TOPICS Biophilia and urban planning | Biopolitics and design | Human health and design | Epistemology of architecture and urban planning | Peer to peer urbanism | Morphogenetic design | Sustainability | Renewable energy | Urban greening | Ecological networks | Architecture, urban and environmental planning | Landscape ecology and planning | Design learning strategies | Participatory design and planning | Information and communication technology | Multi-criteria analyses for urban planning | Land suitability evaluation
Journal of Biourbanism (JBU) is a peer-reviewed international online journal of architecture, planning, and built environment studies. The journal aims at establishing a bridge between theory and practice in the fields of architectural, design research, and urban planning and built environment and social studies. It reports on the latest researches and innovative approaches for creating responsive environments, with special emphasis on human aspects as a central issue of urban study and architecture.
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Editorial

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We are very pleased that we have been able to reach our purpose to publish a new series of very interesting papers that are relevant to our principles and practices of Biourbanism.

The contributions of the authors for the second issue have been conscientiously selected in order to initiate discussions on themes or issues that do not only relate to urban growth, but also to technological advancements enabling several contemporary cities to achieve almost full sustainable status (or, at least, assisting modern societies and local communities in their struggle to prevail against current rapid and volatile climate changes globally).

In his paper Towards sustainability: Self-organising communities, Juan Diego Pérez Téllez, a new researcher, introduces self-organising processes of urban communities in Spain supported by a variety of functional elements in micro scale through physical interactive elements for social collaboration. The author looks at proactive involvement of self-organised communities in the dynamic development of the socio-cultural heritage as controlled context for the evolution of modern urban systems. His approach is based on the geometrical linkage through permeable membranes of neighbourhoods, fractal interfaces of urban fabric and structures that support a hierarchical organisation of geometrically arranged urban components able to provide large scale coherence. A case study on Andalusia’s so-called casa de vecinos and patio town housing, given the distinctive morphological aspects and social development from past to present times and its relevant contribution to the contemporary urban fabric within a city, shows that still common uses of patio spaces shared by more than one neighbours may perform as fractal elements favouring complexity in human interactions and thus guaranteeing long-lasting urban coherence.

In the second paper with the title Studying Ten Principles of the Wholeness Theory Established By Christopher Alexander in Jamshidieh Park Design in Tehran, Iran, Aida Jadidi, an independent scholar, tries to understand re-uses of green areas for public use according to long-established formation of important nodal points/centres within natural environment; these important core areas may still support and complement each other to form wholeness (a self-balanced system). If some of these elements disappear during redesigning processes of green park areas, as it happened in Jamshidieh Park, a failure occurs, so that users should find themselves alienated. Thus, unbalanced core parts of a green park become unfavourable places to be, in spite the efforts to imitate nature in design.

In their paper Performance of underground dams as a solution for sustainable management of drought, Mir Masoud Kheirkhah Zarkesh, Delnaz Ata & Azadeh Jamshidi present the advantages of underground dams as valuable resources to provide not only water in rural agricultural areas, but also drinking water in costal urban areas. Their paper offers the
opportunity for us to consider that, even the simplest technology to preserve water supplies nowadays can be proved an invaluable one and especially in coastal areas that are so close to sea water or in areas with high temperatures in which water supplies may dry out very fast.

In his Sustainable Architecture: Utopia or Feasible Reality?, Dr. Zaheer Allam reflects upon issues relate on Sustainable Architecture as a contemporary discipline to be taught in order to train architects who will be brave enough to face the idea of acquiring a common view about sustainability; they should act as human beings to deliver more, when they share a common view to work for the greater good for an organization and have a common goal to serve communities of people. Dr. Allam proposes that a shared set of norms and values on sustainability may provide architects involved with a common language to understand events. Thus, they should be able to communicate easily with experts and communities at the same time to develop a desirable sustainable future for all.

In their Application of compensatory methods in industrial development site selection, Besat Emami, Farzad Taghizadeh & Elnaz Neinavaz discuss “site selection of industrial developments for establishment of coke making plant, using one of the relatively new compensatory decision-making methods; spatial analytical hierarchy process (S-AHP)”; the obtained results suggested that the application of compensatory methods used can be considered an appropriate powerful tool in decision making in practical and scientific terms. It could be considered as a very useful tool today where trends suggest that industrial development sites are often situated in wrong areas in proximity of urban areas or far away from them by spoiling green belts.

In Joseph Akinlabi Fadamiro’s paper with the title Affective correlates of landscapes for passive recreation in institutional campuses, Ogbomoso, Nigeria, the author suggests that statistical results of the data obtained and analysed have showed that landscape elements for passive recreation have physical qualities that are attractive to human beings to evoke affective responses and also the two groups of variables are positively correlated. In this study the author argues in favour of passive recreation through the outdoor landscape design of work environments and in conclusion suggests an approach to selecting elements for built landscape that will enhance suitable effects for passive recreation of human beings/users of institutional campuses.

Once again it has been a great pleasure to act as Editor in Chief of this issue and I should like to thank all the authors who have taken the time and effort to produce the published papers. However, I should also like to thank those authors who submitted papers, which did not attain the review process before the publication deadline. We are looking forward to seeing also these papers published in one of our next issues in which the papers should be considered as relevant to the specific theme proposed and discussed accordingly by our scientific committee.

I am also convinced that all issues raised by the papers included in this current issue will create a fruitful and interesting debate again. Therefore, I should encourage all readers and scholars to participate in additional discussions and contribute actively by writing their thoughts and findings in more papers in the near future. We are strongly encouraging research developments in the discipline of Biourbanism and we believe that this could only take place whenever constructive scientific and philosophical debates appear at any time worldwide.
Part A – Peer-reviewed papers
Towards Sustainability: 
Self-organising Communities

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ABSTRACT

This paper explores the self-organising processes of urban communities supported by the connection of a variety of functional elements on the smaller urban scale through physical interactive elements for social collaboration. These processes acquire a local dimension through the proactive involvement of self-organised communities in the dynamic development of the socio-cultural heritage as an organised context for the evolution of the urban system. This approach is based on the geometrical linkage through permeable membranes, fractal interfaces and urban structures which support a hierarchical organisation of nested scales of urban units providing large scale coherence. The study is delivered through the case-study of a traditional community-based housing system within its urban context, with the aim of identifying linking elements which lead to a certain level of self-organisation, likely to be extrapolated to different urban sets. Finally, these connective elements are considered in a contemporary context so as to provide a design framework towards self-organisation, considering the potential of new technologies.

Keywords: Self-organizing Communities; Socio-cultural Heritage; Social Interaction; Sustainability; Social-urban Flexibility; Socio-geometry.
INTRODUCTION

Sustainable development, seen as a long term project, aims to achieve a balance between economic, social, environmental and cultural issues, integrating all of these concepts within the context of the posed built environment. New perspectives, with potential for innovation, bring dynamism to individual and collective initiatives to enhance the urban realm and minimise the impact on the natural environment. New urban theories tackle urban sprawling into the green belts of the cities through the compact city concept and increased housing density, thus favouring the reclamation of urban identity through the regeneration of older districts and former industrial zones (Gauzin-Muller, 2002). This approach fosters the mixed use city, for social sustainability and inclusion. It thus encourages re-population of the city centres and the avoidance of mono-functional projects which lead to a higher demand for mobility (Lehmann, 2010). Moreover, sustainable urban regeneration and redevelopment combines energy and water conservation, waste management, noise abatement and the creation of a pleasant living environment. It also improves the microclimate and biodiversity through external planting and gardens. The socio-economic factor has been considered in this complex equation by stating the necessity of involving residents both in design, management decisions and construction strategies. Therefore, active co-operation from the population and other stakeholders is required in order to sustain this whole urban model. This involvement fosters a civic responsibility for their environment among the population, by the sense of ownership and social identity derived from the process of consulting them (Gauzin-Muller, 2002).

From the social point of view, transforming the city districts into more compact communities and flexible typologies for inner-city living and working, aims to increase the urban and social resilience against de-generation (Lehmann, 2010). These new urban approaches towards sustainable communities set specific targets to achieve, but seem to be inconclusive when it comes to their definition and integration: What is the level of compactness required without compromising socio-economic factors? How is population co-operation implemented in the existing urban environment? Is the link between sustainable urban realm and social resilience really defined? This paper aims to provide insights into the relationship between the urban morphology and social interaction, so as to present an integrative model for socio-economic self-organisation towards social and urban resilience. This study is conducted through the case-study of a community-based life-style delivered in the cities of Andalusia, southern Spain, within the specific built form of the ‘patio’ town-house in the historic cores of the cities. A fractal analysis of the ‘patio’ town-house and the urban morphology developed through this built unit is therefore undertaken to identify the relationship between geometrical form and social interaction. Although this community-based life-style has certain homologies throughout the rest of Spain, the case study considered in this paper focuses on the region of Andalusia, due to the morphological aspects of these buildings and its socio-cultural connotations. The social and economic evolution through history to present day is taken into account. This is done in order to pave the way for an analysis regarding socio-economic stressors which configure the social-urban fabric using a historic-correlational research strategy.
CASE STUDY

The community-based housing typology ‘casa de vecinos’ is a multifunctional space which has traditionally included artisanal workshops, vicinal and cultural associations as well as different commercial uses, apart from the main dwelling use. This housing typology has traditionally been delivered within the built form of Andalusia’s ‘patio’ town-house, which forms a structure of homes or dependencies clustered around a social ‘patio’, mostly in a tenancy scheme. The term ‘casa de vecinos’ can be literally translated as ‘neighbour’s house’. However, for practical reasons, the present paper will refer to this community-based building typology with the Spanish term in order to avoid confusion with the English term used by a not-for-profit, faith based, American community development organisation with different connotations. With regards to the context considered in this paper, ‘patio’ is a central courtyard, focal point of the building’s interactive social life, and a typical characteristic of this community-based housing typology. Although this housing typology for community-based living is somehow shared in certain urban areas of Spain, each area has different morphological features, giving them specific senses and social connotations. This study is focused on the Andalusian ‘casa de vecinos’ and ‘patio’ town-houses, given the distinctive morphological aspects and social development to present times, along with its relevant contribution to the contemporary urban fabric within the historic cores of the cities.

Historic evolution of the Andalusia’s ‘patio’ townhouse

Andalusia’s ‘patio’ town house is a distinctive building form which constitutes the core of the vernacular architecture in the generation of the historic urban fabric of cities in Andalusia. The ‘patio’, in terms of its architectural elements, finds its origins in classic Greek architecture, developed afterwards by Etruscans and subsequently adopted and spread within the Mediterranean by the Roman Empire. The disposition of the rooms clustered around this ‘patio’ without any windows in the outer skin of the building, allowed this kind of building to add to other buildings in the development of the urban fabric without compromising natural lighting. This building typology continued its evolution within the Iberian Peninsula through the Visigoth to the Al-Andalus period, being adopted by emergent Islamic culture with little structural changes, most recognisable in ornamental features, and the evolution of the ‘patio’ as a socialising element (Romeo, 2011). This building typology continued its evolution through the catholic period, adopting the different stylistic and ornamental characteristics of the time in its design. The transition between the different periods did not generally mean the total destruction of the prior cities due to a variety of socio-economic and political reasons. Therefore, today’s result is that the historic cores of most Andalusian cities resemble a continued evolution of the former accretive urban structures with the same former urban morphology (Ladero, 1987).

Urban morphology analysis

This analysis draws its fundamentals from Nikos Salingaros’ work regarding fractals surfaces applied to complexity and urban coherence. In his work ‘Complexity and Urban Coherence’, Salingaros applies structural principles developed in biology, computer science and economics to propose theoretical rules for the assembling of coherent urban environments,
developed outside urbanism, to analyse the urban fabric on successive scales. These rules are applied in the analysis of the case-study proposed in this paper so as to establish a correspondence between the different urban elements considered and its hierarchy within the organisation of the social-urban realm. The study goes from the smallest organised social scale, identifiable with the community-based housing typology ‘casa de vecinos’, to the larger scales, identifiable with districts, local urban environment and, to some extent, the regional dimension. This approach finds its foundation in the notion that any urban element is constituted by diverse sub-elements defined on a hierarchy of different scales. For this purpose, it is assumed that the urban and social elements on the small scale support the large scale coherence (Salingaros, 2000). The purpose of this analysis is to identify linking elements within the urban realm leading to a certain level of self-organisation, with an adaptive capacity and likely to be extrapolated to different urban sets.

Smaller self-organised urban scale: community-based housing buildings

The central ‘patio’ of the ‘casas de vecinos’ housing systems resembles a folding of the urban fabric, establishing an enclosed space with enough privacy for human interactions to occur on the smaller social-urban scale, thus leading to a certain social organisation. This element is a semi-public space which forms the transitional area between the private dwelling and the urban public space. Since all of the inner dwellings are clustered around the central ‘patio’, the permeability of the dwellings is focused on this element, fostering social encounters among the community. The access from the street is commonly formed by a small corridor leading to the central ‘patio’, which is usually formed by a colonnade in the ground floor and a communal corridor with windows to the central courtyard, or eventually an upper colonnade on consecutive floors (Fig. 1). This arrangement is reinforced by the coherence provided by the geometrical proportion on the human scale of the inner patio facades, along with the contrast of light and shadowed areas provided by the colonnade, giving certain aesthetical value to the whole ‘patio’ element. Therefore, the coupling of the different homes units is achieved by totally surrounding a void (‘patio’) with a structured thick boundary of the same scale (Alexander, 2000).

Despite this geometrical coherence, the patio element cannot lead by itself to the social organisation of the community, but instead acts as a catalyst element. This catalyst element leads the neighbours to co-operate in the ornamentation and maintenance of the patio and communal areas, for which a level of self-organisation is essential. This process of self-customisation constitutes the process in which the neighbours cooperate to make it a place of their own, establishing links with the building and between them, thus reinforcing the sense of place. Therefore, the geometrical structure of the clustered homes around the ‘patio’ along with its aesthetical value is interdependent on the social interaction: the neighbour’s community take pride in and time to ornament, maintain and show off this semi-public space, providing an identity to the community building in the process. This space is usually visible from the street during day time, providing certain dynamism to the urban environment and nourishing people who walk by.

Moreover, the urban realm (streets, public spaces) couples with the community-based housing building through interpenetration (Salingaros, 2000), by creating this semi-public space. The central courtyard catalyses the coupling of the homes clustered around it for greater
coherence, unifying them into a higher-level module with new emergent social properties. Hence, the coupling of the ‘patio’ with the clustered dependencies is reinforced by the permeability of its surfaces, provided by its geometrical coherence on the human scale, along with a coupling through contrast. This structural arrangement acquires completeness, thus creating an overall boundary sustained by the strength of the couplings on the smaller scale (Salingaros, 2000).

Traditionally, this central community space has also served as a place for celebrations and events within the community, providing a valuable space for social interactions to occur. In 1964, the Associations Law provided a legal framework with which vicinal communities could associate. This formerly represented the interest of the individual families, but ultimately served as a catalyst for the so called ‘Vicinal Movement’ which later largely supported the transition from the dictatorial government to the democracy with the consolidation of democratic local councils (Gonzalo, 2010). In the beginning, these vicinal associations called for improvements within decadent urban environments (Gonzalo, 2010; Mendez, 2012; Sequera, 2011). From late 1950’s, the foreign capital investments on the Spanish economy localized in the most important cities caused a significant migratory movement of the population of rural areas to the developing cities (Sequera, 2011). Furthermore, in the late sixties, the unviability of the agricultural practices aggravated this rural exodus (Antolin, 1992, cited in Gonzalo, 2010). Hence, some of the cities of Spain were significantly affected by the effects of the uncontrolled urban overdevelopment and the construction of modern housing states in the suburbs for the incoming population. Additionally, these new developments were hardly planned and the urban services and infrastructures were usually missing (Gonzalo, 2010; Mendez, 2012; Sequera, 2011).
Thus, the historians have traditionally explained the Vicinal Movement as a spontaneous reaction to the living conditions of the modern metropolitan areas -consequence of a chaotic urban overgrowth- in the context of the Associations Law of 1964 (Gonzalo, 2010; Mendez, 2012; Sequera, 2011). This research approach was supported by the fact that the cities with a more proactive Vicinal Movement were the ones that suffered an uncontrolled urban overgrowth and migratory income demanded by a developing economy (Gonzalo, 2007). Apart from the political connotations of this movement, not relevant to this analysis, the socio-cultural achievements of this social movement are very significant. Such achievements include the integration of rural communities into urban environments (Gonzalo, 2007), the self-organization processes of the population and the social construct of a collective identity (Fuentes & Contreras, 2012). However, in some regions of Spain this associative movement was slowed down due to the lack of communal spaces for gathering -largely ignored in modern housing states developments- and where the social interaction was flawed by the disconnection between different levels within the housing blocks.

Many of the first gatherings of these vicinal associations of northern Spain -such as Burgos (1976), Leon (1970), Zamora (1966)- took place in bars and dependencies of the local churches, and consequently becoming entities dependent of churches. Most of these associations only remained during the first stages of the political transition and disappeared before they could be self-managed by the neighbours (Gonzalo, 2010). The regular participation and diffusion on the lower levels of the population of these associations were also very poor (Bayona, 1978, cited in Gonzalo, 2010). In the case of the city of Leon, the interactions between different vicinal associations were also very poor. This situation has been blamed by the local press in the early 1970’s to the lack of competent leaders to deal with the local authorities and the absent participation of the neighbours to organise the Vicinal Associations (Temez, 1971, cited in Gonzalo, 2010). In the other hand, the city of Valladolid had a very strong Vicinal Movement, although the movement was not significant until late 1970’s. Likewise, the first Vicinal Associations of the city of Segovia were founded in the late 1970’s and the Vicinal Movement of the city of Avila was absent until late 1980’s. However, it can also be explained by the low demographic and urban increase of the city (Gonzalo, 2010). In other cities of Spain with a more controlled and steady urban growth the Vicinal Movement was also less active in political concerns and focused on the improvements of public ornamentation and urban services, such as Barcelona and some cities of Pais Vasco (Gonzalo, 2010; Sequera, 2011).

