleyball, basketball courts, outdoor swimming pool, meditation garden, running track, children playground, cafeteria, fitness gym, movie house, shopping mall, indoor parking lot and security. Gated community areas in the city perimeters are types of house which are protected and covered with high walls or fence. They particularly have a tendency to be a new type of house, which meet all the needs of the upper income class, which drive apart the people from social environment, alienate them and which are private.

5 house examples such as "Loft", "Residence", "Terraced House", "Gated Communities" are examined in the study and it is clarified that the house presentation types, which target the upper income group, lead the house sector. As it is seen in Table 1; it is observed that the new house



Figure 17. Narcity-plan



Figure 18. Narcity-outdoor



Figure 19. Narcity-indoor



Figure 20. Narcity-indoor

Feature	Loft	Residence	Terraced House	Gated community at city centres	Gated community in city perimeter
	Incity-Loft	Eltes Gold Residence	Akasya Acibadem	Ritim Istanbul	Narcity
Natural Structure					
Modern Architecture	*	*	*	*	*
Luxurious Consumption Method	*	*	*	*	*
Multi-layer	*	*	*	*	*
Little-layer					*
Social and recreative functions (Spa, sports, hair dresser, Shopping Mall, etc.)	*	*	*	*	*
City Centre	*	*	*	*	*
City Perimeter					*
Sloping Land		*	*	*	*
Floor Gardens (Terrace, balcony, etc.)	*	*	*	*	*
On transportation axis	*	*	*	*	*
Population of minimum 1000 people	*	*	*	*	*
Population of maximum 1000 people					*
Studio Flat	*	*	*	*	*
1+1, 2+1, 3+1, 4+1 type flat	*	*	*	*	*
Residence	*	*	*	*	*
Loft	*	*	*	*	*
Terraced House	*	*	*	*	*

tendencies such as loft, residence, terrace house have, in fact, no clear differences. Accordingly; house production is turning into a market, which is shaped by the similar features and customer concerns, and serves the same purpose and accelerates the competition.

#### 4. Result

House, globalisation, gentrification, urban transformation, spatial segregation, socio-economic and cultural qualities before and after 1980 were examined as a sample of 4 different types of house, which are "Loft", "Residence", "Terraced House", "Gated Communities", in terms of a structural criteria. In this sense; houses tendencies, which are produced through different concept and concerns today, are queried in the research.

Accordingly; post-1980 economical, political and social changes in Turkey caused capital groups to invest in housing areas. Development of the house is examined through Istanbul, which has the highest population and faced this change. Particularly the growth in house construction in Istanbul after 1980

accelerated the social and class differentiations. Class differentiation, urban transformation and gentrification process caused an unpreventable house construction within the urban development of Istanbul. Development of the house brought about a change in communal class based on the life standards. In this sense, today's house constructions were shaped for particularly the upper class. They were started to planned as private housing areas, which reflect the life style of the upper income group, support the communication with technology. Accordingly; it is seen that, in the background of the house production, class differences and particularly the upper income group have the affect.

Thus; in today's ever changing and developing world, the house accelerates the urban venue transformation by becoming a consumption object. In addition to the countries which were changed particularly during the globalization process, Istanbul is also included among the growing cities. Reflections of globalization and urbanisation process on the city cause class differences in spatial terms. A great percentage of the house sector shapes their house productions in this direction by carrying out productions for the rich class. This shaping and differences sharply separate the urban environment in such a way it belongs to the upper and lower income groups. Accordingly; we encounter house projects, which serve the same purpose, use the same presentation types but which are separated with different names. Recently, it has been interesting that they sell the luxurious house projects such as loft, residence, terraced house, private house by featuring them through "name and advertisement" rather than content in order to accelerate the competition of construction sector. In this sense, the house projects, which are marketed under "residence" or "loft" although they are not "residences" or "lofts". The houses, which increase their sales value through their names, do not reflect their real meanings, and cause an increase in the competition among the producers. "Loft is a type of house where a free-planned, high-ceiling, wide window and bare structured natural structure is preserved" while "Residences are, somehow low-cost, multi-layer buildings, which are close to business centres as house-hotel, and located on smaller parcels than the luxurious house sites" and "Terraced houses are the type of houses, which provide green areas and obtained through the placement of the houses on a sloping land in such a way they do not block each other" Today's house examples are put on the market solely through their names without having any real features.

Accordingly; when new housing tendencies are analysed in terms of Istanbul; It is clearly seen that loft, residence, terraced house, gated communities tend to a life style, which does not provide any indicators regarding the cultural life of Turkish society, without sticking to their real meaning and that a new life style, which stimulates the luxury consumption, has become apparent. As it is seen in five different housing type examples; the important factor in the embodiment of today's houses is the preferences of the customers, who wish to have a luxurious and privileged life. Although called different names, the housing examples discussed feature similar aspects.

In this sense; the house productions, which shape the typology in Istanbul, constitute the spatial transformation which occurs through the effect of the new economic balances and socio-cultural changes. Urbanisation, globalisation, gentrification, spatial separation, socio-economic-cultural structure, which affect and somehow lead the development of urban space, have an important place in the embodiment of today's house projects while significantly increase the spatial separation through the growth in class differences. Eventually; in the study, it is put forward that house types, which are differentiated in Istanbul as an indicator of the cultural life, have turned into a life style, which does not bear the traces regarding the cultural life of Turkish society, besides being shaped through similar qualities and commercial concerns despite different approaches and production types.