In the case of Andalusia, the same socio-economic and political context mentioned above applies. In the cities of Sevilla, Granada and Jaen, new districts were built during the 1950’s and 1960’s in the suburbs to dwell factory workers and the incoming rural population. These districts did not have the same ratio of urban services and equipment in comparison with the city centres and certainly not enough for the population standards. Consequently, Granada and Jaen vicinal associations called for better urban services and the improvement of the public transport (Fuentes & Contreras, 2012). In 1962, the dwellers of the ‘El Carmen’ neighbourhood of Sevilla asked for help to the public entity that promoted the construction of this modern housing state for better urban services. It must be noted that this housing state did not present any decadency and it was regularly maintained by the neighbours (Méndez, 2012). However, the first vicinal association of Sevilla was founded in 1970, although it started a decade before as a ‘families association’ (Cabezas de Familia) under the Associations Law of 1967 (Méndez, 2012). The urban improvements, green areas and public services demands
began to include oppositions to future urban developments that the population considered inappropriate to their collective identity. Hernandez (1999) stated that the physical disconnection and the social classes dwelling in these modern housing developments of Sevilla lead to social interactions at the district level, linked by a shared problem and leading to a collective district identity.

However, Cobo & Ortega (2008) proposed a different research approach to the Vicinal Movement more adequate to the Andalusian case. Their research paradigm considers these social movements as processes of social interaction founded in the everyday life among the people. This approach differs with the previous research paradigm in that it does not explain the Vicinal Movement as a causal product of the legal framework of its social context, but as social construct of the collective identity and values of the population. Therefore, this social movement cannot be solely explained by the poor conditions of the urban environment, economic recession or the political opportunities. Although these elements influenced the social movement, the constructivist research approach can provide a framework to perform an in depth analysis of the Vicinal Movement. Thus, the way in which the people got involved in the movement, got identified with it and how they behaved consequently in its social, political and economic context (Fuentes & Contreras, 2012).

Therefore, to truly understand how a person gets involved in the vicinal movement, in which the social interactions occur within the everyday life is fundamental to understand how people interact at the lower scales and become part of a larger social structure (Fuentes & Contreras, 2012). This larger social structure then acquires new emergent properties that demands higher organisation at the larger scales, and that is coherent with the structure at the smaller scales. Therefore, this social movement is considered as the result rather than the beginning of the analysis. It is in these networks where the new emergent properties of the groups experiment and create new cultural values that challenge the dominant values of the society. Thus, the vicinal groups founded through the everyday life and domestic networks related to a housing building or district lasted longer and were reinforced through affective and emotional links (Carrillo, 2008, cited in Fuentes & Contreras, 2012).

Hence, the Vicinal Movement acted as a catalyst for the formation of the collective identities of the districts, as a diagnosis element of the urban problems and to propose possible solutions for their problems (Fuentes & Contreras, 2012). Therefore, the vicinal associations acted within a macro-scale of the social movement and were supported by the social interactions and organization processes at the micro-scale (everyday life). Consequently, in the buildings and urban environments where the social interactions at the lower scales were restricted by physical disconnection and by the lack of socializing spaces, the social movement was negatively affected. Therefore, a close-knit social fabric supported by a geometric coherence of the buildings and urban spaces support the self-organisation processes at the larger scales. In any case, the intangible entity of the vicinal associations support this processes by acting as a common ground not linked to a physical space for social interaction.

Although in the beginning these vicinal associations called for improvements within decadent urban environments, lately the creation of vicinal associations in new dis-connected housing state developments has been delivered as an organisation framework for the building’s management. These associations are constituted democratically with a governmental structure, president, treasurer, secretary, etc. by its components, which have a certain level of
self-similarity with local, regional or national governments. In many cases these associations do not contribute to the self-organisation of the community, as recent times have seen the functions of the building management frequently delegated to real-estate management companies, in a process of alienation and dis-linkage with the community building. Therefore, the provision of a well-connected communal space within collective multifunctional housing models linking the different units into a whole, is fundamental for the self-organisation of the communities.

This self-organisation of communities has been recognised by Andalusia’s regional government as a platform for co-operation between the authorities and the population regarding the task of detecting the necessities of urban society, protecting the environment and fostering social inclusion (CAVA, 2008). The Urban Regeneration Offices within the historic cores of certain cities have been delivering a collaborative work with the communities to support the refurbishment of materially degenerated buildings and urban elements, under the initiative of the communities prioritising community-based housing systems as a cultural and ethnographical urban heritage which gives identity to the social fabric.

Subsequent organised social-urban scales: district, local urban environment and regional dimension

These ‘patio’ buildings add themselves to the formation of the urban blocks, incorporating other functional building typologies or individual town houses. This agglomeration of a diversity of building typologies and sizes constitutes a reciprocal coupling through boundaries of the different units to a higher level of coherence and completeness (Salingaros, 2000) (Fig. 2). On the one hand, the individual housing and other functional buildings reinforce the clustering of the units in the generation of an overall boundary; in contrast, the socially organised community-based buildings mitigate the random organisation of the individual units, thus placing them into an organised context. The social interaction of the individual housing and other functional buildings typologies is therefore focussed on the subsequent social-urban nodes or focal elements self-similar to the ‘patio’ element: squares, markets, churches, schools and other communal spaces and buildings. These urban elements establish a link with the smaller elements through their functionality, which is reinforced through visual and structural coherence (Salingaros, 2000).

Moreover, this variety of housing typologies, rather than counteracting the self-organisation, provides choices for different living and contributes to the geometrical coherence of the block in the consequent hierarchical scale. In this hierarchical scale, the permeability of the buildings is delivered through the street facades, allowing physical movement through gaps proportionate to the human scale (Salingaros, 2000). It is not common to find street colonnades providing coupling through contrast in the historic cores of the cities of Andalusia. However, the reduced dimension of the pedestrian-oriented street network provides a sense of certain enclosure and pleasant shadowing. Therefore, this new module acquires new emergent social properties reuniting non socially-organised units into an organised context in the creation of districts (Fig. 3).

The design of the street facades plays a relevant role in the legibility of the urban environment through its surfaces, whilst the design and geometrical proportion play a significant role in
identification and interaction among users: example given. The stone-carved main door frame provides identity through its unique design which clearly signifies that it constitutes the main gate through which the community or individuals interacts with the public space. Therefore, the urban block’s facades constitute a permeable urban interface with folding to create semi-public enclosed spaces, thus leading to a higher level of organisation on the smaller scale (Fig. 3). To foster the permeability of this urban interface, and allow physical movement, the gaps are efficient when they are proportionate to the human scale, 1 to 3 metres (Salingaros, 2000). Therefore, the fractility and geometrical coherence of the surfaces reinforce the coupling of the building block with the public urban environment, along with the coupling by interpenetration provided by the ‘patios’, as mentioned above (Salingaros, 2000).

According to Salingaros (2000) the focal elements or nodes at this scale could not be understood without the smallest scales to give coherence to the whole. Some nodes establish links with the smaller scales through functionality as the main purpose for interaction (markets, schools, churches, workplace, etc.) as well as other nodes, mainly through visual and structural coherence (parks, squares, etc.). However, a combination of all these factors is more likely to occur in any case. The strongest connections are the small scale, local ones, although in contrast, connections between smaller and larger elements are weaker. Functional nodes establish strong links with the smaller scales and provide a certain level of organisation. With this said however, visual nodes establish weak coupling with the smaller scales. Hence, functional nodes reinforce this interaction via an intermediate catalyst, the primary function of the node. With regards to the visual nodes and small scale nodes, the potential social interactions are reinforced through a variety of connective elements. Salingaros supports this variety of connective urban elements theory based on recent findings in evolutionary molecular biology, revealing that the probability of a reaction increases with the number of
different molecules which are in contact with each other and certain catalytic molecules. Therefore, a molecular mixture becomes auto-catalytic rather than simpler systems.

Urban life is thus generated spontaneously when a critical mixture and density of urban elements have been achieved, and disappears when essential urban elements are removed, isolated or concentrated (Salingaros, 2000). Therefore, the segregation of urban functions counteracts with this variety in the urban mixture and halts the connective process (Jacobs, 1961; cited in Salingaros, 2000). Although these interactions constitute the dynamics of urban everyday life, they rely largely on the randomness of the system. A larger number of these random interactions may induce a virtual state of organisation within an urban context with a large number of random connective elements. Therefore, a self-organisational process on a scale similar to that of the smaller scale must be identified to support a hierarchy of nested scales towards self-stability.

Salingaros (2000) states in his rule five for Geometrical Coherence of Organisation that: “long-range forces create the large scale from well-defined structure at the smaller scales. Alignment does not establish, but can destroy, short-range couplings”. Therefore, elements at the smallest scale provide the foundations for the entire structure (Salingaros, 2000). Likewise, the social-urban coherence is founded at the smaller scales. Therefore, a certain balance of self-organised communities at the smaller scale contributes to a higher level of organisation at the larger scales. This process is delivered through the cooperation of self-organised communities or districts in the development of projects at the larger local dimension. This cooperation finds its meaning in the recursive process of continuation and contribution to the local socio-cultural heritage and takes its form in a diversity of events through the year. Moreover, these organised communities contribute to the organisation and management of different socio-cultural events within the local cultural agenda with a single functional unit in the creation of the whole event, coupled with its functionality, which takes place within the public space at a determined time. Thus, the involvement of local authorities is an indispensable element for this process to occur, providing infrastructure and supporting the continuum of the local socio-cultural agenda. Each functional unit provided by each community, social collective or individual initiative, resembles the cultural identity of its creators taken to the local scale, acquiring new socio-cultural emergent properties within the whole event. Thus, this socio-cultural agenda gathers random interactions into an organised context which provides opportunities for economic development, culture and local product promotion, together with social interaction at a larger scale. Ultimately, the socio-cultural heritage provides time-marks and meaning to its local community, contributing to the formation of its collective memory in the knitting of the social fabric, which provides identity to the local community as a whole in a determined urban context through time.

Traditionally, these local socio-cultural agendas have served as a functional and economic link not only at the local scale but at the regional scale. Lately, due to the development of media and global mobility, these events are gathering people at a national and international scale attracted by the urban and cultural identity of the Andalusian cities. This fact may have different negative effects on the social-urban fabric: on one hand, the attracted floating population has fostered the creation of temporary dwelling within the historic cores of the cities, creating a dis-linkage between the local communities and its urban environment; on the other hand, this floating population may create a local economic overreliance on the tourism and leisure industry, which has been proven to be unstable.
The self-organisation at the smaller scale therefore supports the self-organisation at the larger scale with the evolution of the socio-cultural heritage of the population, also reinforced by a mixture of random social-urban interactions. These self-organisation processes make a footprint in the collective memory of the locality contributing to the creation of a tight-knitted social-urban fabric. Thus, the socio-cultural heritage must not be seen as a static entity rooted in the traditions of the past, but as a dynamic entity always evolving towards a higher level of organisation. A resilient social-urban fabric can therefore provide an organised context in which new additions are likely to be metabolised by the physical urban environment and the social community. A good example here is the collective memory of self-organisation which provides a model or framework for self-organisation to new housing developments implemented within the urban environment. Hence, it must be considered that the uncontrolled addition of un-connected urban elements may damage the social-urban fabric, thus also affecting its ability to metabolise new changes towards the evolution of the system.

**Socio-economic Context and Urban Evolution of the ‘Patio’ Townhouse**

Since the fifteenth century, business development and incipient trading relations with the Spanish American Indies has attracted a large number of incoming populations to the main cities of Andalusia. On the one hand, this economic climate has attracted populations from the rural areas, whilst on the other, it has attracted a significant number of national nobility families and international traders from Europe (Flores, 2005), willing to establish mercantile relations with the Indies. As an extreme example of this situation, there are those cities on the Atlantic coast of Andalusia which have the privilege of trading with America. This economic and demographic climate led to a quick overgrowth of the urban environments of these cities (Gomez, 1995). Indeed, a large number of ‘patio’ town-houses were built by noble families and the ‘casa de vecinos’, within the same ‘patio’ house structure, in order to provide dwelling to the less favoured and floating incoming population (Laredo, 1987). The ‘patio’ nobility town-house was designed and built with a double function: as an individual family dwelling and as a headquarters and storehouse for the Indies’ trading operations. Therefore, the historic cores of these cities include a large number of former ‘patio’ town-houses and palaces developed by the wealthy Indies traders (Gomez, 1995).

On the other hand, the former ‘casa de vecinos’ was developed as community-based housing typology, with a communal interactive space formed by the ‘patio’ with washing facilities, shared kitchen and toilets. The private dependencies for each family unit were usually one or two rooms for the other normal family uses, clustered around the central ‘patio’. This clustered multi-home arrangement constituted by itself a distinctive life-style, delivered traditionally by the less-favoured and poor social sectors. Therefore, this kind of community building has negative connotations derived from the fact that was mostly tenancy scheme housing and usually hosted less-favoured social classes. This life-style created a very strong bond between the families living within the same building. The regular use of communal facilities and common shared socio-economic problems fostered a sympathetic feeling among the community which led to self-supportive attitudes (Muriano, 2011). This shared system evolved through time to its present individual flats form, where the kitchen and toilets are no longer shared and the main communal interactive space is the ‘patio’ and commonly the roof terraces.
From the XVII and XVIII centuries these cities suffered different socio-political and economic changes. Firstly, the decadency experimented with by the nobility houses within the Andalusian region after several agricultural crises and the confiscation of agricultural land, deeply affected the economic resources of the cities. Secondly, the America’s trading operations began to decrease, leading the America’s mercantile families to gradually lose their properties and the palaces where they lived in the urban area (Gomez, 1995). In this context, some of these buildings were transformed into housing complexes in the form of ‘casa de vecinos’ for the continuously incoming population and some dependencies adapted for small commercial uses and artisanal workshops. The owners rented the rooms to these people as well as other dependencies they adapted to familiar dwellings, thus achieving a certain level of uniformity of social classes living within this community-based housing system. This also allowed small businesses to establish themselves within these urban communities (Fig. 5). This process of adaptation of housing buildings to multifunctional ‘casa de vecinos’ has been delivered progressively throughout history to the present day. This process of adaptation regarding the functional uses of these buildings without altering the building’s main structure and contributing to an adjustment of urban fabric therefore shows a significant level of flexibility to adapt to socio-economic changes.

Hence, from a positive economic imbalance, the cities experimented with an overgrowth based on an external un-sustainable large scale economic resource. Once this external economic imbalance was removed or balanced, a system likely to collapse self-adjusted to a smaller socio-economic scale based on local resources. This self-adjustment is largely supported by the flexibility and geometrical coherence of the urban environment and its social resilience. Therefore, the urban environments considered in this study allowed for a self-adjustment of the social-urban fabric, due to socio-economic changes. This self-adjustment fostered the distribution of population into well-connected community-based housing systems, which calls for greater organisation at the larger scale; and a self-adjustment of the local economic model to small and medium scale businesses based on local production. Ultimately, this self-adjustment provided a mixture of functional nodes on the smaller scale supported by the urban structure towards a greater coherence and self-organisation of the whole urban system, delivered progressively until the twentieth century.
Over the last decades, the current economic model has led to major urban changes within the cores of the Andalusian cities and has fostered the urban sprawling. Moreover, the current economic system is absorbing or eliminating the small and medium scale local businesses, segregating almost all of the commercial uses into large scale commercial complex systems. Therefore, the local decentralised economic system has moved to a variety of centralised multinational companies. Hence, the damage provoked to the social-urban fabric through uncontrolled socially disconnected developments and the centralisation of the economic system is deeply affecting the dynamics of the cities. The extent of this damage is still to be completely defined and the test for new urban developments is to metabolise these changes and self-adjust to new conditions.

The purpose of this study is not to propose that urban environments must follow the same traditional urban and economic structure analysed in this paper, but to identify interactive elements leading to the self-organisation of the social-urban realm. This study recognises the synergistic action of both concepts, urban and social, as one interdependent entity acquiring new properties. Therefore, the dynamics of the cities must not be understood as independent morphological and societal aspects. Hence, flexibility is defined as the ability of an urban system to metabolise the different socio-economic and demographic changes towards the evolution of the system. This concept of social-urban flexibility is based on its capacity to allow for the inclusion of incoming and floating population within its social-urban fabric and its capacity to reciprocally self-adjust the economic system between larger and smaller scales. Thus, a resilient and coherent social-urban fabric is likely to metabolise demographic changes within a set of self-organised communities. This, coupled with the fractal geometrical structure of the city, is likely to allow for economic adjustment between smaller and larger scale systems, based on local resources, into the social-urban fabric. Thus, both approaches are interdependent, since they support each other.

Furthermore, the inclusion of this incoming and floating population within the social fabric of the urban environment requires its participation on the social dynamics of the city. This is, to
participate in the social interactions at the building’s community scale and to participate at the district and local scales in the socio-cultural agenda. As mentioned above the everyday life social interactions that occurs at the community levels are fostered by the geometrical coherence of the community building and its connection to a socialising communal space. Additionally, to assure the evolution of the system, these incoming populations should be integrated within existing self-organised communities. The resilience of the social-urban system at the smallest scale to metabolise this demographic change is then provided by the collective identity of the community. Likewise, the resilience of the system at the district and local scales is provided by the existing socio-cultural agenda, based on the local traditions and the collective identities of the communities. This is also supported by the geometrical coherence of the socialising public spaces, self-similar to the smaller communal spaces of the buildings.

As mentioned above, the social-urban flexibility concept also includes the self-adjustment of the economic system between larger and smaller scales. Therefore, the evolution towards sustainability requires adjustments in the current economic model and in the way people live, as well as how they improve the well-being of the society and the quality of the social fabric, while reducing the ecological footprint. With this approach, the relationship between environmental and social dimensions of sustainability calls for social innovation so as to evolve to new sustainable living models. In this context, Manzini proposes the concept of ‘cosmopolitan localisations’, as the result of the balance between being rooted in a community and being opened up to global flows of ideas, people, information, etc. The innovative character of these new models relies on the concept of collaborative networks catalysing interested people towards the development of an open common future project, towards an optimisation of local resources and exchanging within the network which cannot be locally provided. This concept does not refer to a little self-contained entity but to a highly interconnected system (Manzini, 2011). The challenge is to design socio-technical systems whilst avoiding macro-systems and mono-logical solutions. The systems must be able to auto-organise themselves, thus fostering socio-economic innovation based on a different combination of already existing local capacities (Manzini, 2011).

CONCLUSIONS

The provision of interactive communal elements which linking a varied group of functional units on the small scale fosters the co-operation of its users towards self-organisation. These elements give the community access to a physical space for sharing, social interaction and support. This approach fosters self-supportive attitudes among the community through proactive involvement within its environment, thus fostering the sense of place. Therefore, the capability of these interactive elements as connective elements linking the functional units at all levels is fundamental. As mentioned above, this connective property may be enhanced through geometrical coherence and configuring the urban character of the element as a transitional area for better coupling with the public urban space. The challenge is to design connective elements incorporating cutting-edge socio-technical systems towards social innovation at a higher level and new dimensions, all the while fostering the collaboration inter-communities for creativity and sustainable potential. Therefore, the aim is to create a highly interconnected, resilient community with a strong sense of place and cultural identity.
A level of self-organisation on the small scale supports the self-organisation at the larger urban scale, and in turn fosters the participation of the community at the local dimension. This is achieved by promoting the proactive involvement of self-organised communities in the dynamic development of the socio-cultural agenda, as an organised context for the evolution of the socio-economic urban system. As mentioned above, the socio-economic and cultural agenda provide linking elements for social interactions to occur in an organised context. Therefore, the challenge is to design a responsive environment for a responsive community. Hence, the design of urban public spaces must be flexible to deliver an evolving socio-cultural agenda and provide physical and technological means by which to foster the collaboration of the community within an extended network for socio-economic innovation, whilst also promoting local products and resources. The aim is to create a decentralised local economic system within a resilient social-urban fabric, thus giving a meaning to the local cultural identity towards the evolution of the urban system.

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Studying Ten Principles of the Wholeness Theory established by Christopher Alexander in Jamshidieh Park Design in Tehran, Iran

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ABSTRACT

Growth of population in cities in the past 40 years has resulted in growth of residential areas, however, little room have been allocated to open spaces and nature (Giulio, Holderegger & Tobias, 2009). In the last decade of the 20th century, the public attention towards parks, green spaces and their design as means of preserving nature and bringing liveability to urban environments have increased (Özgüner & Kendle, 2006; Salazar & Menéndez, 2007). Jamshidieh Park, an urban park with strong natural features located in Tehran-Iran, has lost the aforementioned goal (Pasban Hazrat, 2009). This research will introduce ten principles presented by Christopher Alexander (2002a) in the “wholeness theory”. It will try to reach a new method for studying the reasons for the failure of the expected goals of the Jamshidieh Park. By doing a case study, this researcher has used variety of qualitative methods. The results indicate that only some of the principles were found in the design process of Jamshidieh Park. The findings show how these principles can be incorporated in the design process of urban parks. Further, the methodology used in this research can be applied in future studies of urban park design to gauge usefulness.

Keywords: Design, Living Structures, Liveability, Urban Park, Wholeness Theory, Christopher Alexander
INTRODUCTION

Rapid population growth, expansion of cities and the increasing of the residential areas has caused a lack of open spaces. This result has separated cities from nature. Open spaces play an important role in cities. They have always considered as important components of urban design. They provide an opportunity to bring nature into urban life. Therefore, there is an increased demand to allocate more land for public green spaces such as urban parks (Salazar & Menéndez, 2007). Such places make cities liveable and attractive to live in through providing different opportunities such as psychological, social, economic, aesthetic, recreational and environmental benefits (Chiesura, 2004; Chen, Adimo & Bao, 2009; Jim & Chen, 2010; Whyte, 1980). Green spaces affect human health and well-being (Chiesura, 2004; Pacione, 2003). Additionally they can positively affect an individual’s mood. They are able to reduce the pressure and stress of urban life and places; green spaces stand as an escape route for people from the daily routines of city life (Grahn & Stigsdotter, 2010). In addition, green spaces can calm the mind by removing mental fatigue (Jim & Chen, 2010). According to Francis (2006) urban parks are places which offer essential, life-enhancing qualities; they are also able to build a sense of community and improve quality of life. They provide places for people to interact and connect with each other (Whyte, 1980). The physical structure of every environment, including parks, impacts its functions and qualities, and affects people, their behaviour and their lives (Alexander, n.d.b; Goličnik & Thompson, 2010; Mehaffy, n.d.b; Smith, Nelischer & Perkins, 1997; Whyte, 1980). On the other hand, the way a community uses a park directly affects the structure and design of the park. So what makes a park or any urban space most valuable is its design. In Iran, little room is allocated to open spaces and parks (Pasban Hazrat, 2009). Moreover Pasban Hazrat (2009) holds that these spaces are not well-designed to provide human needs. Jamshidieh Park, located between the city and nature areas, has the ability to benefit the city and its residents. The primary purpose of the park was to create an urban space that preserved natural features so as to give people an opportunity to be away from the chaos and crowd of urban life in Tehran. But over time it has lost most of its functions and most of its spaces are not welcomed by people. Consequently, the park now receives fewer visits by users. In addition, despite detailed studies during the design process, the park fails to work as it was supposed to (Pasban Hazrat, 2009).

In order to study the reasons for the failing of Jamshidieh Park, the current research focuses on principles presented in the ‘Theory of Wholeness’, presented by Christopher Alexander (2002a). His theory provides a new worldview toward design process which is able to adapt to human needs. Alexander (2002a) believes he has identified the only way which is able to bring humane quality and a sense of life and liveability to every space without being hostile to human activities. The adaptation of this theory with its idea of urban parks as urban spaces which are objects in cities would be appropriate.

The primary purpose of this research is to study whether the principles laid out by Alexander’s theory are present in Jamshidieh Park. By studying the theory as applied to the park (if any), this study will present a way in which the park can be a liveable place in attracting people and meeting human needs. This research would not apply this particular theory to redesign the park. Rather, it will study and identify if the principles of the theory and its ideas have been applied in the urban park design process by the park’s designer.
With the above aims in mind, it should be mentioned that the main goal of this research is to answer the following question: “Are the principles proposed by the wholeness theory present in the urban park design (in the case of Jamshidieh Park)?” In order to meet the goal of this study, three objectives will be undertaken:

**Objective 1**: To identify the wholeness theory presented by Christopher Alexander.

**Objective 2**: To examine if principles suggested by the wholeness theory are found in the park design.

**Objective 3**: To recommend the incorporation of wholeness theory principles in the design of urban parks.

**WHOLENESS THEORY**

Modern humans’ perception of the world is greatly impacted by science – most importantly by physics. While some scientists believe that the science of the 20th century was based on physics, the science of the 21st century is based on biology (Alexander, 2002a; Bortoft, 1996; Salingaros, n.d.). In the modern scientific world-picture, the parts of the world are to be viewed through mathematical models or mechanisms. These scientific conceptions try to get a true understanding of the world and discover interrelationships among the phenomena. In other words, they try to define what happens in the universe. In current scientific conceptions everything is seen as separated objects in the universe. The world is made up of separate objects which are independent of the observer. In this worldview everything is explained as a mechanism. It interprets our responses to the environment as a mechanism. Some scientists believe that in this worldview people are nothing but meaningless machines (Alexander, 2002a; Bortoft, 1996). This worldview has ignored a part of humanity; the part which deals with feelings; the part that is involved in humans experiencing the world around them. On this view, the world is considered to be a machine, which is separate from a human’s spirit (Alexander, 2002a).

The scientific-mechanistic worldview has indirectly impressed people’s cosmology and activities. It controls their thoughts and affects their behaviour. On this view, people tend to interpret and analyze everything in the world through mathematics and models. From this analytical perspective everything is explained as a cause or an effect. In this view, the universe cannot be understood by human qualitative experiences. The mechanistic view tells very little about the deep order which exist in the world. In recent centuries people have been habituated into thinking in this kind of mechanical manner (Alexander, 2002a; Bortoft, 1996). As a result, during the second half of the 20th century, many scientists began a serious attempt to repair the world-picture. This attitude came from a confluence of quantum physics, system theory, chaos theory and the complexity theory, fractal, nonlinearity, biology, genetics, and other sources (Alexander, n.d.b; Bortoft, 1996, Hanson, n.d.; Salingaros, n.d.).

Christopher Alexander (2002a) believes that the 21st century is an era where all signs of life, humane quality and liveability have been gone from our cities and urban spaces. Most of these spaces are not able to respond to human needs (Alexander, 2002a; Salingaros, n.d.). Alexander in his seminal book, “The Nature of Order (2002)”, makes an attempt to find a new
way to improve the current situation of our environment. He claims that his theory is able to reintroduce human quality and liveability to urban spaces. Alexander (2002a) states that his work is more about changing the worldview on the principles of a new architecture and a new society. Brian Hanson (n.d.) holds that Alexander is one of the rare scientist-architects. Alexander’s work does not only refer to architecture and design; it is more about a new science (Alexander, n.d.a; Mehaffy, n.d.a; Salingaros, n.d.). In order to reach his aim, Alexander (2002a) has tried to capture the nature of liveable things and the order behind their structure. Discovering this aids him in identifying basic laws of the world. The sense of wholeness which exists in natural forms is inspired by the existing order in them. As a result, Alexander (2002a) claims that understanding these laws could help us create living forms. He mentions that all the order in the current world-picture is explained by science and it is a mechanical order (2002a). But the order which he is trying to explain cannot be understood and explained mechanically. In the mechanistic picture, people separate all parts from each other and from themselves (Alexander, 2002a; Bortoft, 1996). Understanding the conception of order helps to incorporate the structures which Alexander calls ‘living structures’. Living structures are defined as every structure, natural or man-made, with humane qualities which make people feel happy, comfortable and belonging (Alexander, 2002a). Further, Alexander holds that what makes a living structure is its wholeness, and one of the main problems of built environments in current urban spaces is they lack integration between different parts and so have no sense of wholeness to them (Alexander, 2002a; Alexander, n.d.b). He concludes that this lack of wholeness leads to a lack of living structures and the lack of liveability in our urban environments. His theory, then, starts with a conception of wholeness. In the last two decades, this conception has begun to develop in almost every branch of modern science to get a proper understanding of the physical world (Alexander, n.d.b). Alexander states that, this concept is an essential part of architecture and design. Every time we try to build or design, we participate in the greater wholeness of the world (Alexander, n.d.b). Alexander (2002a) tries to show a more holistic picture of the world – a picture which sees things in their wholeness and their interrelations. He believes that wholeness is something real in the world; that wholeness is a mathematical structure existing in space. The wholeness is made of parts, and the parts are created by wholeness. In this way he defines wholeness as a structure which is made of various, coherent entities and their relations (Alexander, 2002a). David Seamon holds that wholeness, whether natural or human-made, is the source of coherence in any part of the world (Seamon, 2006). In order to get the idea of wholeness, he calls these entities ‘centre’, which is as the basis of all living structures (Alexander, 2002a). Alexander (2002a) mentions that by using the term ‘centre’, he refers to a physical set. He believes that a centre is not a point, but rather a field of organized force. In addition, he holds that this idea of ‘centre’ is fundamental to the idea of wholeness (Alexander, 2002a). The wholeness of any part of the world is the connected system of larger and smaller centres (Seamon, 2006). Centres are defined in terms of other centres. That is, every centre is made of other centres in different scales. As the centres help each other more, the wholeness becomes stronger.

Throughout his work Alexander (2002a) proposes a process which is called, a “living process” in order to create living structures. He believes that this process is the only way to create living structures and life, and that it leads to a harmonious whole. He states that it is not the process which he has invented; it is exact the same process which nature acts to create livable structures (Alexander, 2002b). Alexander presents a humanistic, scientific and artistic methodology that every building and city is created by a living process. Here, his emphasize is mostly on process. That is, the way that nature works. In this way the living processes
appear as processes of step-by-step adaptation where each step must preserve the structure of what has been made before. It is an adaptive process which allows the whole to guide the formation of the parts created. On his view, this is the exact process which nature acts to create living structures (Alexander, 2002b). At every moment there is a need to be aware of the whole and to control it. Through this understanding, Alexander defines ten structure-enhancing actions. He holds that, by applying them, the liveable quality would be attained. These actions are:

a) Step-by-step adaptation;

b) Each step helping to enhance the whole;

c) Always making centres;

d) Allowing steps to unfold in the most appropriate order;

e) Creating uniqueness everywhere;

f) Working to understand the needs of clients and users;

g) Evoking and being guided by a deep feeling of wholeness;

h) Finding coherent geometric order;

i) Establishing a form of language that rises from and shapes that things are made of;

j) Always striving for simplicity by which thing becomes more coherent and pure (Seamon, 2008).

METHOD

This research is a qualitative study with one case study: a park in Tehran, Iran. In order to answer the research question, the information about the process of park design and its structure, is collected. In this way, three methods are employed to get data: review of documents; interview with designer; and site observation. The information obtained through documents reviewed is comprehensive. Two different sources of documents are used. The first source is, “The Nature of Order” by Christopher Alexander. In this text, he shows how the principles of his theory have been applied in real cases. His method helps identify the way to study the site, factors and variables which need to be studied in the process of data collecting and analysing in order to study his theory. The second source used in this study is, “Design in Nature” by Gholamreza Pasban Hazrat, the designer of Jamshidieh Park (the case study), which has been awarded —The Aga Khan Award for Architecture. The book is one of the most impressive projects of park design with regards to the value of nature in Iran, Tehran. This document includes every detail about the park, including maps, pictures, design processes, structure and the design principles used. Most of the information required to analyse the park has been obtained by studying Hazrat’s book.
The interview with the designer of the Jamshidieh Park was done in a face-to-face session; it involves in-depth open ended questions. That interview was developed in a very flexible way, and was conducted by the researcher in a way to get the required information about the design process of the Park. Note taking was a strategy which the researcher used during interview to preserve information. The questions mostly related to the design principles and the process of design that was applied by the designer. In order to prevent any bias during the interview, the principles of theory were not asked directly. The intent of the researcher was to indirectly gather the designer’s idea about theory, its conception and principles through the explanation of the process of design. In order to achieve the latter, questions were asked based on those which have been established by Mark Francis (1999) in his case study methodology for landscape architecture. The other method that the researcher was engaged with was observation which provided important information that would triangulate the interview results.

In order to gather the required data, site observations were carried four different times: two times in the middle of week days, and two times during weekends. On each occasion, it took this researcher between one and two hours to visit the whole site. Observations were also video-recorded, allowing the researcher to carry out more detailed observations when not physically at the site. The main purpose of the observation was to identify the existing ‘centres’ at the research site based on Alexander’s wholeness theory, and to identify how the centres present were related to each other – how they intensify each other, and which centres were most liveable.

The Site of Study

Jamshidieh Park was established as a memorial to Jamshid Davallu Qajar – a Qajar Prince that dedicated this garden to Farah Diba, former Empress of Iran. Farah Diba decided to give the garden to the public as an urban park. The park was designed by the architect, Gholamreza Pasban Hazrat in 1978 with the cooperation of other architects. It was developed during the reign of the Pahlavi dynasty (1925-1979), but has been extensively upgraded and maintained since the Iranian Revolution in 1979.

Jamshidieh Park is located north of Tehran, in the Niavaran district, at the foot of the Kolackchal Mountains. It is triangular in shape. Its original design was completed in 1978, and redesigned in 1991. The old garden contained three main axes. The first axis in the eastern part of the park contains old trees. Narrow, and with a slipping slope, this area was considered to be the main axis of the park.

The axis was covered by old plane-trees in two sides which were irrigated by streamlet. The second axis was the central axis; most of it has been ruined. This axis consisted of stairways and a terrace. It was almost unparalleled with the first axis and needed to be reconstructed.

The third axis was located in the north part of the park and was designed as an east-west axis. Trees, mostly pine, surrounded this axis. At the end of the western part of the third axis was an empty open space lacking trees. In this empty space, there was another open space at the foot of the mountain with divergence in surface. The main part of this space was encompassed by a rectangular pond which acted as the water supply of the garden (Pasban Hazrat, 2009).
The design principles implemented by the designer to make the garden an urban park were based on the site slope. This preserved the existing trees and the structure of the garden in adaptation with the topography. Because it was decided that the old garden would be made into a public park, an adaptation of the old garden to the new function was needed. To reach this goal, the user’s needs needed to be considered and the conditions of the garden that would co-ordinate with the new function needed to be preserved. There was a need to change some parts and make some new parts. As was noted earlier, the park contained natural features. These features were needed to keep people close to nature. As a result, after studying the site, five design principles were extracted by the designer. They included: a) preserving the structure of the garden, including pathways, pool and trees; b) choosing the stone (from the mountain) as the main material; c) shifting the sufficient stone from the mountain and using them in a natural way; d) designing every space according to existing natural elements; and e) maximum usage of water in pathways. In addition, new functions were defined: an open air amphitheatre; a greenery; a restaurant; a playground for children; a resort for climbers; a centre for meditation; a pond; some places to sit and breath; spaces for hiking; and some new entrances.