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# THE ASSESSMENT AND IMPACT OF SHOPPING CENTRES: CASE STUDY LEMAR

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## Abstract

*Economic, socio-cultural and demographic changes in Famagusta have altered consumers' shopping expectations; they expect good architectural quality as well as various functions and activities besides shopping. The concept of shopping has moved away from being purely a necessity towards being part of the urban lifestyle. Accordingly, recently developed shopping centres try to satisfy these new demands in a variety of ways. The new Lemar shopping centre in Famagusta, Northern Cyprus, is an example of such a centre. This study aimed to measure user satisfaction and identifies the impact of the Lemar shopping centre on the immediate local context by surveying 104 randomly selected consumers, local residents and shopkeepers. Statistical analysis of the resulting data was used to determine Lemar's physical qualities, functions and activities as well as its general impact on its close urban context and the wider city. Survey data is supplemented with on-site observations. This study reveals that the majority of respondents perceive the shopping centre as a positive contribution to the area, as an attractive building with a contemporary style and pleasant indoor spaces. On the other hand, it has increased the traffic on the high street, the area has become more crowded and air pollution has increased. This study suggests that consumers' and citizens' viewpoints should be considered in planning decisions in order to contribute to the success of shopping centres.*

**Keywords:** Famagusta, Shopping Centre, Public Satisfaction, Public Space.

## INTRODUCTION

There is a perceivable increase in shopping centre developments worldwide. This is especially visible in Turkey and other developing countries where large-scale shopping malls – which have become attractive places to shop, visit and spend time – have been newly constructed. Since 2000, the shopping mall has become 'one of the most recent additions to the lexicon of built forms' (Jewell N. 2001). In more recent years, the shopping mall has undergone further essential changes in form, increasing the leisure activity components. In particular, malls in Turkey have transformed into Disneyworld-like entertainment parks rather than shopping places. As shopping centres have moved towards social gathering spaces they have a great impact on the lifestyle of citizens (Aktas G. G. 2012). Hence, the contemporary shopping centre not only derives value from consumption, but contributes to active urban living. Several scholars have contributed to the discussion on the role of shopping centres in society and the environment (Erkip F. 2005; Amendola G. 2006; Jewell, N. 2001). Erkip et al. (2014) noted that globalisation has had a strong impact on the retail sector and particularly focused on the role of shopping centres in urban spaces in Turkey. Wakefield and Baker (1998) turn their attention to the influence of tenant variety, mall environment and shopping involvement on consumers' excitement and wishes to stay at a mall. Various scholars have observed that apart from the functional offerings, visual and aesthetical appearance or the choice of location may have an impact on the existing environment

and the users of the space. Finn and Louviere (1996) looked at the contribution of an anchor store to a shopping centre's image and consumer choice. Ng (2003) analysed how the physical environment affects the shopping experience and satisfies the psychological desires of the shopper. Oppewal and Timmermans (1999) evaluate the influences of shopping centre design and management on consumer evaluations of the public space presence. Evans et al. (1996) assessed the impacts of social influence and role anticipations on shopping centre patronage intentions. Kusumowidagdo et al. (2015) examine visitors' perceptions of shopping centre public spaces as creating a sense of place. Oppewal et al. (2006) considered how retailer and town centre corporate social responsibility influence consumers' evaluations of town shopping centres. Abdul-Ghani et al. (2011) discussed usability as a hidden quality in determining shopping centre success. Clearly, the shopping centre has gained much attention from scholars from variety of disciplines and viewpoints. The Urban Land Institute defines a shopping centre as a 'group of commercial structures with integrated architecture, that is built in a planned location, developed, owned and managed as an operational unit' (Kusumowidagdo et al., 2015:266, Kowinski W. S. 2002). But what makes shopping and shopping centres so attractive around the world? Shopping is one of the oldest human activities, dating back to the Ancient Greek Agora and Roman Forum. Shopping is a vital and ordinary activity of human beings (Ng C. F. 2003; Hewer P. & Campbell C. 1997). It is often a social performance with little exception, achieved together with friends or

relatives (Evans K. R. et al. 1996). Therefore, shopping is about with social gathering and may be seen as the most significant part of city life. The shopping centre is also a part of the built environment, influencing the image of the city. Shopping places can also be classified according to their sizes, functional characteristics and activities offered (Mui Y. K. et al., 2003, Ahmad, Z. et. al., 1996). Abdul-Ghani et al. (2011: 496) categorize trade into large and small scale retailers. Small-scale retailers include hawkers, peddlers and market stall holders, whereas 'superstore, discount store, hypermarket, department store, supermarket and shopping centres' belong to the large-scale group.

In the case of Northern Cyprus, large-scale retail has only become relevant in the last couple of years. With its small population (286,257), there was previously no necessity nor were there any attempts to build larger supermarkets or malls (DPO, 2011). Nonetheless, there is now a similar tendency in Northern Cyprus towards mall development along with the rest of the world. There are currently several new shopping malls and larger supermarkets under construction in the larger cities of the island. In Famagusta, there is currently one large shopping mall under development as well as a mixed-use building with residential, shopping and recreational areas. This research is based on this recent trend and focuses on the impacts of the newly established Lemar shopping centre in Famagusta. It is located in a popular area of the city centre, which has been undergoing renewal over the last few years. The Lemar shopping centre, the first of its kind in Famagusta, is part of this renewal, along with a large number of new shops, cafes and restaurants which have been established along the high street. It offers more functions than a conventional supermarket and has a distinctive architectural style. This research is mainly concerned with the following questions: What is the contribution of the new shopping centre on its surroundings from a functional, spatial or social perspective? Is the visual quality of a shopping mall an important contribution to the urban quality?

## ASSESSMENT OF THE LEMAR SHOPPING CENTRE IN FAMAGUSTA, NORTHERN CYPRUS

This study deals with the newly designed Lemar shopping centre in the Northern Cypriot city of Famagusta (or Gazimağusa in Turkish). Famagusta is a small coastal city located on the eastern shore of Northern Cyprus, with a small harbour and a historic walled city, with medieval as well as Ottoman traces in its built environment. The city also has a newly developed area along the high street, İsmet İnönü Bulvarı (known as Salamis Road). The new Lemar shopping centre is located in the central part of the İsmet İnönü Bulvarı. Frequented by families, this area has become a new focal point of the city over the last few years, especially through the establishment of a youth centre; MAGEM (Mağusa Gençlik Merkezi) with a small city park and several sports facilities. In addition, the location is popular with students due to its proximity to the Eastern Mediterranean University (EMU). The Lemar shopping centre has three storeys, with a supermarket, its major function, on the ground floor. It also has some fast-food restaurants with access to an open area in front of the centre. Shops are located on the second floor with the third level serving as an enter-



Figure 1. New Lemar Shopping Centre, Famagusta.

tainment area with a Cineplex as well as bowling and play amenities (Fig.1).