Data Analysis

Based on reviews of Alexander’s theory, the first, and most important, thing to do is identify ‘centres’ as variables and find the relation between them. In the first step of analysis, the main centres of the park should be determined. These centres, include those which already existed in the park as one system of centres, and those which were defined by the designer to be added to the site based on the needs of users. Also, in this step understanding the actual needs of users is important in defining the main centres. If the designer does not try to understand the actual needs of people, it will be difficult to define correct centres. After defining the main centres, these two categories of main centres should be identified as one system. This means that they should be designed in a way which intensifies each other and can be considered as parts of one whole. This first step is considered as the most pivotal, and difficult, part of the application of the Alexander’s theory. If this step is not observed in the process of the park design, it will loose the main principle of the theory. In the next step, other centres should be identified. In contrast to the main centres, these centres operate on a smaller scale. They must be added to the main centres in a way which intensifies them and makes a whole with them. On the other hand, it can be said that each of the main centres should be defined by smaller centres, which help them to be intensified. In the next steps, these smaller centres should be defined by some other centres in smaller scales. This process of creating centres in different scales continues until a deep feeling of whole between all centres has been created. In conclusion, all of the defined centres in different scales should intensify each other and help each other make one whole. It can be mentioned that each of the centres must be designed in the best possible way. The best way to do this is to strengthen the whole mostly. These adaptations in different steps between all centres should be observed. Furthermore, it should be noted that all the centres ought to be created in a way that has the most coherent order and uniqueness. If this adaptation between different scales exists in a way which intensifies each centre as a unit and helps all centres to be seen as one whole, we may conclude that most principles of the theory have been applied in the design process.
RESULT AND DISCUSSION

The results show that just some of the identified centres in the park strengthen each other. Most of the new functions and centres, which were defined and added by the designer, became isolated from other centres and could not preserve and enhance the whole. There were no adaptations between them and the other main centres already existing in the site. Only a few of the defined functions and centres by the designer were adapted to the pre-existing centres in the land. Taken together, these made a coherent system of centres and a coherent geometrical order. Overall, in the design process, only some of these 10 structure-enhancing actions have been applied. Based on Alexander’s theory, most of the problems in the process of design derived from the lack of two fundamental principles. First, there is the lack of attention to the user’s real needs. This leads to the isolation of main centres. Second, there is a lack of success in the combination of the two systems of centres as one whole; one defined by the site and other defined by the needs of users. According to Alexander (2002b), the systems of centres play an important role in making wholeness. Based on his theory, two systems of main centres are not well-defined to strengthen each other and make one whole. Thus the park failed to work well. On the other hand, preserving the natural features of the old garden was one of the strengths of the design. Among all presented principles, the new park design observed a respect for the land and nature most highly. As it happened, the designer tried to preserve the old structure of the garden and make the adaptation of some new centres with the land. He defined some functions in relation with pre-existing elements. The other strength of the park was its uniqueness and simplicity in some parts. This happened as a result of respect to the land and nature (another principle of theory). The other principles could only be observed to a small degree in a few parts of the park.

In conclusion, this study tried to develop a new way of looking at the park design process. The outcome could provide some support for Alexander’s theory insofar as they emphasize the validity of his theory. The study reveals how this theory can be used as a tool for analysing an urban park design.

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Performance of Underground Dams as a Solution for Sustainable Management of Drought

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ABSTRACT

Many developing countries are located in areas where the rainfall is seasonal and unpredictable. In these countries, water is supplied through storing in wet years for dry years. One way to overcome seasonal shortages of water is utilization of groundwater. However, in the late dry seasons, in some areas, even underground water resources are also depleted. Alongside, in some other areas, underground water is not available so that there is a need to dig deep wells and install pumps to exploit water which is not cost-effective. Unfortunately, the groundwater levels have declined in recent years due to inefficient management. This matter causes lot of issues including drop in groundwater levels and salinity of soil and water. The expertise believe that the construction of underground dams can be partly overcome these problems. The issue whether the construction of underground dams is in consistent with the objectives of sustainable development or not and in what extent needs to be cautious. The present study attempts to identify advantages and disadvantages of different types of underground dams to determine the future sustainability of such structures from economic, social and environmental viewpoints.

Keywords: Underground Dams, Subsurface Dams, Sand Storage Dams
INTRODUCTION

Most of the developing countries are located in areas where rainfall is seasonal and unpredictable. In these countries, the supplying water process is largely done by saving it in rainy seasons for the seasons of low rainfall as in wet years for dry years (Forzieri et al., 2008; Ravnik and Rajver, 1998). Usage of underground waters is one of the diverse ways to overcome the seasonal water shortages. However, in some areas, at the end of the dry season, even underground water resources are brought to an end or not accessible (Gustafsson, 2005). Therefore, it is essential to drill deep wells and install pumps to exploit water, which is not cost-effective (Arango, 2002). In recent years, the usage of underground water has been considered as one of the ways to supply water (Nordmark, 2002). Silva and Neto, (1992) defined the underground dam as any structures blocking sub-surface water-flow of a natural aquifer as well as a tank which is constructed on underground level. According to their definition, for construction of an underground dam, impermeable bedrock like igneous rocks with low porosity and fracture and also a suitable tank with high storage coefficient are required. From thousands years ago, the water conservation and prevention of desertification have been major concerns in the world. Thereby, new strategies including construction of underground dams have been emerged. It is considerable that a large part of Iran is located on arid and semiarid ecosystems. Around 75% of Iran is consisted of dry lands. In terms of geographical location, it is situated in areas where all impassable deserts are located. Accordingly, peaceful coexistence with desert is an inevitable principle which requires proper planning and appropriate actions.

Issues like lack of rainfall and low soil fertility have been considered major problems in rehabilitation of agricultural lands and rangelands in Iran. Currently, more than 57% of annual rainfalls waste in the form of floods and run-offs. These are all related to lack of sufficient knowledge about the issues such as new sciences and technologies as well as optimum usage of existing water resources.

To deal with drought, the construction of underground dams is vital in many arid and semi-arid areas like Iran on the grounds that these types of dams prevent the withdrawal of groundwater and reduce costs. In addition, site selection and implementation of such structures are easy. The construction of underground dams can be a great solution to overcome the problems such as the low level of underground water, the water salinity and soil downfall according to the withdrawal of underground water levels and insufficient management measures in recent years. Annually, about 1.2 billion m³ of surface water wastes in Iran while this volume of water can be accumulated by using underground dams together with flood spreading system.

The construction of underground dams has no effects in terms of environmental issues and it is useful to deal with shortage of water resources. The level of water evaporation is zero in these dams. Moreover, their discharge rate varies between 10 to 15 liters per second which are used for agriculture and drinking purposes. Although, the underground dams are constructed in small sizes but they are just sufficient to provide drinking water requirements for the inhabitants near provinces and villages.

Unfortunately, the level of underground water has been declined due to uncontrolled withdrawals of underground water (Valett and Sheibley, 2009). By construction of underground dams, water can be collected by the outer wall of the dam. It causes the water
table of the aqueduct to rise. By installing some valves on the wall of dam, the surplus 
water can be conducted towards the aqueduct. The measure helps to rehabilitate the aqueduct 
and underground springs. Construction of underground dams is one of the specific and unique 
methods to restore aqueducts and fountains whereas other countries have not been successful 
in managing aqueducts. The construction technology of underground dams is under restriction 
of few countries including United States, India, Brazil and China. Iran is the sixth country 
which has achieved to this technology but the only difference is that the building instruction 
of underground dams is fully localized in this country.

**Definition of an underground dam**

Unlike normal dams which are made in the width of rivers or streams to store and collect 
water in upstream reservoirs, underground dams block and store groundwater-flow below the 
ground level. Besides, they are used as collective structures which are able to divert the 
groundwater-flow (Goran and Nilsson, 1986). For example, underground dam can feed the 
neighboring aquifers. It also enhances the water table of an aquifer which has low-flow in a 
manner that can be easily extracted by pumping operations (Mori et al., 1996). Different 
composition of superficial layers of earth in various areas causes water to penetrate into 
substrates slowly or quickly. If the composition of subsurface layers is in a way that water 
can penetrate to depth areas, then the water is actually nowhere to be found and it will 
transmitted to unreachable depths (Mori et al., 1996). In some areas of the earth and at depths 
under 100 m, soil composition is so that water cannot penetrate the underlying layers. 
Underground aquifers are divided into two types:

1. **Free aquifers**: In this type, water table level is the same as upper surface of the 
saturated area. The amount of pressure in water table is the same as atmospheric pressure 
(Herrera and Chen, 1982).

2. **Under pressure aquifers**: these aquifers are known as “artesian” or “confined”. They 
are formed in locations that the underground water is confined from above by a relatively 
impermeable layer (Zhang et al., 2007). As a result, the underground water is under greater 
pressure than atmospheric pressure.

In some areas, in natural composition of soil, vertical layers of soil cause the underground 
aquifers to be altered to different sections. Also, it leads to conversion of each underground 
aquifer to several reservoirs (Freez and Cherry, 1979). In natural conditions, these layers act 
as a natural underground dam (Onder and Yilmaz, 2005). By recognizing the benefits of such 
natural dams, human tries to construct artificial dams in extensive aquifers of underground 
water and establish underground water reservoirs (Jandric, 2000). Creating extensive vertical 
columns in the direction of water flows or in underground reservoirs having more or less than 
70m depth is called underground dams. Building underground dams requires different factors 
such as accurate calculations, aerial photos and satellite images, economic justification and 
the most important one environmental investigation (Jabrand, 2000). Underground dams like 
normal dams have impermeable wall that water is collected behind it. This wall is made of 
compacted clay, pottery, brick and stone with cement mortar, PVC and polyethylene (Ishida 
and Kutoku, 2003). In order to construct the wall, a trench, perpendicular to the direction of 
river, is generally drilled up to impermeable stone-bed level. The width of the trench depends 
on the thickness of the alluvium, depth of impermeable rock of river bed, the soil or alluvial
type of dam site and materials used in dam wall (Gupta and Mukherjee, 1987). In rivers that sediment loads are mostly sand, the adhesion alluvium is naturally low and the trench walls are possible to fall during drilling and excavation (Ishida and Kutoku, 2003). Therefore, it is required to hold the trench walls using retaining plates or other techniques. However, sandy areas are considered as appropriate parts of rivers for construction of underground dams whereas they have suitable storage coefficient. During trenching, it is usual to collide with water table which indicates that the subsurface flow is in canal bed. Thereby, during drilling, it is needed to pump and bring the water out of the trench bottom (Gupta and Mukherjee, 1987).

History

Dam engineering is an integral part of human civilization because dams have been constructed to provide water (Fei et al., 2010). Moreover, dams are undoubtedly considered as the first man-made structures. Evidence reveals that dams have been at the service of human civilization from at least five thousand years ago in civilizations including Babylon, Egypt, Iran, Europe and East (Norman, 1971). The history of dams is generally referred to Roman times in Europe (Arenillas et al., 2003). Underground water dams were built in island of Sardinia in Roman times (Trevor, 1992). Buildings in Tunisia indicate that blocking the flow of underground water was done by ancient civilizations in North Africa (Norman, 1971). There is an evidence of an underground dam construction in eighteenth century in Arizona but scientific growth and development of underground dams began from twentieth century and they have become more popular between countries in the past three decades. In Germany, France, and Italy several dams have been constructed in order to enhance the underground water table levels. Underground dams are used with various purposes for example in Austria to expand water resources, in Greece to develop aquifers and in Yugoslavia to protect fresh water aquifers against sea (Norman, 1971). Several examples of these dams have been reported in Iran. One of the world's oldest underground dams was constructed in Meymeh (Isfahan), near Kashan. The height of this underground dam was 9 m and it was able to store about 270,000 m³ of water for irrigation and drought periods. This technique has been used in an aqueduct in Vazvan City in Isfahan in order to prevent water loss and also in rivers of Sistan and Baluchestan Province to supply water. It should be mentioned that techniques of using underground water flows, particularly underground dams and aqueducts were firstly invented by Iranians. Despite the topographic and climatic conditions of Iran, many areas are suitable for building underground dams (Hartung et al., 1987). There have been no serious studies about the construction of underground dams in Iran despite the ancient histories and importance of using underground water in different ways such as aqueducts and canals. Several underground dams are currently under construction such as Kharanegh underground dam in Ardakan City of Yazd Province. Besides, several underground dams have reached to operational phase such as Kahnuj underground dams in Kerman Province which includes a series of scattered villages in impassable and mountainous places.

In order to supply water needs for the inhabitants, according to the natural and climatic conditions of the region, high evaporation, possible outbreaks of malaria and comparing the costs in comparison with other various projects, construction of an underground dam with 9.5 m height and 17 m wide has been approved. It should be noted that the basin average annual rainfall is 207 mm and its annual discharge equals to 1.66 million m³. Some other underground dams can be mentioned as below:

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Kuhraz Damghan: The method of its construction is divided in two parts. The first part is in the form of Chinese brick wall with tar surface from floor up to 4 meter height. The second part is made of knocked clay and its height is 3 m.

Tuyeh Davare Yazd: it is made of stone, mortar and concrete. Stone and mortar are used up to 5 m depth and the remaining parts are filled with concrete. A twenty-centimeter wall is built in order to protect the tar layer and gravel materials which are used inside the dam reservoir. Some other examples are as Kuhraz Damghan, Sefid Dashte Shahrekord, Chalkrud in Ramsar, Maku in West Azarbaijan, Kharanegh Yazd and Chndab in Garmsar, Sabzevar and Meymeh Underground dams in other countries can also be mentioned as following:

Coastal area located in the Horn of Africa (Print, 1997), Islands and coastal areas of Japan, Myaku Island in southwestern Japan, Nakajima Island in Japan (Nagata, 1991), central regions of Tanzania (Print, 1997), north and north-west regions of arid and semi-arid regions in Tibet, China (Qi et al., 1995), and lots of other cases.

**Types of dams**

In a general, underground dams are divided into two groups of sand dams and subsurface dams.

**Subsurface dams**

In this type of dams, the dam walls are limited to impermeable bedrock at the bottom and it is restricted to alluvium layer in upper parts. Water reservoir is only formed in the basement. It is common to use this type of dams in order to increase the storage of agricultural water resources in North East parts of Brazil (Telmer and Best, 2004).

![Figure 1. The profile of underground dam](Source. Telmer and Best, 2004)

These dams are constructed to store water in natural aquifer (upstream reservoirs of the dam). They are built perpendicular to the river direction. The dams prevent subsurface-water to flow
downstream and accumulate water in their sand bed. In this way, the fluctuations of underground water level are largely reduced by storing water. This role can be seen exactly in surface dams for controlling the changes in river discharge and establishing a stable state. The walls of the dams can be made of concrete, stone, compacted clay, asphalt, brick with cement mortar or even resistant plastic plates against water flow (poly ethylene), but it is better to use the nearest borrow materials and resources. Unlike the surface dam, the bodies of subsurface dams do not need to be thick or have a retaining wall (Diettrich, 2003). The most important issue which should be regarded in constructing these kinds of dams is to build the dam walls on impenetrable bed and stone anchor to prevent leaking water to downstream. Ideal locations for construction of subsurface dams are buried valleys and narrow valleys with width of 100 to 200 m which are filled by materials with good water discharge such as sand and gravel. Natural subsurface dams are frequently caused by rock outcrops and blocking the flow of water. Development of subsurface dams in valleys and river beds can be a helpful tool to store a high volume of water (Telmer and Best, 2004).

**Sand storage dams**

In this type of dam so-called sand fill dam, the impermeable wall of the dam is laid on the impermeable bed. It continues up to the alluvium level existed in the river bottom.

These dams are mostly built in rivers that the thickness of the alluvium is slight (about 2 to 3 m).

![Figure 2. Schematic cross section of a sandy dam (Source. Orient and Hoogmold, 2009)](image)

In these dams, a part of the dam wall which is placed above the alluvium, works as a sediment trap (similar to the sediment control dams) and the volume of underground reservoir is increased by accumulation of sediments behind the dam wall over time (Foster and Retsios, 2004). Indeed, a surface reservoir and an underground tank reservoir are made in which the surface reservoir turns into underground reservoir over time. In this way, sands and gravels are collected behind the dam in flood seasons and the increased dam height will consistently continue. Fine-grained sediments such as silt and clay which have been deposited in the space between coarse-grained sands and gravels are taken out from top of the dam due to confusion during the flood (Foster and Retsios, 2004). Only coarse-grained sediments remain and this causes high storage capacity. However, in discussions associated with sedimentation
engineering, this process intensifies by designing channel-like structures in river beds that causes water involvement and circulation between the river bed sediments. These types of dams are more costly and complex than subsurface dams. Therefore, before making these types of dams, a subsurface dam should be made with lower cost in the same location in order to ensure the impermeable nature of the body and dam reservoir. Moreover, maybe the stored water by the initial dam can be responsive for the population needs.

Advantages and disadvantages of underground dam

Among the advantages of the underground dam can be pointed to its high flexibility in finding suitable locations for construction. Unlike the big dams which are commonly constructed away from places that use water; underground dams can be built in the vicinity of agricultural, rural and industrial areas (Hut et al., 2009).