## METHODOLOGY

The data for this study was obtained from a field survey and on-site observations conducted at various times of day and on various days of the week during the spring of 2015. The survey was conducted during March/April 2015 sample size of 104 respondents, approached at different periods of the day and week. The questionnaire was divided into six main categories: 1) socio-demographic issues; 2) frequency and aim of shopping centre usage; 3) physical aspects of the building; 4) functions and activities; 5) general impact of the shopping centre on its surrounding area; 6) general statements about user feelings towards the new Lemar shopping centre. In the first part, respondents' socio-demographic characteristics were established, such as gender, age, occupation, education, nationality and area of residence. The second part of the survey was related to the frequency and aim of shopping centre usage. The third and fourth parts contained 42 questions related to the shopping centre's physical, functional and contextual aspects, each with a rating scale from 1 to 5. Finally, the respondents were asked about their personal opinions and general statements on the new building.

The questionnaires were evaluated using Microsoft Excel, cross-tabulation, frequencies and an analysis of variance (ANOVA). The ANOVA was used to evaluate the significant correlations between user profiles and the above-mentioned categories.

## Sample Size

The study was limited to residents and employed people living/working within walking distance of the shopping centre (i.e. a distance of 800m or approximately 10 minutes' walking time). This limitation ensured that respondents were directly involved in the changes to their everyday environment and neighbourhood. Four districts were identified within an 800m radius of the centre: Baykal, Karakol, Sakarya and Dumlupınar districts. In addition, the respondents had to have lived/worked in the specified area before the construction of the shopping mall, in order to offer an evaluation of the direct impact on the neighbourhood and lifestyle. According to the 2001 census, Famagusta city (excluding the outskirts) has a popula-

tion of 40,202 inhabitants (DPO, 2011). Of this total, 2,574 live in Baykal district, 2,940 in Dumlupınar, 7,647 in Sakarya and 7,046 in Karakol (DPO, 2011) totalling 20,207 inhabitants. However, since less than half of these districts' areas are within the prescribed 10 minutes walking distance, this total was halved for the purpose of this study. Accordingly, the population is considered to be 10,100.

In order to determine the correct sample size, Daniel and Terrell's (1995) formula, below, for applications with finite populations was considered the appropriate calculation tool for this study ( Cengiz, 2012:181, Atici, E. 2012).

$$n \geq \frac{Z^2 \times N \times p \times q}{N \times D^2 + Z^2 \times p \times q}$$

n = Sample size, Z = Confidence coefficient (z = 1.96 for 95% confidence level), N = Population size, p = Proportion of the sample in the population, q = 1-p = 0.5, D = Sampling error (% 10)

$$n \geq \frac{(1.96)^2 \times 10.100 \times (0.5) \times (0.5)}{10.100 \times (0.10)^2 + (1.96)^2 \times (0.5) \times (0.5)}$$

$$n \geq 95$$

This formula yielded a sample size of 95; the actual number surveyed was 104. The interviews were conducted on İsmet İnönü Bulvarı and partially in the neighbouring districts. The respondents were randomly selected, rejecting any potential participants who did not live or work within the research area.

## FINDINGS

### SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Table 1 shows an almost equal number of female and male respondents. This is not surprising as the shopping centre is located in a leisure and entertainment area used by both genders. About 65% of the respondents were Turkish Cypriots, followed 23% Turkish citizens and 12% from other countries. The dominant group, at 52%, lived in the Sakarya district followed by the Karakol district with 37%.

More than 60% of the respondents had lived in the area for more than 5 years, with 50% having even more than 10 years. This is important because the longer people live in the area, the more they are likely to be affected by the changes in their environment and the better they may be in evaluating these changes. The largest group of respondents (75%) was

	Weekly	Monthly	Never	Total
<b>Sex</b>				
Male	18	27	5	50
Female	15	33	6	54
<b>Age</b>				
13-18	6	5	0	11
19-24	10	15	1	26
25-34	9	15	3	27
35-50	4	16	5	25
51-64	3	5	2	10
65+	1	4	0	5
<b>Occupation</b>				
Employed/Self-employ	12	29	7	48
Univ. student	11	18	2	31
School student	7	6	0	13
Retired/unemployed	3	6	2	11
Housewife	0	1	0	1
<b>Education</b>				
Lower school	4	4	0	8
High School	12	25	3	35
University	21	33	7	61

Table 1. Socio-demographic characteristics of respondents.

between the ages of 19 and 50. The majority of the respondents were employed or self-employed (46%), followed by university students and school children. Interestingly, the shopping centre is least used by house wives (1%). This could be explained by the shopping centre's proximity to business and leisure areas where most people are working or studying, rather than to residential areas.

### ENVIRONMENTAL ASPECTS OF THE SHOPPING CENTRE

Respondents were asked 42 questions regarding the physical aspects, functions or activities offered by the shopping centre. These are important factors for measuring user approval. The questions used a rating scale from 1 to 5, with 1 for 'strongly disagree' and 5 representing 'strongly agree'. The questions were designed to gather information on the following aspects in particular:

Physical aspects of the building: architectural quality, interior space quality, outdoor spaces

Functions and activities

General impact on the context/environment: pollution, traffic, general impact on the neighbourhood

Statements about user feelings

### ARCHITECTURAL QUALITY

Considering the architectural quality of the building (Table 2), the majority of respondents indicated that the shopping centre is attractive (68.3%), has a contemporary style (62.5%) and that the finishing material is appropriate (75%). Additionally, 68.3% of respondents agreed that the new shopping centre is an architectural landmark for the region. Even more, the majority considered the building to be a landmark for the whole city (60.6%)

### INTERIOR SPACE QUALITY

Table 3 shows that the majority of users (61%) are satisfied with the indoor design of the shopping centre. 81.8% agreed that the indoor spaces are clean and tidy, 76.9% found the indoor design organisation to be successful in terms of ease of shopping and 75% felt it offered ease of circulation.

### OUTDOOR SPACE QUALITY

Architectural Quality	Yes	No
Shopping center is an attractive building	68.3	31.7
The building has a dynamic, contemporary architecture	62.5	37.5
The building's finishing material ( large glass surface, steel) is appropriate to its style and form	75	25
The building is an architectural landmark for the region	68.3	31.7
The building is an architectural landmark for whole Famagusta	60.6	39.4

Table 2. Evaluation of the Architectural Quality.

Interior Space Quality	Yes	No
The interior design of the shopping center is satisfying the users	61	39
The indoor spaces are clean and tidy	81.8	18.2
The interior design eases the shopping activity	76.9	23.1
Easy circulation	75	25

Table 3. .Evaluation of the Interior Space Quality.

Outdoor Space Quality	Yes	No
The car parking in front of the shopping center is a good location	51	49
The location of the car parking in front of the center disturbs the appearance of the building	72.1	27.9
The location of the car parking in front of the center disturbs the usage of the outdoor space in front of the building	80.8	19.2
The shopping center is easily accessible for everyone	76.9	23.1
The access from the main street to the shopping center is well integrated to the existing traffic	42.4	57.6
The physical quality of the outdoor spaces of the shopping center is attractive	60.6	39.4
There is a need for street furnishing in the outdoor space	90.4	9.6
The lighting in the outdoor space is adequate	70.2	29.8
The outdoor spaces have enough greenery	12.5	87.5

Table 4. Evaluation of Outdoor Space Quality.

The design and quality of outdoor spaces are significant aspects of contemporary shopping centres. Accordingly, the respondents were asked a set of questions to evaluate whether outdoor design quality was a significant issue for the consumers in Famagusta (Table 4). Even though there is a large underground car park, 51% of respondents were pleased with, and preferred using, parking spaces directly in front of the shopping centre (Fig.1). Conversely, most of the respondents felt that this car park has a negative impact on the appearance of the building (72.1%) and compromises the usage of exterior spaces (80.8%) such as the outdoor area of the fast-food restaurants. The majority of users confirmed that the building is easily accessible for everyone (76.9%). Indeed, the entrance has no steps and is easily accessible for elderly or handicapped users.

As the shopping centre is located on the main road, respondents were asked to evaluate the access from the main street to the building. The majority of users claimed that the connection to the main street is not successful (57.6%). This corresponds with observations and statements of users on the site.

Although the majority of respondents (60.6%) found the outdoor spaces attractive, 90.4% felt a need for street furniture, 70.2% found the lighting inadequate and 87.5% claimed that there is not enough greenery. This indicates that the attractiveness of the outdoor spaces are not dependent on the location of the car park, green areas etc. Moreover, the users appreciate the simple existence of outdoor space in front of the centre.

## FUNCTIONS AND ACTIVITIES

Table 5 shows that respondents agreed that the functions of the building are proper (76%), adequate in diversity (51.9%) and satisfy the users' needs (67.3%). Similarly, the activities on offer are perceived as adequate (58.6%) and appropriate (75.9%). Moreover, a high percentage of the respondents indicated that the building serves as a landmark for the area (72.1%) and for Famagusta (59.6%) as a result of its functions. These findings overlap with similar developments in other European cities, where shopping opportunities are serve as magnets in a similar way as cultural attractions (Amendola, 2006:90). In that sense, it is not only the building's attractiveness that creates a landmark effect, but the shopping activity gives the building its landmark character.

## IMPACTS ON THE CONTEXT AND ENVIRONMENT

According to the respondents, the shopping centre has a negative impact on the environment in terms of pollution and traffic issues (Tables 6 & 7). Responses indi-

Functions and activities	Yes	No
The functions of the building are proper	76.0	24.0
The existing functional diversity is adequate	51.9	48.1
The functions of the building satisfy the users' needs	67.3	32.7
Existing activities (shopping, leisure...) are adequate	58.6	41.4
Existing activities (shopping, leisure...) are appropriate	75.9	24.1
Lemar shopping center is a landmark for the area, because of its functions	72.1	27.9
Lemar shopping center is a landmark for Famagusta, because of its functions	59.6	40.4

Table 5. Evaluation of functions and activities.

Pollution	Yes	No
The shopping center increased noise pollution	62.5	37.5
The shopping center increased air pollution	64.4	35.6
The shopping center increased waste pollution	72.1	27.9

Table 6. Evaluation of Pollution.

Traffic	Yes	No
The new complex has increased the traffic	96.1	3.9
Parking problems in the area increased	84.6	15.4
The usage of cars for shopping is reduced	51.9	48.1

Table 7. Evaluation of Traffic.

cated that there is an increase in noise level (62.5%), air pollution (64.4%) and waste pollution (72.1%) as well as increased traffic (96.1%) and parking problems (84.6%) as a result of the new building. However, it appears that the shopping centre's central location, in walking distance to residential areas, has not affected vehicle use; only 51.9% of respondents reported a reduction in car use. This indicates, that the central location of the shopping centre and its position in walking distance to residential areas and offices is not affecting the frequency of usage of cars.

## GENERAL IMPACTS ON THE NEIGHBOURHOOD

The majority of respondents perceive the new shopping centre as a positive contribution to the neighbourhood (Table 8). The area has become more urbanised (64.4%), shopping activities have increased (79.8%), use of other facilities has increased (74%) and the amount of other facilities has increased (68.3%). Additionally, respondents feel that the construction of the new centre has enlivened the area (90.4%) and that there has been an improvement in the physical quality of the vicinity (74%) as well as cleanliness (56.7%). On the other hand, a high percentage of respondents claim that rents/land values

General Impact on the Neighborhood	Yes	No
The building urbanized the context	64.4	35.6
The shopping center increased shopping activities in the neighborhood	79.8	20.2
The shopping center increased the use of other facilities in the neighborhood	74	26.0
The shopping center increased the amount of leisure facilities nearby surrounding	68.3	31.7
The shopping center increased the rents/ land values in the nearby surrounding	75	25.0
The shopping center has enlivened the area	90.4	9.6
The shopping center increased the physical quality of the nearby surrounding	74	26.0
The environment in the nearby surrounding is more tidy and clean	56.7	43.3
The area is more crowded than before	94.3	5.7
The area is less safe than before	60.6	39.4
The amount of greenery and trees in the nearby surrounding increased	15.4	84.6

Table 8. Evaluation of the general impact of the shopping center on the neighborhood.