Benefits

Using underground water dams has many benefits compared to common methods of surface water storage. The most important advantage of underground dams is the possibility of building the dam close to residential areas for example these dams can be constructed next to deprived villages requiring water. Construction of underground storage dams help to store rainfall and feed the groundwater aquifers and provide water for farming. Site selection of the underground dams is so easy, i.e. high flexibility in finding suitable locations for construction; underground dams can be built in the vicinity of agricultural, rural and industrial areas unlike surface dams and large aquifers which should be far from areas using water (Peter Dillon et al., 2000). Low cost of implementation, operation, maintenance and repair is another important advantage of such structures. They have simple structures which can be implemented by using available resources and local workforce. Underground dams reduce evaporation losses considerably. No temperature changes take place in reservoir water. The stored water has a constant temperature. This matter is notable in terms of industrial uses. Unlike surface dams which accumulate water on the earth's surface and they cause the areas of dam reservoir to go underwater, in this type of dam reservoir damage is very low because of accumulation of water below the ground level. Compared to surface dams, regional ecosystem is less affected because of accumulation of water in subsurface (Peter Dillon et al., 2000). It follows by the least vulnerability for humans. The structure also reduces reproduction opportunity of dangerous insects like anopheles mosquito which carries malaria considered a crucial problem in tropical areas. The volume of dam reservoir is not decreased because of river sedimentation and it has longer life (sedimentation, even in the underground dams of sand is considered as an advantage). The design and construction of underground dam is permanent. Therefore, water storage is available for a long time, while the practical storage capacity of the surface dams is reduced during time because of plant growth and deposition of sediments. Subsurface water flow is not static and they get out of reach in semi-irrigated seasons while they can be stored in underground reservoir based on the project dimensions. Besides, they can be utilized with a greater efficiency in appropriate time due to rising water level in underground aquifer. Underground dams are planned and implemented based on the subsurface flow and they are considered as more reliable water source in comparison with common surface dams. Underground dams can be accompanied with other projects such as soil conservation, preventing erosion and floods, artificial feeding and
enriching upstream wells. These types of dams can be constructed as dual use in many cases. In addition to fresh water storage, they can act as a barrier and avoid the invasion of sea saltwater or contaminated water with areas of clean water. It is possible to make several underground dams on the waterways of a region to increase underground water storage.

Underground dam is a method for optimal utilization of available water resources. This method prevents the loss of underground water. The impact of these dams on the control of subsurface water is comparable with the role of surface dams in controlling surface runoff in stream and rivers. Other advantages of underground dams can be summarized as follows:

- No need to use tools and skills for water treatment.
- No contamination of water reservoir.
- No damage in case of deterioration of the dam.
- less sensitivity towards drought phenomena
- Construction failure of underground dams is much less than surface dams
- No risk of dam failure in establishing
- No heavy costs for maintenance and protection
- No flood in the fields and pastures and no social issues
- Applicable in most communities and seasonal waterways
- Possibility of extensive public participation in implementation and operation of the project
- Water distribution is much cheaper than surface dams
- It is possible to use reservoir land in periods of land shortage

Disadvantages and limitations

The correct estimation of usable water stored by underground reservoir is relatively difficult. It is difficult to control operations such as quality of dam walls and the amount of water passing across borders because it cannot be supervised. The construction of dams without enough studies can be harmful for downstream underground aquifers.

The underground dam reservoir has smaller volume of water compared to surface dams because it is formed into the alluvium behind the dam wall (Nilsson, 1988). Therefore, their site should be selected in rivers with coarse-grained alluvium (such as igneous areas). Step by step controlling the construction of dam-body requires high accuracy and lots of considerations. Whereas, after constructing the dam, the body is out of reach and in case of trouble in the dam wall, these problems will be far from the engineers’ sight. In some cases, construction costs and facility operation may be more expensive than surface dams.

It is difficult to estimate the exact volume of reservoirs because of storing water underground and lack of accuracy of geophysical methods (geo-electric method) in estimation of subsurface structures geometry. In areas where government does not support farmers for financial issues, building a large number of these dams for agricultural purposes is not affordable for local people and using these dams is only limited to domestic consumption. An underground dam may prevent penetration of subsurface flows to downstream aquifers but usually these aquifers are not absolutely fed with subsurface flows passing through the dam.
site. By designing suitable structures in the body of underground dam, a certain extent of water can be drained to downstream areas (Abu-Zeid and Elbadawy, 2005). Salt making in reservoir of underground dams is considered another disadvantage of underground dams. Raising the underground water level to vicinity of surface by construction of underground may be associated with evaporation of water from reservoir or accumulation of salts. For solving this problem, the underground water level can be reduced by lowering the height of dam wall which helps to prevent evaporation (the height of wall is usually considered to be from the impermeable bed up to 3 or 4 m below the alluvial river bed). Moreover, in some countries like Brazil, plants absorbing salt are cultivated in reservoir in order to reduce the effect of this phenomenon (Telmer and Best, 2004).

To reduce the potential of salt-making in underground reservoir, it is possible to embed a drain pipe at dam heel. The drainage pipe is designed at dam heel, in parallel with dam wall. Besides, it is laid on impermeable bedrock. This pipe is extended across the dam wall and then it passes through the inside of walls. Alongside, it is connected to a vertical pipe in the downstream that water can be drained by its help. Indeed, this pipe is used as a mean for discharging dissolved salts from dam reservoir.

CONCLUSION

In general, the application of underground dams can be summarized in the followings:

A) Underground water storage (Water supply)

In Iran, these dams can be used to provide agricultural water. Besides, they are useful to supply drinking water in coastal areas. Due to low storage volume of the reservoirs and high construction costs of underground dams compared to other hydraulic structures, the required water is mostly provided by transferring water from neighboring basins. These structures are applied around the world to supply agricultural and drinking water and also artificial feeding. It should be noted that underground dams are used and implemented in various dimensions and sizes. Thus, their small sizes do not mean they are not important. These dams are of vital importance in many areas due to being the only source of supplying water.

B) Preventing saltwater penetration to fresh water reservoir in coastal areas and salt plains

These dams are usually made in coastal areas, salt plains and islands. In these areas, the water table is lowered as a result of exploiting underground water. Due to increasing the hydraulic gradient, saltwater is combined with fresh groundwater in reservoirs and the use of the groundwater is limited. Nakajima Dams in Japan and Bang Tu in Thailand are examples of these dams. The sidelong applications of these dams are controlling flood, increasing underground water quality and preventing soil erosion.

C) Management of water resources

Unfortunately, underground water level has been declined due to uncontrolled usage of underground water. It can be stored with the construction of underground dams. Underground water is collected behind the outer wall of the dam. This matter causes aqueduct water level to
rise. Excess water in the dam can be conducted towards aqueduct by embedding some valves on the dam wall and this action causes aqueduct and underground springs to rehabilitate. Whenever, original springs or wells and aqueducts are faced with water crisis in a region, by construction of underground dams and blocking few springs or aqueducts, it is possible to lead the water towards the main spring and well or aqueduct and avoid them from being dried.

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Sustainable Architecture: Utopia or Feasible Reality?

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ABSTRACT

This paper delves into the current issues and limitations that outline the modern day architectural teaching and practice. It reveals the unfortunate flaws that arise from our selective and interpretative adoption of the concept of sustainable architecture. The numerous pitfalls in the theory and application of green architecture are brought to light and invites introspection and challenge. We expose our own inequities and question whether we are truly doing right by our planet. We acknowledge the resistance of the global community to change and aim to put forward feasible suggestions towards cementing and nurturing a symbiotic relationship with our environment. We project a realistic perception of the multiple challenges facing our world and attempt to explore and create possible avenues for constructive change. Our ultimate goal is to foster from now on a harmonious union between Man and nature and to halt and possibly prevent further degradation to our green planet.

Keywords: Adaptive design; Climate change; Modern architecture; Sustainability, Ecology
INTRODUCTION – A FAINTING IDEOLOGY

As a buoyant and new graduate from high school and relieved to have left the pedantic world of high school behind, the author was brimming with enthusiasm when finally attending university to join the other avid learners of architecture. Architecture is poetry in motion and from any problem, emerged an assemblage of shapes that are discrete entities in themselves and yet intricately linked. The setup of the architectural academic syllabus invites interest and arouses curiosity. It is a skillful blend of the basic scientific principles of the subject and its technicalities, the intrigue behind the history of its evolution as well as exploring other modules such as urban design, structure and other such relevant ones. One particular lecture that was imparted in our history class is vividly imprinted on my mind. In that class, we were taught the when and how of the various contributions of architecture to our society in the past century. Much emphasis was placed on how all those additions to the world of design by the famous Bauhaus school, directly or indirectly set in motion numerous changes that ultimately provided a better lifestyle. Thus was born the tenet that architecture had power to change the world and from there on, we considered and prided ourselves on being enlightened.

However, despite our knowledge, when we are asked to produce forth a design, we generally tend to belie those very principles to which we were first introduced. There is a tendency to forget that architecture, in its very essence, has the simple task of providing the solution to a number of problems while not only taking into account the penultimate objectives of the projects but also in analyzing its effects on society. Instead, the goal of our focus and our approach similarly changed to follow a trend that originated in the 19th century which advocates our aim as addressing the issues of our current century. That trend is undoubtedly admirable and suits the needs of the people but due to its rigid timeframe, overlooks the simple fact that society is progress in motion. As our world changes, so do our needs. Architecture, in itself, being an advocate promoting innovation and creativity should reflect that model of change and provide not only for the present but prepare for the future. The words of Juhani (1994, 74) embody the current permeating lack of foresight: “The view of the world and the mission of architecture that had appeared unquestionably grounded in concepts of truth and ethics, as well as in a social vision and commitment, have shattered, and the sense of purpose and order has faded away.”

Should we adapt a more flexible frame of vision and widen our scope from the aesthetics aspect that comes with the job to encompass society and the problems that our world is facing on a global scale, we would be aware of the many challenges that are being experienced but that we have yet to concretely address. For an architect, the environment can be an ally or an obstacle to a project. Our relationship is symbiotic and is central to the very foundation of our job. And yet, we have failed to take good notice of the changes affecting our environment. Most places are experiencing extreme climatic changes, sea levels are rising, weather patterns are fluctuating, ecosystems are being stressed, just to mention a few. This phenomenon is the direct effect of global warming. (Impacts of global warming, 2011) & (Maria n.d.) Unfortunately, despite the continuous efforts of scientists and politicians to raise awareness on the matter, people are still either in blissful ignorance or frankly skeptical. But as Barack Obama so rightly said, “Not only is it real, it's here, and its effects are giving rise to a frighteningly new global phenomenon: the man-made natural disaster.” (Energy independence and safety of our planet 2006) However, the tragedy of the matter is that this is not a once-off phenomenon. It is a progressive and slow destruction that can culminate in disaster. NASA
released a statement delineating that “Scientists have high confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gasses produced by human activities.”, (Climate change: Effects n.d.). As architects, we can shoulder a burden of responsibility in attempting to improve the situation through means that take into account potential future changes.

There are more compelling reasons advocating present action as opposed to inaction where global warming is concerned. As Al Gore so rightly says,” The warnings about global warming have been extremely clear for a long time. We are facing a global climate crisis. It is deepening. We are entering a period of consequences.” Such consequences would directly impact on our ecosystem but do not define the sole imperative to act now. If we, as architects, do not fulfill a self-obligation to take immediate action to redefine our contribution towards environmental preservation, we will be placing ourselves in a position where it will be too late to find adequate solutions to current problems. More importantly, we will not be able to prevent the advent of larger and more catastrophic changes. We will find ourselves dragged down in a landslide of ecological disasters that will be in part, of our own making. The importance of this issue cannot be emphasized enough. That architects, as much as environmentalists and engineers, have shared responsibility towards sustainable ecology as well “As the construction sector is responsible for an estimated figure of 30-40% of a large part of the total global emissions of climate gases either relating to operational emissions or those related to production, maintenance and demolition.” (Berge 2009, 32). Our focus should be directed towards redefining the concept of building as a whole to encompass every minute detail of the construction process. The erection of the building façade or the energy consumed should not be our sole targets for improvement and change since “Impacts related to the production of materials correspond closely to the embodied energy in the materials though chemical emissions from the products can also play a role.” (Berge 2009, 32).

In the face of the dramatic and pervasive consequences of global warming around the world and the flagrant role factored in by the construction industry in the process, one should re-evaluate our ethos as architects. We, as designers of a better future, should adhere to a moral obligation to constantly change and improve our design principles and philosophies. Our aim should be to not only address architecture towards the proper audience but also align it to the present and future ecology of our planet.

**SUSTAINABILITY IN DESIGN**

With that ideology in mind, the most effective way to pave for the future lies in the concept of sustainability. Sustainability enforces a more eco-friendly way of life and transcends the barriers of time. At its core, it delineates a quality and way of life which allows the current generation to meet its own needs without splurging the resources available for the future generation and their potential needs. The underlying belief is that we can have a symbiotic relationship with the environment and work to ensure our lifestyle and actions are not of harm to our ecosystem. “Essentially, it means ensuring that we leave our environment no worse than we found it (and if possible, better)”, (Ecomii n.d.). This notion of protecting the environment should therefore be set as a benchmark by professionals in various spheres of work in order to ensure our own survival as well as that of our descendants. It has to become a concrete reality instead of an ephemeral vision. As such, the first step is to delve to the cause
of the matter. “The regular meeting of scientists around the world to review the latest scientific findings has enabled them to locate the greenhouse gases responsible for global warming and the one on top of the list is Carbon Dioxide (CO2)”, (National Geographic n.d.). This being acknowledged, we can concentrate on identifying and isolating the various sources of carbon dioxide in the systems we once designed. This would then expand to figuring out means to reduce or avoid those emissions altogether. While it would be too ambitious to attempt to totally eradicate those emissions presently, we should nevertheless aim for a noticeable reduction while we figure out a way to recycle those noxious gases into fresh air through the preservation of our ecosystems. Sustainability, from an architectural perspective, refers to environmental sustainability. However, the issue of social sustainability should not be neglected since it encompasses and affects public health and promotes a fairer distribution of physical resources and physical risks (Hagan 2001,3). When serious such concern imposes itself in a discipline, a call for new concepts, strategies or themes usually tend to arise. Hence, our perception of architecture has been redefined and now “The concept of good architecture has shifted to encompass the notion of a building that is sensitive to its environment- one that will adequately protect the environment from the potential pollution and degradation caused by human habitation.” (Williamson, Radford, and Bennetts 2004, 1).

Viewed from this perspective, the notion of a ‘green’, ‘ecological’ or ‘environmental’ building is one that takes into account the fundamental relationships between the design of buildings and its surrounding environment. The overall aim is a creation that works in harmony with the environment. However, there are four noticeable points where the concept of ‘green’ architecture might be of an abstract or blurred understanding.

**DESIGNING FOR THE COMMUNITY**

The concept of community is multi-layered and has to be respected for sustainable development to be a truly successful endeavor. As a ‘green’ architect, community sensitivity has to be reflected through the use of land, the layout and design of each construction and building operations. Green development seeks to achieve community mindfulness on every level, complementing and connecting to it where possible. Such developments make appropriate use of land, both in terms of scale and function and plan for pedestrians as well as cars. They also facilitate access to the existing infrastructure incorporating the use of services, schools, work and shopping and they offer and maximize the range of public and quasi-public spaces such as squares and courtyards for gatherings. Also, “Just as important, green developments address community in the way they are operated, including educational components in which concepts of sustainability are conveyed to occupants or users.” (Wilson et al. 1998, 8).

While keeping the concept of green development in mind, one should not overlook the fact that the main purpose lies in the aesthetic architectural façade of the building, both to the inhabitants and onlookers as well as to satisfy the requirements for a fulfilling living experience in the said building. While green buildings are usually born from the architect’s creativity and design philosophies and the engineer’s concept of construction complexity, one can still challenge the outcome of those combined set of skills. One should keep an open mind and retain a broader focus as opposed to giving sole priority to design. Building construction is a massive industry and as such, warrants extra attention. One should promote understanding
of the intricacies of the teamwork involved and attempt to give due attention to each discrete component of the building process so as to create the best possible outcome in terms of cost-effectiveness, employment opportunities and aim to be as green as possible.

From the Davis Langton study of over 221 buildings (Davis Langton 2007), we cannot help but notice that the cost of a sustainable building is comparatively higher depending on the desired green outcome. Cost is inevitably a driving factor in any purchase and as such, should we manage to reduce the pricing of green buildings, we would ultimately appeal to a wider audience. This would be a decisive force in the community acquisition of green architecture. One possible means of achieving this would be to resort to the use of alternative materials in the construction of green buildings.

Alternative materials would represent a more sensible choice over conventional construction techniques as “material consumption by the construction industry is even higher than its energy use.” (Elizabeth and Cassandra 2005, 11). Choosing alternative materials would considerably help to reduce our resource consumption by providing materials with less embodied energy and thus ultimately attenuating our ecological footprint. Most such materials are found onsite or in the surroundings and therefore constitute a cheaper alternative whereby almost no transportation costs would be involved in the erection of a residential building. Not only would it provide a cheaper alternative to traditional construction methods but it is also a portal to the provision of local employment.

Therefore one should not forget that a green “Community involves many things, including quality and quantity of human interaction, safety and a sense of involvement and neighborliness.” (Wilson et al. 1998, 8).

THE COHABITATION PRINCIPLE

The world’s environment has a rich history that dates back some four and a half billion years ago and that history is entrenched in every individual piece of land. Each parcel of that history has had its ups and downs. Study the marks of time in the rocks and one will see periods of relative stability which encompasses the cyclical wheel of bloom and decay, of dormancy, and of birth, death and rebirth. Some of those periods are long and some short, but none are everlasting. Interspersed among those stable periods, one can find occasional upheavals of sudden change. Since the development of agriculture over a span of the last twelve thousand years, and especially during the two centuries since the birth of the industrial period, human beings have been the main driving forces behind the upheavals. Lyle (1999, 1) highlights that “Our relentless passion for change, in combination with our technical prowess, has contributed to alter much of the world’s landscape.”

We tend to forget the fact that undeniably, the best approach to survive this global warming is to find a way to co-exist with nature with harmony rather than to dominate it. The undeniable fact remains that ultimately we are the ones who depend on nature. Since the advent of industrialization and the era of globalization, we have developed and adopted the idea of fast conception while unfortunately overlooking the fact that if we do not treat nature with respect, we would be the ones most harmed by it. One main issue in architecture would be the process of waste management. One’s sole focus should not be only on the erection of the building but
also include the concept of waste management. This would cause not only a considerable reduction in the total embodied energy but also in the cost of construction.