	A	B	C	D1	D2
Employment	0.00		0.04	0.03	
Age	0.00	0.04	0.00		
Education			0.04		0.04

Significant:  $p < 0.05$

A: Usage of Shopping Center. B: Physical aspects of the building.

C: Functions and Activities, D1: Traffic, D2: Pollution

Table 9. Results of the statistical ANOVA analysis.

have increased (75%), the area has become more crowded (94.5%) and is less safe than before (60.6%). Only a small amount of respondents perceive that greenery has increased (15.4%).

## RESULTS OF THE ANOVA

The ANOVA was applied between and within categories, revealing. As an outcome, there are significant correlations between socio-demographic data (employment, age and education) and shopping centre usage, physical aspects of the building, functions and activities, traffic and pollution (Table 9).

The ANOVA shows that there are considerable correlations between employment status and usage of the shopping centre, its function and activities as well as traffic. The results show that the retired, the unemployed and housewives use the centre least frequently. On the other hand, employees and university students are among the most frequent users, especially for leisure activities. Most employees use cars to access the centre, whereas most students prefer to walk. Furthermore, employed people are most likely to find the functions proper, adequate and satisfying users' needs. The same user group found the existing activities adequate and appropriate. Employed people and university students highlighted the shopping centre as a landmark for the district, and the city, because of its function as well architectural appearance. Furthermore, they were most likely to highlight the traffic problems caused by the shopping centre.

The statistical analysis also indicates a correlation between age and shopping centre usage, its physical aspects as well as its function and activities. The least frequent users are the age group over 50. Conversely, the most frequent users of the leisure functions are between 13 and 34 years old. The same age group accesses the shopping centre most frequently by walking or cycling. Users between 24 and 50 years of age found the building attractive and appealing and the age group between 19 and 24 sees the building as a landmark for the district because of its architectural quality. Users between 19 and 50 years of age are unsatisfied with the quality of the interior space, but the same age group is satisfied with the location of the parking spaces in front of the shopping centre. This result is not surprising as the majority of Turkish Cypriots, according to personal observations, generally prefer to minimise walking distances. The age group between 19 and 24 found the functions and activities of the shopping centre appropriate and adequate, but this age group did not consider the building to be a landmark for the region nor for the city.

Additionally, there is a significant correlation between education and functions and activities as well as traffic. Those with high school education or above are more satisfied with the appropriateness of the functions, but found the diversity of existing functions and activities inadequate. The same user group emphasised the building as a regional landmark, but pointed out that the shopping centre has increased the

traffic intensity and car parking problems in the area. Personal observations show that this is related to standard working and studying hours. During weekdays and on weekend mornings there is less crowdedness, but every afternoon between 16.30 p.m. and 18.30 p.m. the area is overcrowded and there are limited parking spaces. On Saturdays after 10.00 a.m., the district is very crowded until night time while on Sundays the mornings are quiet, with crowding from 14.00 p.m. until night time.

## CONCLUSION AND RECOMMENDATIONS

This paper discusses the impacts of the Lemar shopping centre in Famagusta in Northern Cyprus, the first of its kind from a functional as well as architectural perspective. The aim was to understand its contribution to the immediate urban context and how it is perceived. It was intended to get feedback in particular from people who knew the area before the new construction. Observations and interviews with local users show that the liveliness of the neighbourhood the Ismet İnönü Bulvarı has increased since the shopping centre was built. Furthermore, the area has become a magnet and the physical appearance of the environment, as well as the quality of the public urban space, has visibly improved. Indeed, the majority of users refer to the newly designed buildings as a regional and city landmark. Additionally, the majority of respondents perceived the shopping centre as a positive contribution to the area, as an attractive building with a contemporary style and pleasant indoor spaces. It may consequently be concluded that the contemporary shopping centre, if its design is meaningful and appealing to consumers and citizens, is not just a place for consumption, but may contribute to active urban life.

Since, the shopping centre, as a building typology, is relatively new to the urban context of Northern Cyprus, this study's findings could act as a guide for future shopping centre design proposals as well as local and government authority planning decisions.

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# PEDAGOGY OF ARCHITECTURAL EDUCATION ON SUSTAINABILITY IN MALAYSIA – STUDENT PERSPECTIVE

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## Abstract

The increasing global concerns about the environmental degradation and climate changes oblige architecture students to apply sustainable design approaches in their studio projects. Therefore, renewable energy raises the expectation of providing sustainable solutions for their architectural design proposals. This paper aims to investigate the learning of students in knowledge, awareness and applicability on sustainability during their first three years of the part 1 architecture programme. Surveys were conducted on 500 students from eight architecture schools from the local universities, two architecture schools from the polytechnic colleges and three architectural schools from the overseas universities. These survey results from 335 respondents confirmed that the learning on sustainability through self (51.6%), peer (48.6%) and design studio lecturers (37.0%). These results confirmed also that most respondents did rely on pre-design assessments to develop sustainable design strategies in their final architectural design proposals. These results concluded that the perception of architecture students on learning sustainability is based mainly on other sources. These findings provide knowledge for educationists and practitioners towards the planning of architecture curriculum and the implementation of pedagogical approach in sustainability. This paper determines the most important source of learning on sustainability knowledge for students in the pedagogy at university level.