Moreover, an in-depth context study should be initiated in order to be able to reveal the most intelligent ways to pioneer green design in the true sense of the word. Presently, the whole process of environmental management is geared towards the establishing control over nature as well as predicting and accommodating growth rather than working in a linear fashion with natural processes. Further, the environmental management sector still has a narrow perspective in the way they treat environmental management issues. For example, they segregate workers assigned to either wilderness protection or industrial pollution into academic and professional sectors. “Due in part to linear-reductionist thinking, they have largely overlooked the demands created by the urban and built environment upon both wilderness and industry.” (Birkeland 2002, 3).

THE FORGOTTEN MAJORITY

While scientists, environmentalists and architects are focused in their pursuit of perfection of ecological designs and immerse themselves in the achievement of a new goal, the sad reality is that they are simultaneously neglecting and ignoring the current properties that are already erected. Although progress towards the adoption of ecological design practices is making solid ground, the green movement has nevertheless restrained their primary focus to the transformation of building practices for new developments only. This is inevitably beneficial for emerging economies like China and India, which, collectively, are responsible for the construction and expansion of urban sites to house accommodation for more than thirty million people annually. However, until now, sustainable development practices are still not laying enough emphasis on the importance of ecological retrofits of existing buildings across the globe. The mentality of those involved in the development of ‘sustainable’ architecture is defined by the precept that ‘sustainable’ is merely a temporary distinction since in the future, all architecture will be environmentally sustainable. However, according to Hagan (2001,3), the prevailing question that arises is “will existing-architectures-made-more-sustainable, modernist and post-modernist, be able to remain as they are, or will they inevitably be re-formed by the exigencies of environmental design.”

This statement is backed by a study of the statistics on the matter. Existing buildings inevitable comprise the majority of current building stock. Indeed, in most developed countries, they represent 98% of the stock. By contrast, new construction account for 1 to 1.5 percent of properties at any one time. However, this percentage may be less in dense urban areas. Statistics imparted by the New York City Office of Sustainability reveal that of the 950,000 buildings that currently make up the city, 85 percent will still be standing in 2030. Such figures clearly delineate the importance of old buildings in our ecosystem. New construction, no matter how sustainable or environmentally sensitive cannot, on its own, contribute a significant change towards the environmental impact of the built environment. (Urban land institute 2009, 3).

Thus, a collective awareness should be encouraged with regards to how existing buildings can be adapted with green retrofits. Efforts should be made so that this is performed in a cost-effective manner so as to attract the attention of the mass and incite others to adopt a similar
attitude. Those retrofit designs that are successfully implemented should be documented and logged into a collective database so that designers can easily refer to one another’s portfolio and marshal their resources for the common good.

CONCERTING IDEAS TOWARDS INCREMENTING PRODUCTIVE OUTPUTS

The architect has a clearly defined role and usually takes on the mantle of project leader and manager in most construction projects. However, since the same architect is responsible for the design phase, he will, by intention or not, be biased about his design. In such a case, should he have overlooked crucial components, he would nevertheless give the go ahead for the project since he possesses the power of being the manager as well. Nowadays, in an era of change, contemporary practice should call for drastic changes. Since projects are considered as temporary organizations by most project managers, it is a must that the project manager toils for the overall best interest of the organization while providing a forum for a fair exchange of ideas from all stakeholders. (Cleland and Gareis 2006, 2-2). This would be a justifiable approach since the concept of integrated design is one of the guiding principles in construction. This essentially means that, at the inception of a project, architects and engineers engage in a constructive dialogue. (Smith 2005, 128).

“Integrated design”, also known as “design charrettes” can be a significant and positive adjustment in the design process since it calls for multidisciplinary ideas. Therein lie the true possibility of sifting through the best ideas to emerge with the best possible outcome while satisfying all the project objectives. This, in whole, would be a more intelligent approach to the management process. As highlighted by Nikos Salingaros (2007, 44) “An intelligent system is able to solve problems. It finds different relationships that lead to a solution, each solution being a network of connections.” Moreover, the power dynamics in such a process is a more positive one. Human beings generally deliver more when they share a common view to work for the greater good for an organization and have a common goal. The aim is to offer a platform for genuine dialogue which promotes the exchange of ideas and allows a cross influence of mutual attitudes and opinions. This allows the development of a shared set of norms and values and provides everyone involved with a common language to understand events. As highlighted by Boonstra and Gravenhorst (1998, 110), “Understanding each other's perspectives, interests, and convictions is a prerequisite for developing a common image of a desirable future.”

PRACTICE & ECOLOGICAL ETHICS

The irony of the situation is that, while most people spend their time in buildings, relatively little attention is being paid to the built environment. Our designing principles have been put in place to address the need for shelter while also incorporating the creature comforts of living. In doing so, we have flagrantly ignored a critical component of design and that is the interaction of our designs with nature and its impact on it. While various developments contribute to the destruction of vast and diverse ecosystem and bionic communities, we, unknowingly, often attribute the “green label” to those buildings in that area, merely due to the fact that they are located in greener surroundings as opposed to cities.
Human beings, as individuals, marshal for autonomy and embody a spirit of competition. In a society, which is, more a collection of individuals than a whole, it is thus of no surprise that people relate to each other in terms of ‘rights’ or power. Hence, in a liberal society, the ethics of decision making structures and processes is inevitably ‘Rights based’. The pitfall in such a system is that those who have more power possess more rights. Moreover, the concept of equal rights only cannot be the sole factor in the fight that is the preservation of ecosystems and wilderness areas. After all, components of our flora and fauna cannot exert those rights. In practice, the purpose of a rights based ethics is to achieve a balance of interests. An approach which illustrates the principle of interest balance is the example of construction in indigenous areas. One can periodically allow the allocation of portions of native forests for development purposes when the demand arises. However, preservation of those forests is maintained at other times with the government not being able to indiscriminately build over native green land. “Thus we have rights-based, utilitarian decision-making tools and processes that are designed to make trade-offs.” (Birkeland 2002, 21).

The problem with trade-offs lies in the fact that ultimately one side will lose out over time. This is in conflict with the relational view that stresses on the individual being an integral part of society. That view stems from a feeling of care as opposed to being rights based and promotes equity which in its essence advocates fairness rather than equality. In trade-offs, people of lower social classes and nature inevitably lose out, which defies the principle of fairness. Hence, systems should be designed to make provision for our basic needs and foster cultural and natural diversity. The design discipline should prioritize the equitable distribution of environmental benefits and burdens as well as cater for society’s basic needs such as the shortage of housing, sanitation and clean water. This means that we should not only take care of nature and monetarily compensate for the impacts of our behavior, but we should also give something back. As the environment bestows generously on us, so should we on her. Creative design thinking can thus avoid trade-offs between those on different levels of the social ladder as well as between man and nature. Dr. Janis Birkeland (2002, 22) claims that “The relational view would therefore foster proactive ‘systems design thinking’ and problem solving methods geared toward restoring the health of human and natural systems.”

Mankind has a rich history in its wake. That history paints periods of tyranny alternating with peace, periods of suffering and collapse and periods of democracy. Through all those disparate periods in time, one cannot fail but notice that, the passion fuelling those men who waged a war for the greater cause was the fact that they shared common philosophies and goals. They were dreaming of a better future for the world and for the generations to come. Now that we have concrete proof that the world is on the brink of a major climate shift, we should purge from that same passion. Our philosophies and actions should coalesce into a common goal. By attempting to remediate the unraveling of our planet and by advocating social and environmental concerns, one would not only strengthen their commitment to the community but to the survival of mankind as a whole.

However, one barrier to the pursuit of that noble goal lies in the fact that the world is segregated into cultures and social groups that hold dear unique beliefs and values that could be at odd with each other. The principle of ethical relativism clearly delineates the matter. Ethical relativism describes the relativity of morality. Morality follows a linear trend with the particular rules and norms of each culture and hence, what is perceived to be morally right in one culture may be morally unacceptable in another. Some even argue that the beliefs of a
culture are only valid for the people belonging to that culture. From that point of view, it would be impossible to reconcile people from different cultures and persuade them to adopt universal moral standards that would benefit everybody. Although some credit should be given to ethical relativism, the issue of global warming is too important for us to give up on the matter. Hence, “universal ethical standards should be applied in fundamental issues such as human rights or the environment where we have common bonds of humanity and the commons.” (Krahnke and Wanasika 2011).

Hence a call for a change of goals and values must be made at individual, national and international levels. This would lay the foundation for enabling planned measures to take place with the view of reaching a rational and planned equilibrium in our social and natural environment. We have to transcend cross cultural barriers to act in the common good and preemptively avert catastrophe to befall our planet.

Ultimately, as architects, we are the sole definers of our own morality and ethics. We can be engaged or cynical in our approach to the very real problem affecting our planet. It is our civic responsibility to respond adequately in the face of the choice being presented to us. As Stephanos Polyzoides (2007, 185) states: “It will define you as it will define the long-term prospects of Architecture in this society.”

THE CONTRIVANCE OF VISUAL ILLUSIONS

Architecture is still shrouded in mystery and most people still find it an abstract concept. This lack of an intelligent and understanding relationship between people and architecture has been present for far too long and unfortunately makes up the terrain on which architects maneuver. In an era where rational thought was inexistent, this would have been an acceptable premise. However, in this modern day and age, when the human mind has transcended all limits, it is illogical that architecture continues to be perceived in a semi-mystical fashion. (Saligaros and Masden II 2007, 46).

This permeating lack of understanding leads to the design of building envelopes of all kinds, which, sadly, are interpreted as being of artistic or creative nature. Once that label is ingrained to particular buildings, it inevitably influences the design of others and starts a chain reaction that gives people the wrong perception of architecture. While the growing awareness about global warming issues is thought to incite changes in human decisions and activities, architecture, on the other hand, continues to mislead. The aesthetics of a building remains more appealing than the elusive concept of a green building. This trend also uses, to wrong intent and purpose, the green label as a marketing tool. Designs promoting that label, cater to fame rather than society since most “green buildings” which boast good aesthetic features still use materials that carry a rich history of production and manufacturing. All for less goes against the very essence of the ‘green’ tags attached those buildings.

One of the reasons why environmentalists are still reluctant to give credence to architectural expressions of sustainability is that while they acknowledge that this represents a new favorable contract between nature and architecture, it does not necessarily mean that architects will adhere to it. While the buildings promoted as being “green” proclaim a new
regard for nature, they still operate in an entirely conventional way, namely by using fossil fuels. (Hagan 2001,5). This, thus renders the whole concept of green as being superfluous.

TEACHING FOR PRACTICE

In pioneering for change of any kind, one has to start at the bottom of the ladder. We have to impart a ‘green’ conscience to those who are still in the student phase of their architectural journey. Historically, higher education has been a vehicle to promote holistic student development. The ideology of providing consistent educational schemes works successfully in educational fields such as law, accounting or economics, which consist mostly of static principles that do not evolve much through the decades. Architecture, on the other hand, is ever-changing and cannot be properly imparted through a rigid educational mould. Designers usually create from a sense of purpose or simply follow principles of construction that have been taught to them. While our planet has evolved through change, by comparison, architectural education has not similarly evolved to match its needs. Granted that a few environmental courses to raise awareness have been implemented but there still lacks the appropriate stress on the development of new concepts and ideologies to tackle the problem. Ideally, our design education has the role of shaping fresh minds to strive for logic and sustainability in their own design perspective. Hence, such an education should encourage students to engage themselves and produce designs that incorporate cohabitation with nature rather than to simply inhabit it. The aim is to work towards making architects and landscape architecture inseparable. (Polyzoides 2007, 186) The ultimate design ideal in this day and age would be to have typical urban development adjacent to areas of inviolate nature. Considering the fact that the first ten percent of building determines whether a place is urban or rural, the establishment of a proper construction pattern is fundamental to our survival in nature. Hence, if we help current and upcoming architects to revitalize the art of designing buildings as well as green areas, we would be taking a massive step towards the preservation of our environment.

“Intelligent architecture is responsive to human needs and sensibilities through adaptation to existing buildings and nature. This is a new way of viewing the world a way of connecting to it, and to ourselves.” (Saligaros and Masden II 2007, 40).

Another issue lies in the fact that all too often, architectural education tends to be restricted within faculty walls. The way forward is to promote intelligent design in the form of integrated design and simultaneously reduce the thinking gaps between architects and engineers. A well-known misconception pervades those two specialties. Engineers consider architects to be too focused on design as their sole objective whereas architects bemoan the lack of creativity that they feel is predominant among engineers. Surprisingly, this tension and mutual put down is more or less encouraged in academic circles. It is no wonder that some tension is therefore present in every interaction bringing together the design team and engineering department on any particular project. This issue could be tackled by the implementation of interdisciplinary projects, coordinated by different faculties, as a pre-requisite for university students. These projects could be designed to incorporate disciplines such as accounting, economics, architecture, engineering and marketing, and framed in such a way so as to simulate real life scenarios. In doing so, students get a taste of the very real
tension that exists in such interactions but also get familiarized with the importance of proper design at its most basic level.

The very foundation of our biological relationship with nature is in need of repair. Henceforth, projects should be fully aligned to their surroundings, in terms of their physical and chemical properties. Every piece of work should be a testimony against the mindless consumption of nature. Every design concept should implement means to produce energy, to recycle water and sewage, to contribute to clean air and to re-use materials. “The view of Architecture as the ephemeral consumption of superficial images and irreplaceable resources must reverse. The pursuit of permanent form and environmental replenishment is your next mission.” (Polyzoides 2007, 187).

INFORMATION & TECHNOLOGICAL AVAILABILITY

The advent of this era of technology and information has opened the portals of information wide open to our society on a daily basis. Breakthroughs in telecommunication have ensured that there is easy accessibility to information nowadays. Such a development has contributed towards reducing the cost of computer hardware and thus creates an affordable market for consumers. The introduction of the internet, on its own, can be considered to be the brainchild of technology, catering to the needs of an information-starved society. It has provided us with unimaginable resources at our fingertips since, in the space of seconds, one can obtain any information desired. It has opened the gateway to accessing research publications more easily as well as they are now offered freely by open access journals online.

Architecture should take advantage of such breakthroughs to pave the way for the future but instead, displays a desolating lack of creativity in furthering its own progress in accordance with the new trend. While the field of sciences and social sciences has been enriched with knowledge accumulated in double blind peer reviews and authored books to promote the validity of the respective subjects, architecture faculties have been placid by comparison. The lack of architectural publications is astounding, even more so since one expects some consistency in high-cost research. Instead of striving to produce papers that help establish solid reference and knowledge about key, fundamental problems, they tend to create design work, edited collections, commentaries and “research with broadly humanistic bent—all good things”. (Forsyth 2007, 179). The scholarly production of each of those disparate components is not linked and therefore exists independently of each other instead of providing academic value to one another.

Architecture has to impose on itself an obligation to adapt and profit from the technological advantage at its hands. Technological capability is of critical importance to any new venture in establishing a lead role in domestic and international marketplaces. It is undeniably a crucial strategic resource that enables new projects not only to gain advantage on the market but also to attempt to establish a competitive advantage through the constant process of self-innovation. (Zou, Lui and Ghauri 2010, 100).
RESISTANCE TO INNOVATION

Unfortunately, along with innovation comes a strong sense of resistance. Psychological resistance is a broad notion that refers to various situations. Knowles and Linn (2004, 4) suggest that it encompasses the instinctive non-compliance that arises when a directive is imposed on one; it embodies the automatic desire to resist someone else’s attempt to limit our choices; it refers to peoples’ avoidance of unpleasant thoughts but also, and particularly relevant to us, it symbolizes the ambivalence that people have towards change. Hence, resistance to innovation is predictable and a very present reality. Customers invariably feel safer with their habitual choices and therefore view new situations or products with skepticism. Their lack of knowledge about said product or situation makes the notion of potential investment in them very risky. As we start addressing sustainable issues, change is an inevitable by-product of our new design trends. Designers should be able to showcase to customers the numerous advantages offered by those innovative products and demonstrate that their investment in such an enterprise is worthwhile, not only from the perspective of personal gain but also in the wider scheme of things. We have to remember that “Change and resistance go hand in hand: change implies resistance and resistance means that change is taking place.” (Gravenhorst 2003, 3).

The initial resistance is not only an active mechanism but occurs passively as well. This is largely the consequence of habit whereby a customer becomes entrenched in the safety of routine and is singly, the most powerful determinant in creating resistance. Human psychology epitomizes that tendency as our cognitive mechanisms work towards the preservation of habit since “the typical human tendency is to strive for consistency and status quo rather than to continuously search for, and embrace new behaviors” (Bagozzi and Lee 1999, 220).

Awareness about sustainability should be aimed towards, not only customers but also towards organizations involved in real estate. External and internal developments such as the current pressing issue of global warming are powerful incentives for organizations to change in order to adapt (Gravenhorst 2003, 3). However, one major barrier to such a change lies in the fact that organizations are made up of people who are inherently resistant to the concept of change. Thus, educating those parties is to be considered the primary objective of any organization. A change embraced by a big corporation or organization is more likely to influence others to act in a similar fashion and will more likely create confidence in customers. An example set by big numbers in big companies is an effective advocate for change.

CONCLUSION – A COLLABORATIVE CALL FOR CHANGE

The sheer importance of striving towards sustainability cannot be emphasized enough. Our planet has suffered and wept and yet we continue to turn a deaf ear to its pleas. We willingly blind ourselves to the fact that day by day, our climate continues to be subject to upheavals, our carbon dioxide emission is sky rocketing, our glaciers are retreating and our sea levels are rising, Little daily changes that over time accumulate to hasten global warming. Our planet threatens to self-combust and we are watching passively. It is important to realize and acknowledge our responsibility in this process. As architects, we can be advocates for change.
The essence for an ethically oriented architecture should encompass various factors, all with the same goal in mind: striving for an ecological future.

Architecture, unlike philosophy, cannot complain of a logical deficiency. Instead, it is ever dynamic and epitomizes poiesis, which is the making of things, either material or virtual. Whether it is at a conceptual level or firmly grounded in reality, architectural projects interfere with society and with our planet, thus contributing to the transformation of the world. Such transformation should be closely monitored and effectively channeled. Architects should be sensible and ethical in their endeavors and strive towards creating shelters that cohabit with nature.

As it stands, the future of architecture looks bleak. After modeling the principles of modernist ideology for almost 80 years, architecture has been deconstructed by different human generations to be shaped to the image of evolving cultures and societies. Such professional relativism has had a negative impact on the status of architecture worldwide. For instead of representing an authoritative single language, it has undergone division and judgment. It has reduced the natural and urban environment to a state of unprecedented barbarism and degradation.

Architects are environmental guardians and have a duty to not only encourage but to adopt sustainable approaches to construction. It is high time for us to become personal and professional advocates of a new kind of Architecture. Our work more than ever, should be clear in purpose, focused on the usage of appropriate materials, intent on pursuing not only urban construction but also regeneration of nature and dedicated equally to the service of status and wealth as it is to social equity. We have to prove ourselves worthy of our infallible human spirit and heed the cries for help of our planet. Passivity is as condemnable as ignorance and hence we should all rise to the situation and fight for the survival of our planet, the mother and sustenance of our future generations.

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Application of Compensatory Methods in Industrial Development Site Selection

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ABSTRACT

Like any other engineering projects, industrial unit site selection requires basic data and careful planning whereas; lack of comprehensive attention to this case causes deterioration of life quality, environmental degradation, destruction of natural resources, reduction of habitat areas and so on. Therefore, it is necessary to determine the suitability of land for implementation of industrial units to establish balance in ecosystems; natural and human environment, preservation and development of natural resources as well as coordination of development processes with environmental features. Considering a large volume of data and information layers required, without application of Geographic Information System, determination of areas owing suitability for industrial development is very time consuming and difficult. Selection of multiple factors is led to multiple information layers, thereby, efforts to find suitable solutions to analyze such a large number of layers as well as obtaining the correct result, lead decision makers towards application of a system enjoyed speed and ease of operation, besides the high accuracy. Study ahead aims at site selection of industrial development for establishment of coke making plant, using one of the relatively new compensatory decision-making methods; spatial analytical hierarchy process (S-AHP). The obtained results suggested that the application of compensatory methods along with eliminating criteria can be considered an appropriate powerful tool in decision making offered more accurate results in scientific and practical terms.

Keywords: Eliminating Methods; Spatial Analytical Hierarchy Process; Industrial Development; Site Selection.
INTRODUCTION

Each kind of development with every degree of quantity or quality is followed by specific environmental impacts. Human manipulation in the natural environment does not necessarily mean changes in the natural and primary environment. Continuity of human operation in changing the natural conditions can eventually disturb the current balance of the environment and follow a chain of unintended or unforeseen consequences. Industrial development and utilization of the facilities and capabilities in each region needs planning. Whatever the planning is based on objective realities and potential natural capabilities, achieving predetermined goals will be more possible. Implementation of land exploitation projects including construction of factories or industrial development involves examination of land natural capabilities for considered development purpose. Accordingly, site selection is among desired methods to achieve sustainable development goals (Kurtener et al, 2004). Site selection is performed to identify environmental features of the area wherein the proposed plan or project is established (FAO, 1993, Kheirkhah et al, 2010). Determination of the establishment place of industrial unit can apply as a planning tool in order to propel performance goals of a project in line with environmental laws and regulations (Shahbazi et al, 2009, Dai et al, 2001). Since, the ecological land capability evaluation is associated with complex and broad qualitative and quantitative variables thus, conducting such studies can be so complex. Solving the noted problem would not be possible without application of a powerful system as a reliable tool enabling to use and analyze multiple layers simultaneously. Considering the vast capabilities of GIS in decision-making process and ability to integrate and overlay information layers, the best appropriate and reasonable option to find out a suitable site for industrial development is application of GIS and its related technologies enjoyed high accuracy in addition to speed and ease of operation. Due to the high capability of GIS in management and analysis of layers, it can be used for optimal management of industrial development. Since 1990 onwards, integrated multiple criteria decision-making strategy (MCE) along with Geographic Information System (GIS), have been significantly intentioned by planners to solve spatial issues. Compensatory method is a multiple criteria analysis approach which provides a useful tool for decision making. The principle of the method is that the deficiency of a criterion is compensated by advantages of other criteria. Including compensatory methods applied in the current study is Analytical Hierarchy Process (AHP). AHP Method along with GIS provides a spatial, simple and flexible tool in solving complex issues within decision making process. The method has desirable application in examining the issues associated with land capability evaluation (Zaredar & Kheirkhah Zarkesh, 2011, Zaredar et al, 2010, Jozi et al, 2010, Rezakhani & Zaredar, 2011). Simultaneous investigation of qualitative and quantitative criteria, possibility of simplification, conversion of complex issues in the form of hierarchy, pairwise comparison and weighting of criteria, powerful analysis of issues, the simplicity of the computation and possibility of final prioritization of options are considered among special features of the method (Keeney, 1992, Ying et al, 2007, Hsu & F.C. Pan, 2009, Dagdeviren et al, 2009). Application of geographic information system techniques, multi criteria evaluation, spatial approach and analytical hierarchy process have been known as useful tools in determining land capability through recent researches. Şenera et al. (2010) combined AHP with GIS in determining the suitable landfill areas in Konya, Turkey. Results presented a standard tool for selecting suitable landfill sites. Chen et al. (2010) examined spatial sensitivity of multi-criteria weights in GIS-based land suitability evaluation. The research is a novel approach for examining weight sensitivity, recognizing the dependency of the model output on the weights...
of input parameters, and identifying criteria that are sensitive against weight changes. Radiarta et al. (2008) presented a new model for determining suitable aquaculture sites using geographic information system along with spatial multi criteria evaluation. Liu et al. (2007) applied a GIS-based system along with analytical hierarchy process to weight criteria. They presented a land use management model to establish a lake on the sideline of the central part of China. In 2008, Wong and Li examined effectiveness of analytic hierarchy process in selection of intelligent building systems.

The current study focuses on combination of geographic information system and a compensatory method; AHP in selection of suitable sites for industrial development. Thereby, site selection of a coke making plant located on Ravar County in Kerman Province was selected as a case study.

**MATERIAL AND METHODS**

**The study area**

The study area is situated in Ravar; a county in Kerman Province. The rectangular shaped study area is located within longitudes 56°11´45" to 57°00´00" E and latitudes 31°11´ to 31°00´00" N. In terms of topography, the height of the study area varies from 680m to 3450m and the western part of the area has a higher elevation than the eastern part. Much of the study area has a slope between 0 to 6 degrees. Knoll hills and deserts include the overall landscape of the study area. In terms of land cover, Ravar is considered among the poorest regions. The area tolerates desert, arid and ultra arid climate conditions through almost all of the eastern parts. The average annual rainfall of the watershed is 30 mm meanwhile, the annual dominant wind direction is north and monthly temperature in July and January are equal to 28.1 and 4.4°C respectively. The study area is situated in Kavir-e Lut Watershed and Ravar Plain. It is surrounded from the north by Kavir -e Markazi through low-elevation mountain ranges. Figure 1 demonstrates the situation of Kerman Province, Ravar County and the study area.

**Preparation of required data**

To select a suitable place for establishment of coke making plant, the required base map layers were collected. Afterwards, they were imported to the environment of GIS Software to prepare a geo-referenced database. The required information as well as their supply sources is briefly explained as follows:

1-the slope map of the study area: initially, 1:25000-scale topographic maps were reviewed and corrected and finally the slope map of the study area was obtained from it.

2- Land use map: the land use map was extracted from SPOT and ETM satellite images through processing with a great precision.

3- Fault map: The map was taken from the existing geological maps as well as visual interpretation of satellite images and aerial photos.
4- Communication road map: The thematic layer needed, was made using aerial photos, satellite images and available topographic maps.

5- The map of distance from urban centers, airports and other important areas of urban fringe: Information extracted from remote sensing technologies and local plans were found useful to create the map.

6- Mine map: the map of mines existed within the study area was prepared from Industries and Mines Organization of Kerman Province.

7- Geologic map: the geologic map was provided from Geological Survey of Iran on the scale of 1:100000.

It should be noted that some required maps, such as protected areas, pedology, urban areas etc. were provided from Amayeshgarane Pouyaye Mohit Consulting Engineers. Some softwares used through the mentioned above operations include Arc GIS 9.0, Arc View 3.6, ErDas, Excell and ILWIS 3.3.

Criteria selection

In the present study, in order to site selection of Ravar coke making plant in Kavir-e lut Watershed, multi criteria evaluation method was used. For this purpose, initially, appropriate criteria for industrial land use site selection were determined using literature reviews and gathering expertise’s opinion in the form of questionnaire. It is worth noting that some criteria are in the form of omissive factors. Eliminating criteria are considered as a constraint for construction of various development projects in case of environmental, geographic, economic, social and technical aspects (Zaredar et al, 2010, Jafari & Zaredar, 2011).

Table 1: elimination criteria for Ravar coke making plant

<table>
<thead>
<tr>
<th>Buffer (m)</th>
<th>mines</th>
<th>Transmission lines and buffer</th>
<th>Population centers and buffer</th>
<th>Fault and buffer</th>
<th>Ancient monuments</th>
<th>Road network</th>
<th>Protected areas</th>
<th>Surface water sources and buffer</th>
<th>Underground water resources and buffer</th>
<th>Land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>All mines existed through the study area</td>
<td>500</td>
<td>4000</td>
<td>300</td>
<td>-</td>
<td>70</td>
<td>1000</td>
<td>150</td>
<td>105</td>
<td>Agricultur e, forests and orchards, stream and pool, residential areas, rock and mine</td>
<td></td>
</tr>
</tbody>
</table>
As the name suggests, eliminating criteria limit available options. On the other word can be said that, eliminating criteria refer to the areas that are deleted from the study area due to being inappropriate for industrial development, having risks for the environment and human health as well as lack of economic affordability (Rezakhani & Zaredar, 2011). For example, wherein there are residential areas or irrigated agricultural land use, the industrial development will cause not only changing the land use of a part of the agricultural lands but also deteriorate the lands located in its vicinity over the long term. That is why; reductions in the rate of the agricultural product wouldn’t be something far from reality. Therefore, in order to use the noted above information layers, the constraint zones must be eliminated from the study area map. It should be mentioned that some eliminating criteria were removed from the main criteria maps as buffer zones. Eliminating criteria applied in this research are given in Table 1. Subsequently, constraint maps (eliminating criteria) of industrial development are demonstrated in Figure 1.

Parameters examined in site selection of coke making plant include two main groups; environmental factors and socioeconomic and cultural parameters (human). The main parameters were divided into sub-criteria which eventually included 18 effective parameters. Model designed for industrial development site selection of coke making plant is designed in form of Figure 3. The first stage indicates the main goal. The second and third stages show the main and sub criteria respectively. The importance of factors used in this study for coke plant making site selection is mentioned in the following briefly:

- Distance to road network: the importance of the criterion in site selection is considered from economic point of view. Whatever the length of the established route is shorter the costs associated with implementation will be decreased. It is worth noting that based on Roadway Buffer Policies offered by Department of Housing and Urban Development in 1976, a 70 m buffer zone was considered for the access roads through the study area (Kheirkhah Zarkesh et al, 2010). - Distance from population centers: The factor is important in terms of emissions and the impact on human health. Based on modelling the emissions as well as the release rate of nasty and unpleasant smell of ammonia and H2S from both inside and outside the site, it is concluded that there is a possibility of release and transfer of pollutants to a four-kilometre radius around the site. Therefore, a 4km buffer was considered as the city privacy. Whatever distance from population centers increases the site will enjoy more suitability for industrial development.
- Land cover density: whatever the density of the land cover is lower the considered site will find more desirability for establishment of coke-making plant.

- Geology: the geologic map was considered in terms of bedrock and fault. It is worth noting that faults are regarded as a factor increasing seismic potentiality.

- Distance from the cultural and archaeological monuments: Preservation of cultural, archaeological and historical monuments is one of the important cases which must be observed in industrial development. Whatever there is more distance from the cultural, archaeological and historical monuments the considered site will obtain more desirability. So far, no particular privacy policy has been considered for this criterion.

- Distance from mines: Proximity of the selected site to the coal mines is important in order to supply coal needed for coke making plant. The criterion is important not only in terms of reducing the negative environmental impact and economic costs but also, from technical viewpoint.

Slope, elevation, aspect, soil type, soil depth, distance from surface water, distance from underground water, distance from communication lines, land type and land use include other criteria regarded in the industrial development model to establish coke making plant.

Figure 2. Site selection model of coke making plant industrial development. (Copyright © 2012, Journal of Biourbanism)
Standardization of criteria maps

The values in the various input maps enjoy various meanings and are expressed in different measurement units (e.g. slope, aspect, geologic maps etc.). Therefore, to compare criteria with each other, all values are to be standardized, i.e. converted to the same unit of measurement (from 0 to 1 or 0 to 255). Such a process is called making dimensionless (ILWIS User's Guide, 2004).

In this study, in order to standardization of distance and buffer maps such as distance from protected areas, distance from surface water, distance from population centers, the cost and benefit analysis was used while one of the compensatory methods; AHP was applied for making dimensionless of the rest criteria (Kheirkhah Zarkesh et al, 2010).

Weighing of criteria

As it has already been mentioned, there are different criteria in connection with industrial development site selection that each of them has different weight and value than any other. Method used in this study to aggregate the numerical values of criteria is the compensatory method (Zaredar & Kheirkhah Zarkesh, 2011). The principle of this method is so that the low value of a criterion is compensated by high value of the other criteria. It means that if an option is ultimately chosen, may contain the lower value in terms of some criteria. Nonetheless, such a low value is compensated through the high values of the other criteria. In this method, numerical values of criteria are added together to convert the value of each location in the form of a final number called suitability index (SI). The suitability index (equation 5) was calculated for ranking the spatial objects.

\[ SI = RIA_1 \times \sum_{i=1}^{M} RIB_i \times RIKBi + RIA_2 \times \sum_{j=1}^{L} RIC_j \times RIKCy + \ldots RIAN \times \sum_{z=1}^{J} RIDz \times RIKDz \]  

Where, SI is the suitability index of each cells; N is the number of main criteria; RIA1, RIA2 …RIAN are the relative importance of the main criteria A1, A2 …AN, respectively; M, L and J are the number of sub criteria directly connected to the main criteria A1, A2 …AN, respectively; RIB, RIC and RID are the relative importance of sub criteria B, C and D directly connected to the main criteria A1, A2 …AN, respectively; RIKB, RIKC and RIKD are the relative importance of indicators category k of sub criteria B, C and D and main criteria A1, A2 …AN, respectively. This equation is prepared to four levels hierarchy and hence need to be modified for a decision hierarchy with more or fewer levels (Kheirkhah Zarkesh, 2005).

<table>
<thead>
<tr>
<th>Intermediate values</th>
<th>Extremely preferred</th>
<th>Very Strongly preferred</th>
<th>Strongly preferred</th>
<th>Moderately preferred</th>
<th>Equally important</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 4, 6, 8</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2: Preferences scale for pairwise comparison (Saaty, 1980)
Analytical hierarchy process method including among compensation methods is applied in the research ahead. The method introduced by Saaty in 1980 in on the basis of pair-wise comparisons. Table 2 gives preferences matrix for performing pair-wise comparison to determine suitable areas for industrial development.

Spatial analytical hierarchy process (S-AHP)

Combination approach of spatial data with AHP called Spatial Analytical Hierarchy Process (S-AHP) is applied in this study (Kheirkhah 2005; Siddipui et al., 1996). After applying the criteria weights, consistency ration (CR) was calculated (Saaty 1990, 1994). Conducted comparisons were shown CR<0.1 which means that the determined weights are acceptable (Saaty 1988, 1995). The weights of the sub-criteria obtained from AHP Method are illustrated in figure 3.

![Weights obtained from AHP method for the sub-criteria](Copyright © 2012, Journal of Biourbanism)

RESULT AND DISCUSSION

After weighing criteria, the final land suitability map owing numerical values between 0 and 1 was prepared. Figure 4 demonstrates the land suitability map for industrial development (implementation of coke making plant). It is worth noting that places demonstrated with green colour within the final map have the highest suitability degree (equal to 1) for the considered land use. Meanwhile, areas removed from the map are related to the eliminating criteria.
Figure 4. The obtained results related to the industrial development (with exerting eliminating criteria) (Copyright © 2012, Journal of Biourbanism).

Table 3 shows the obtained areas for different suitability degrees; weak, suitable and very suitable. Figure 5 derived from Table 3, demonstrates final classification map for various suitability degrees of industrial development.

<table>
<thead>
<tr>
<th>colour</th>
<th>Suitability degrees for making coke plant</th>
<th>classification of the pixels</th>
<th>area</th>
<th>class</th>
</tr>
</thead>
<tbody>
<tr>
<td>pink</td>
<td>Weak</td>
<td>0-0.5</td>
<td>973830000</td>
<td>1</td>
</tr>
<tr>
<td>Light green</td>
<td>Suitable</td>
<td>0.50-0.75</td>
<td>220210000</td>
<td>2</td>
</tr>
<tr>
<td>Dark</td>
<td>Very Suitable</td>
<td>0.75-1</td>
<td>--</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3: The obtained areas of land suitability degrees based on classification of pixels
Figure 5. Final classified map of industrial development suitability degrees for coke making plant establishment.

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Applying the elimination criteria in the form of constraint maps is somehow considered a stringent approach in principal site selection process and will determine the best possible locations. Finally, places owing the lowest suitability in terms of industrial development will be deleted and cannot be entered to the software analysis. It is important due to application of compensatory method (AHP) for weighing criteria whereas, places with the lowest weight value are rated higher through areas with higher weight values. In this study to compare the difference intensity of site selection without exerting the constraint, the analysis was performed once again regardless of existing limitations which remarkably different results were obtained. It should be mentioned that the green areas demonstrated in Fig. 5 indicate areas prone to industrial development.