**Keywords:** Learning; Sustainability; Architectural Education; Design Studio.

## 1. Introduction

Nowadays, Sustainability is a main issue that should be highlighted at all levels of education in architecture schools around the globe. Architecture education role is a mean of comprehensive introduction of a new generation of architects to the fundamentals and practices of sustainable environmental design is becoming highly remarkable; howbeit this faces a number of pedagogical and professional impediments.

Sustainability in Architecture based on The World Commission on Environment and Development has put forth a definition of “sustainability” as meeting the needs of the present without compromising the ability of future generations to meet their own needs

(London: Oxford University Press, 1987). Architecture is one of the most conspicuous forms of economic activity (Kim & Rigdon, 1998). To educate architects to meet this goal of coexistence, Kim and Rigdon (1998) developed a conceptual framework. The three levels of the framework (Principles, Strategies, and Methods) correspond to the three objectives of architectural environmental education: creating environmental awareness, explaining the building ecosystem, and teaching how to design sustainable buildings.

Kim and Rigdon (1998) indicated that each of these principles embody a unique set of strategies. Studying these strategies leads students to more thorough understanding of architecture’s interaction with the greater environment. This allows them to further disaggregate and analyse specific methods architects can apply to reduce the environmental impact of the buildings they design.

Sustainability has emerged as guidance to produce a new architectural design paradigm in built environment (Brundtland, 1987). For many decades, architectural education has been responding slowly to the new set of profession requirements, the assumption is that the environmental facet of the design was the role of engineers. Recently, the awareness of environmental design and low energy has been shifted from being a technical concern to becoming more relevant to architectural education agenda. Implementation of sustainability through the integration of curriculum in schools of Architecture would play a vital role, as the products from these schools would be responsible for the design of future building

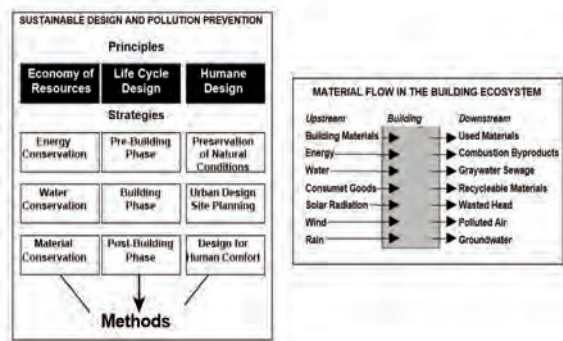


Figure 1. Conceptual framework for Sustainable Design and Pollution Prevention in Architecture (Kim and Rigdon, 1998).

(Hamdan & Bashir, 2012). Thus, Universities at the present are rapidly inaugurating sustainability within their curricula, research, and assessment (Lidgren, Rodhe, & Huisingh, 2006; Lozano, 2010).

Design studio is the core of any architecture curriculum. Also, Design studio is where knowledge is applied, and the act of designing is occurred, as well as, evaluation, and development of alternatives is learned and practiced (Gross & Do, 1997). According to James Wright, 2003, "Sustainability must be laid in the core of design studio...should fully integrate sustainability into the process of accreditation..." In order to include the core values of sustainability, i.e., sufficiency, community, locality, health, democracy, equity, justice, and diversity, more than a deep conversion in curriculum is in need; such a shift necessitates a change in the education and learning systems that includes a new participative epistemology (Sterling, 2004). In design studio knowledge is diverse, and in that environment sustainability sources vary as well. Sustainability comes from different disciplines. Knowledge and skills being introduced and integrated from diverse sources is a daring task that requires advanced attitudes in design studio setting. In response to these advancement approaches an implementation of sustainability knowledge should be confirmed.

### 1.1 Architectural Education in Malaysia

Architectural education in Malaysia began in 1925. It later became the basis to architectural degree programmes which was introduced in 1967. Architectural programme in Malaysia was tailored at the onset, to meet the challenges of modern architecture and relevant to Malaysian's national needs and aspirations, as well as meet current technological advances (Shari and Jaafar, 2006). In Malaysia, the Board of Architects Malaysia (LAM) and the Malaysian Institute of Architects (PAM) are two organizations that coordinate and have the statutory power to determine the caliber for entry into the architectural profession and the accreditation of programmes of study in various schools of architecture in Malaysia (Gafar, Kasim, & Martin, 2012). Then, the Council of architectural Education Malaysia (CAEM) was created under the supervision of LAM to set all matters relating to architectural education (LAM, 2005). Likewise, PAM is a professional body representing architects in Malaysia with several corporate active roles to coordinate, facilitate and advance the development of excellence in architectural education in Malaysian institutions; and to educate the future architects in preparing for professional practice in the construction building industry (PAM, 2002). PAM recognizes that the future of the profession lies in the hands of the current group of students and the future students of architecture (Gafar et al., 2012). PAM believes that the students would benefit from the overseas exposure, which will help the students to experience and understand how architecture is shaped in the different cultures, climatic conditions and other local factors. The Malaysian Architectural Education curriculum is fashioned after

the British system of architectural qualification process and requirement. The LAM Part I and Part II equivalent to RIBA Part I and Part II, respectively, and graduating from schools of architecture accredited by LAM, such graduates automatically exempt from LAM Part I and Part II examination. Two years of postgraduate work experienced under the supervision of a registered professional Architect is a requirement for LAM Part III professional practice examination, which finally determine full membership professional Architect (LAM, 2005). Council of Heads of Architecture School (COHAS) become active on 2006. The objectives of COHAS are: to lead the development and excellence of architecture on national level, and to coordinate the academic activities amongst the architecture school in Malaysia (COHAS, 2011). The platform is able to generate a deeper knowledge related to teaching and learning effective architecture. COHAS may represent academicians rather than the students, however, the students have Architectural Students Workshop.

Shari and Jaafar (2006) indicated that in response to respondent's opinion on how to promote 'sustainability' in Malaysian architectural education, 60 suggestions were obtained and categorized into 6 categories. Overwhelmingly, 45% of the respondents suggested that existing curriculum in their schools should be reviewed and revised in order to promote 'sustainability' in architectural education. The respondents recommended to fully integrate the subject into all course works. . Nearly half of the suggestions recommend the incorporation of sustainability at the earliest stage possible in architectural programmes.

This paper therefore introduces students' perception on sustainability from a holistic perspective focusing on the source of sustainability knowledge and the implementation of the knowledge in the design studio projects. Hence, students need to be more aware the implication of sustainability knowledge not only as an artist but as an engineer, and how they can play a proactive role in promoting sustainability in design studio. Thus, the starting point of comprehensive approach has to be source of sustainability knowledge students obtained and the implementation of that knowledge.

## 2. Methodology

In 2013, Dualisma is the 25th Architectural Students Workshop held in University of Malaya from the 21st of August 2013 to 25th of August 2013. This workshop has been held annually since 1987, initially gathering local architecture students from premier public and private universities. 2013 event, organized by the Department of Architecture, Faculty of Built Environment, at University of Malaya was attended by 651 students and lecturers from 23 public and private universities (UM, 2013)(Table1).

For the scrutinizing of perceptions and basic knowledge of students on sustainability, a questionnaire was distributed to a representative sample selected through stratified random sampling. The stra-

No	Abbreviation	Full name	Country
1	IUM	International Islamic University of Malaysia	Malaysia
2	IUKL	Kuala Lumpur Infrastructure University College	Malaysia
3	PPD	Politeknik Port Dickson	Malaysia
4	PUO	Politeknik Ungku Omar	Malaysia
5	TAYLORS	Taylor's University	Malaysia
6	UCSI	Ucsi University	Malaysia
7	UITM	Universiti Teknologi Mara	Malaysia
8	UM	University of Malaya	Malaysia
9	USM	Universiti Sains Malaysia	Malaysia
10	UTAR	Universiti Tunku Abdul Rahman	Malaysia
11	UTM	Universiti Teknologi Malaysia	Malaysia

\*23 Total of universities that joined the Dualisma event.

Table 1. List of \*Universities participated in the survey during the Dualisma event.

ta corresponded to different Universities based on the belief that sustainability knowledge would influence the attitudes and implementation of knowledge of students on environmental issues in the design studio, and relate that to the source of sustainability knowledge. The questionnaire was distributed and completed during the Dualisma workshop which was held from the 21st of August 2013 to 25th of August 2013. The study introduced in this article was conducted on the campus of University of Malaya. The total number of students who joint the Dualisma workshop is approximately 651. It should also be revealed that the predominance of students is from local universities, thus, including a large number of undergraduates.

Students participated in Architectural Students Workshop (Dualisma) were invited to complete the Student Perception Survey, which prompted students (n=651) to use a six-point scale to rank the development of their personal understanding on sustainability knowledge sources and implementation in architectural design (1 = Strongly disagree, 5 =Strongly agree). Out of 651 students participated in Dualisma, a valid respond of 335 respondents were received which equals to 51.45% of responds rate of the targeted students. There are 23 public and private universities participated in Dualisma, then, only 14 universities have participated in this survey. The structure of the questionnaire was based on the main compellers identified through the literature and was divided to four sections. In the first section, questions related to demographic data were collected concerning university, gender, and year of study were included. The second section aimed to investigate the basic knowledge of students about sustainability in the undergraduate years of study. The third section explores the students' perception on the sustainability knowledge sources they used in their design studio project. The fourth and final section of the questionnaire respondents were asked about the implementation of strategies for sustainability knowledge in their final design studio projects. The statistical analysis of the data collected was conducted with SPSS software.

## 2.1 Respondents Profile

A descriptive statistical analysis is conducted to explain

► 106

Demographics	Frequency	Percentage (%)
Gender (N=335)		
Male	172	51.3
Female	163	48.7
Year of Study in the current university (Undergraduates/Part One)		
First Year	86	25.7
Second Year	95	28.4
Third Year	117	34.9

Table 2. Demographic profile of respondents.

the results obtain from this survey. Based on the acquired data, 117 students are from third year (part one), 95 and 86 students from second and first year respectively. Of the total sample, 51.3% of the respondents were females and 48.7% males. UCSI University with 130 students (38.8%) and University of Malaya with 73 students (21.8%) comprise the major respondents of this study. As shown in Table 2, the study covers Malaysian premier public and private architecture schools, yet, there is a modest participation from other regional schools.

## 3. Results and discussion

### 3.1 Basic Knowledge

An essential factor influencing the effectiveness of sustainability initiatives in universities is the provided information level which may promote participation and cooperation from individuals and also may rise levels of awareness (Evangelinos & Jones, 2009). A next set of questions aimed to investigate the basic knowledge of students on sustainability, which is also linked with the information provision provided from students' schools on relevant sustainability issues. Regarding students' level of knowledge on the sustainability, it was observed that a high percentage of respondents (92%) did identify the basic definition and dimensions of sustainability. Students were asked to show their level of understanding on basic sustainability knowledge in architecture design; basic knowledge section embedded six questions concerning the definition of sustainability, water efficiency, green technology, passive design, material usage, and interior environment. A five point scale applied, where, 1 = strongly disagree and 5=strongly agree. A chi-square test was conducted to test the level of agreement among the respondents with regard to all six statements. As observed in table 3 the p-value of the test is less than 0.05, thus, the results suggest that there is a relationship between three variables namely; sustainability definition, passive design and materials usage, and different years of study.

Regulators of architectural education in Malaysia represented by LAM recognize the importance of sustainability. For this reason, Among the recommended aspects of architectural knowledge concerning sustainability indicated in LAM's Policy and Procedure for Accreditation of Architectural Programmes that to be encompassed in the programme of study (LAM, 2005).

Variables	Chi-square Value	p-value
Sustainability Def.	36.06	0.002*
Water efficiency	15.98	0.383
Green technology	17.22	0.306
Passive design	37.19	0.001*
Material usage	31.20	0.027*
Interior environment	22.86	0.087

\*Statically significant as p-value<0.05.

Table 3. Summary results of the basic sustainability variables in relation to different years of study. (Chi-square test).

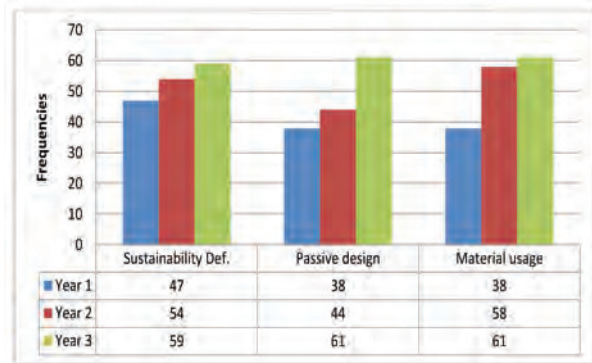


Figure 2. The level of agreement among the respondents with regard to statically significant statements in respect to their year of study.

Figure 2 showed the frequencies of the respondents who agree on the statically significant variables in respect to their year of study. The level of basic sustainability knowledge is increasing starting from first year to the third year of architectural education. In essence, this is indicating that the knowledge on sustainability is developing over years of the study.

### 3.2 Knowledge Sources and Implementation

For the succession of embedded sustainability in architectural education, it is not logical to expect the educators to be inadequately informed and knowledgeable in sustainability themselves. A study by Shari and Zaky Jaafar in 2006, report that knowledge obtained by most of educators through their personal initiatives. The level of awareness and information the educators have eventually will transfer to the students. The important of reliability of knowledge lecturers have come from their role of preaching this knowledge at architecture schools. However, students would share knowledge in design studio not only face to face but by social network that evolve rapidly nowadays. Students would also search information about sustainability by themselves as their educators did. Yet, the information obtained is an object of reliability, in case, this understanding have become a part of students' final design project. For many lecturers the implementation of knowledge into a project considers a validation of that particular knowledge. Therefore, the relation between the source of sustainability knowledge and implementation become part of this study. In this

Source of knowledge	Scale	Year 1	Year 2	Year 3	*Total
Lecturers	Agree	36	36	52	124
	Disagree	23	54	49	106
Friends Sharing	Agree	46	47	70	163
	Disagree	14	24	30	68
Self-Reliance	Agree	43	54	76	173
	Disagree	2	3	2	7

\*The total number of respondents is not applicable in this table only; as three scales have been removed for data presentation.

Table 4. The sustainability knowledge sources and respondents' dependency.

section, three questions were asked in regards to the sustainability knowledge source. An evidential number of students depend on themselves to find information about sustainability with no regard to their year of study in architecture programme. As the statistical analysis ran the data, and accounting only scales of agree and disagree; the results have confirmed the self-dependency on acquirement of sustainability knowledge (Table 4).

The implementation of sustainability knowledge drastically lies on all of these resources; students will utilize all resources to serve the purposes of final project delivery. The analyzed data showed again a relationship between the year of study and implement rather than the knowledge sources. There are 43.1 % of respondents all of them from the third year students whom are using environmental software as part of their design strategies. However, majority of the students believe that software have limited their creativeness while 35% are not sure about this. More than 88% of respondents are using modeling software to assess their sustainability of their design.

### 4. Conclusion

Despite the growing concerns of academicians and universities to integrate sustainability knowledge and values into their education, much is yet to be accomplished to ensure that our education is on the right track. This paper is an endeavor to narrow the gap between education of sustainability in design and its implementation. Development of such sustainability knowledge at universities and delivery of education for sustainability in architectural design could result in the learners' adoption of sustainability values, attitudes and behaviors and facilitate achieving a sustainable tomorrow.

The findings of the research have considerable implication for academicians, lecturers, and tutors at architecture schools. The data provided from this study have confirmed the dependency of majority of architecture students on acquiring the knowledge of sustainable design from any source available to them at design studio. Two main issues must be underlined from the results of the study. Firstly, according to students was the significant constraint was the lack of basic knowledge on certain sustainability elements. Consequently, integration at early stage of architecture study should be applied. This also could be

achieved by considering more core courses on sustainability for first and second years "Curriculum Revision". A theoretical part should be introduced with the values of sustainability, including some aspects of implementation into their projects. As was mentioned in previous part of this paper, sustainability knowledge sources assumed that it will be an obstacle, however, in Malaysia and its region countries architecture students rendered a highly adaptation on this. A positive attitude toward the sustainability sources in design studio environment suggests that architecture students are highly motivated. Therefore, a further research should be conducted to evaluate the level of reliability of these sources within the design studio environment.

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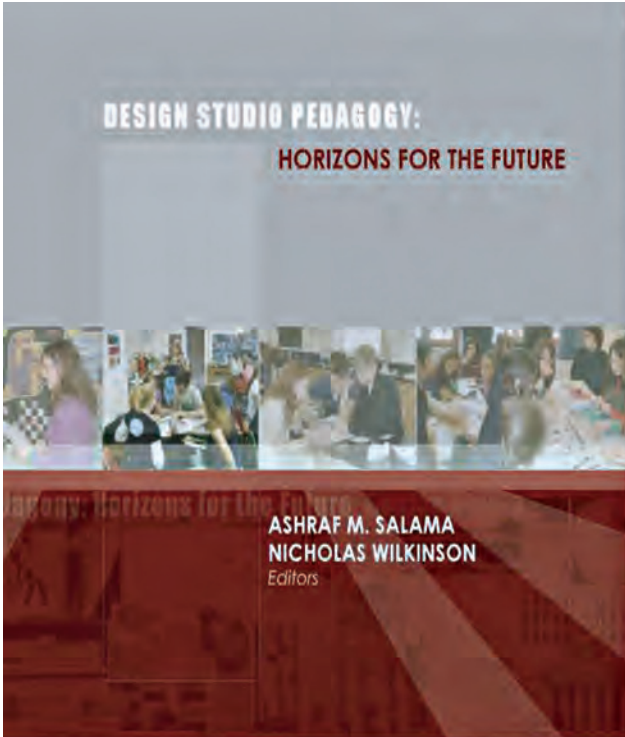
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