CONCLUSION

As it has already been mentioned the current study aims at application of one of the compensatory methods called Analytical Hierarchy Process in site selection studies. In this method, inefficiency of a factor is offset by strength of others i.e. the aspect deficiency will be compensated by the slope. As stated by a research carried out by Zaredar and Kheirkhah Zarkesh in 2011, in urban development site selection, if somewhere has unsuitable aspect but suitable slope, the aspect deficiency will be compensated by the slope. But, sometimes, deficiency of proximity to fault can be compensated by other parameters strength. Study ahead focuses on deficiency elimination of the method by means of a combined approach of Boolean logic (in form of eliminating criteria) and AHP Method. On the other words, by application of the eliminating criteria thought the site selection process, the buffer zones in which no construction is allowed are practically removed from the analysis thereby won’t be offset by strength of any other factors. Generally, the results of the study can be highlighted in the followings:
1- In constraint based approach site selection due to the certain limitations applied, the number of selected sites is less than methods based on non-removal restrictions.
2- In terms of the confidence of the results, according to the restrictions removed, the results are more compatible with reality.

3- The findings of the study reveal the ability of GIS in Modelling and appropriate industrial development site selection as well as combination of various environmental socioeconomic criteria in different models.

4- In the study area, the numerical value is in the range of 0.27 to 0.61 and there is no very suitable class thought the area. This case shows the existing constraints for industrial development such that it can be pointed to the following:

-protected areas constrains: A wide range of the eastern part of Ravar County is protected as "Captive" Wildlife Refuge which is considered as a constraint for industrial development.

-topographic constraint: Very steep slopes make the development operations without economic justification.

It should be noted that these constraints are not just limited to Ravar County and according to the ecological circumstances, each region has its own constraints for considered land uses and goals.

REFERENCES


Affective Correlates of Landscapes for Passive Recreation in Institutional Campuses, Ogbomosho, Nigeria

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ABSTRACT

In view of the sparing quantity and low quality of purpose-built recreation facilities in urban centres coupled with the busy schedules of an average modern worker, there is need to design the outdoor landscapes of work environments like campuses for passive recreation. This should be based on scientific evidence of the correlation between specific built-landscape elements and their affective correlates. This study therefore aims to find these correlates. The study was carried out in Ogbomoso, Nigeria in three campuses by administering close-ended questionnaires on the parameters broken down into fine-grained variables upon randomly selected respondents \((N=261)\). Statistical results of the data obtained and analysed show that landscape elements for passive recreation have physical qualities that are attractable to human beings to evoke affective responses, and the two groups of variables are positively correlated. The study argues in favour of passive recreation through the outdoor landscape design of work environments and in conclusion suggests a robust approach to selecting elements for built landscape that will enhance suitable affects for passive recreation.

Keywords: Built Landscapes; Landscape Elements; Affective Characters; Passive Recreation.
INTRODUCTION

The relationship between the quality of landscape elements for passive recreation and the affective experiences that they invoke in the users is essential to the understanding of the process of functional built-landscape planning. Environmental psychologists and others have researched extensively (Kaplan and Kaplan, 1989; Kaplan, 1987; Kaplan, 1995; Hansmann et al., 2007; Ismail, 2003, etc) on the relationship between natural landscape sceneries and health, developing such concepts as “healing” landscapes. These valuable studies, located in the fields of environmental psychology and environment-behaviour can find application to urban built-landscape planning if their connection to the specific elements of built landscapes are understood through a scientific approach. This concern is the focus of the present study.

One of the bye-products of modern civilization is lack of adequate planning for active recreation as one of the major components of livelihood by humans in view of busy work schedules, religious activities and social engagements. Sati (2005) noted that during most of the seven or eight millennia of civilization the majority of men and women have had to work hard to sustain themselves and their families. The problem is often compounded when we think of the scanty quantity and sparing quality of purpose-built outdoor recreation facilities in our urban centres. It therefore becomes necessary that work environments like campuses should be designed for passive recreation making it almost compulsory for the busy users to recreate unconsciously. While such environment should possess high visual quality while still being functional, they should enhance the acquiring of the affective benefits obtainable in purpose-built outdoor recreation places like parks and gardens. To achieve this goal, such environment should be walkable and safe because walking and strolling are major components of passive recreation (Saelens and Handy, 2008).

Walking is one of the most common forms of physical activity, with documented benefits for health (Hu et al, 2002; Manson et al, 1999). Researchers and practitioners alike have come to appreciate the importance of the built environment in facilitating or constraining walking (Saelens and Handy, 2008). The built-landscape in particular, when properly planned and designed, being the domain of passive recreation, with people in mind constitute recreation sites of work environments. Also, Tahir and Roe (2006) argues that a good management of urban landscapes would have major influence in developing a quality environment, especially for therapeutic advantages. This assertion is true because of current knowledge about the positive effects of the non-human nature on the human nature. Kaplan (2001) discovered that having views of trees from one’s home may positively predict how relaxed and comfortable people feel. The visual landscape is therefore an important part of humanity’s everyday life experience (Bulut and Yilmaz, 2009).

There is a strong positive relationship between how restorative an environment is perceived to be and preferences for that environment (van der Berg et al, 2007). Accordingly, Hartig and Staats (2006) posit that landscape content has roles to play in people’s preference. Because preference is a function of quality appreciation, some environments may be more attractive to humans than are others (Heerwagen and Orians, 1993). White et al (2010) discovered that built environments containing water may evoke equal levels of preference as do green-only environments. In view of the limited number of landscape elements already researched on which are majorly on unbuilt landscapes as available in the literature in these directions, the
present study becomes necessary to generate a robust knowledge-based approach to urban built landscape planning for passive recreation at neighbourhood scale.

Furthermore, the sparing quantity and low quality of purpose-built recreation facilities in urban centres coupled with the busy schedules of an average modern worker is one of the banes of the contemporary human beings. Although the benefits of the non-human nature to the wellbeing of the human nature has been generally established in the literature, there is dearth of scientifically gleaned knowledge of the affective working mechanisms of specific and broad-based built landscape elements to guide a robust landscape design approach of work environments like tertiary institution campuses for passive recreation.

This study therefore aims to understand the relationships between the quality of landscape elements and the affective characters of landscapes towards application to functional neighbourhood built-landscape planning through the following objectives to: examine the quality of specific landscape elements; discover the strength of each affective characters of the landscapes; analyse the relationships between users’ quality judgement of specific landscape elements and the affective characters of the landscapes for passive recreation; and suggest a robust approach to selecting elements for built landscape that will enhance suitable affects for passive recreation.

RESEARCH QUESTIONS

1. What are the users’ judgements on the quality of specific landscape elements?

2. What is the strength of each affective characters of the landscapes evoked in the users during passive recreation?

3. Are there significant relationships between the users’ judgement on the quality of specific landscape elements and the strength of each affective characters of the landscapes evoked in the users?

THE STUDY AREA

The study was limited to built landscapes in view of the goal of application of the expected results to urban landscape planning. The study was therefore carried out in built landscape settings of three higher institution campuses which are neighbourhoods to satisfy spatial scale requirement. The study area was selected because they are work environments with high cognitive demands that could be supported by high quality affective environments. The three campuses are representatives of their typologies – university, teaching hospital and theological seminary. These are Ladoke Akintola University of Technology (LAUTECH) Campus, Bowen University Teaching Hospital Campus (BUTH) and Baptist Theological Seminary (BTS) Campus, respectively (Plate 1). They are all located in Ogbomoso along Ilorin road. Ogbomoso is located on the 8°10′ North of the equator and 4°10′ East of the Greenwich meridian. It is a derived Savannah region and it is 104 km North East of Ibadan, 58 km North West of Osogbo, 57 km South West of Ilorin and 53 km North East of Oyo.
The three campuses are moderately landscaped and their landscape elements can be broadly categorised as structural materials (Table 3), plant materials (Table 4) and enrichment items (Table 5). The landscapes are deemed suitable for the study because they possess sufficient elements as shown in the sample Plates 1-6 below. However, buildings as parts of structural landscapes were not included in the study except in the general area of building massing in relation to openness of the landscapes.

Figure 1: Road map of Ogbomoso, Nigeria showing the location of the three campuses.
Source: Adapted from Ogunkan and Jelili (2010).
Plate 1 A typical walkable landscape at LAUTECH Campus, Ogbomoso, Nigeria.

Plate 2 A typical outdoor seating area shady trees at LAUTECH Campus Ogbomoso, Nigeria.

Plate 3 A typical paved walkway guided with flowering plant edges at Bowen University Teaching Hospital, Ogbomoso, Nigeria.

Plate 4 A paved driveway, exotic palms and concrete kerbs at Bowen University Teaching Hospital, Ogbomoso, Nigeria.

Plate 5 Good combination of structural, plant Greenery and enrichment items at Baptist Theological Seminary, Ogbomoso, Nigeria.
(Pictures’ Source: Author’s field survey, 2011)

Plate 6 A walkable landscape and for passive recreation at Baptist Theological Ogbomoso, Nigeria.
JUSTIFICATION FOR THE STUDY

Functional landscape planning takes cognisance of users’ value-system presented in subjective assessments because of the relationship among people, place and nature. This study therefore becomes necessary to appreciate the physical-affective components of landscape benefits and to provide data to inform specific future decisions on built landscape planning. Furthermore, the current state of the society’s civilisation suggests the need to provide properly landscaped work environments for passive recreation. This can best be guided by a robust landscape design approach based on scientifically gleaned knowledge of the affective working mechanisms of built urban landscapes.

DEFINITION OF AFFECTIVE TERMS

Relaxing: The affective character of landscape to bring about the refreshment of body or mind through recreation.

Fascinating: The affective character of landscape extremely interesting or charming.

Enjoyable: The affective character of landscape to evoke pleasure or satisfaction in the users.

Inviting: Attractive and tempting affective character of landscapes to be welcoming.

Restful: Affording, marked by, or suggesting rest from visual contact with landscapes.

Inspiring: The affective character of landscape to cause great emotional or mental stimulation.

Pleasant: The affective character of landscape having qualities that tend to give pleasure.

Comfortable: The affective character of landscape allowing, producing or having pleasant bodily relaxation.

Beautiful: The affective character of landscape having beauty, giving pleasure to the senses or the mind

Exciting: The affective character of landscape producing excitement

Recuperative: The affective character of landscape to affect recovery from sickness or exhaustion; regain health or strength

Therapeutic: The affective character of landscape having or exhibiting healing powers.

Restorative: The affective character of landscape capable of renewing health or strength.
THEORETICAL ISSUES

According to Zevi (1978), the design process must be concerned with: “...an architecture that is not isolated but can communicate with its external reality”. Zevi’s view is consistent with Neutra’s (1954) who stressed that the design profession needs to be guided by “tangible observations rather than abstract speculations”. Environmental scientists have also criticised architectural aesthetic theory for its lack of external validity (Lang, 1987). Under the above circumstances, expert judgements of impact cannot be completely objective. The above criticisms point to the importance of taking into consideration lay public reactions and to the surrounding setting of developments in visual impact assessment. In other words, any assessment made by designers should be based on ascertainable facts rather than purely on the intuitive judgements of architects. Ascertainable facts are obtained from “tangible observations” of the physical characteristics of landscape and development, and public response. If this is true in the case of the general built environment, it is truer with built urban landscape where humans live, work and recreates consequent upon the perfect manifestation of the non-human nature in them.

Ulrich’s (1993) functional-evolutionary perspective suggests an importance for humankind to be in contact with the natural environment for a range of affective functions, such as stress reduction. In addition, Kaplan and Kaplan’s (1989) attention restoration theory proposes that the natural environment may provide a range of important qualities, like fascination, that aid recovery from over-exertion of psychological capacities. Therefore, exposure to the natural environment has been shown to have a range of psychological benefits such as the restoration of cognitive abilities diminished by mental over-exertion, stress reduction and the evocation of positive emotions (Abraham et al, 2010). For example, having views of trees from one’s home may positively predict how relaxed and comfortable people feel and trees in inner-city and suburban environments may be related to increased feelings of safety. Research indicates that indirect, even subliminal exposure to natural environments (Korpela et al, 2002; Schultz and Tabanico, 2007) tends to elicit largely positive affective reactions (Ulrich, 1993; van den Berg et al, 2003).

HYPOTHESES

Following from the aim, specific objectives and research questions of this study, three null hypotheses are germane:

H01: Landscape elements for passive recreation have no physical qualities that are attractable to human beings to evoke affective responses;

H02: Landscape elements for passive recreation have no affective qualities evoked in the users;

H03: There are no significant relationships between the physical qualities of landscape elements for passive recreation and the affective qualities evoked by the landscapes in the users engender.

H01 and H02 are univariate while H03 is bivariate.
METHODOLOGY

The study was carried out through administration of questionnaire (N =263) upon randomly sampled respondents in each campus, physical observation and photographic recording. The questionnaire design was based on environmental preference model (Herzog and Bosley, 1992; Mahdieh et al., 2011) of aesthetic appreciation. A combination of both 5-point and 7-point Likert scales was used to assess the landscape appreciation parameters of fine-grained classification of landscape elements. The content of the questionnaire was divided into two factors of quality of the landscape elements for passive recreation and affective responses that are psychologically acclaimed to landscapes. The landscape elements broadly include three domains of structural materials, plant materials and enrichment items. The 7-point Likert scale for the landscape elements quality assessment was ordered as: Absent (1), Very Poor (2), Poor (3), Fair (4), Good (5), Very Good (6) and Excellent (7). The affective qualities of the landscapes were ordered on 5-point Likert scale as: Strongly Disagree (1), Disagree (2), Not Sure (3), Agree (4), Strongly Agree (5). Subjective assessment is acceptable as scientific evidence in landscape research (Galindo et al., 2000; Ismail, 2003). Descriptive statistics of Means, Mode, Median, Standard Errors and Standard Deviations and inferential statistical analysis of Spearman’s rho of the data obtained was carried out with Statistical Package for the Social Sciences (SPSS) 16.0 version. Spearman rho is a non-parametric bivariate correlation that allows for test of significant relationship of two variables, one dependent (affective quality in this study) one independent (landscape elements physical quality in this study), both of which are in ordinal scales (Kothari, 2004). The univariate analysis is essentially descriptive.

DISCUSSION OF RESULTS

Respondents

A total number of 261(100%) respondents answered and returned the questionnaire administered upon them. This was possible because of the specific instructions in this regard given to the research assistants constituted by the 300 Level students of the Department of Architecture of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria. While the study population comprised of all staff, students and entire outdoor open spaces of the three campuses under study, this total number was distributed in a sampling frame as follow: LAUTECH, 102 (39.1%); BUTH, 71 (27.2%); BTS, 88 (33.7%). This sampling distribution is judged suitable for the study in view of the relative population and landscape size of the three campuses. Also, 163 (62.5%) males and 98 (37.5%) females participated in the study. The respondents are composed of both staff and students of the institutions with the following educational status: No formal Education, 5(1.9%); Primary Education, 4(1.5%); Secondary School, 27(10.3%); ND/NCE, 42(16.1%); HND/Degree/Undergraduates, 149(57.1%); Postgraduate, 34(13.0%). Their age distribution is as follow: Less than 16yrs., 2(0.8%); 16 - 24yrs., 125(47.9%); 25 - 39yrs., 91(34.9%); 40 - 59yrs., 38(14.6%); 60 - 75yrs., 5(1.9%). The disciplines of the respondents are as follow: Science, 74(28.4%); Theology, 54(20.7%); Environmental, 36(13.8%); Medical, 55(21.1%); Management, 30(11.5%); Arts, 12(4.6%). These demographic distributions are judged suitable for reliable responses.
Null Hypothesis H₀₁

Table 1 below shows the unvaried analysis of the physical qualities of the landscape elements as reported by the respondents to answer the research question 1 and test the null hypothesis H₀₁ which states that Landscape elements for passive recreation have no physical qualities that are attractable to human beings to evoke affective responses.

From Table 1, on a scale of 1 to 7 with 7 being the best physical quality status, the mean physical qualities of the landscape elements for passive recreation ranges from 3.05 (± 1.817 SD) for Water Fountain in the domain of enrichment items to 4.93 (± 1.330 SD) for Road Network in the domain of structural materials. Also, on the lower quartile in the mean landscape elements quality is Zebra Crossing, 3.10 (± 1.938 SD). This general pattern of the result is expected since only LAUTECH has two water fountains, one each at MKO Lecture Theatre and Olusegun Oke Central Library, none of which is functioning, out of the three campuses. The result of the road network also agrees with the physical realities in each campus all the zones being properly connected with driveways. In the case of Zebra Crossing, the result explains the lack of it in necessary points within the landscape in the three campuses.
Table 1
Descriptive Statistics of Respondents’ Assessment of Physical Quality of Landscape Elements

<table>
<thead>
<tr>
<th>Statistic</th>
<th>N</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Sum Statistic</th>
<th>Mean Statistic Std. Error</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road network</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1286</td>
<td>4.93 .082</td>
<td>1.330</td>
</tr>
<tr>
<td>Drainage</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1283</td>
<td>4.92 .079</td>
<td>1.277</td>
</tr>
<tr>
<td>Paved walkways</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1180</td>
<td>4.52 .095</td>
<td>1.538</td>
</tr>
<tr>
<td>Designed car park</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1205</td>
<td>4.62 .089</td>
<td>1.433</td>
</tr>
<tr>
<td>Plant hedges</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1222</td>
<td>4.68 .085</td>
<td>1.376</td>
</tr>
<tr>
<td>Water fountain</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>796</td>
<td>3.05 .112</td>
<td>1.817</td>
</tr>
<tr>
<td>Garden sculptures</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>959</td>
<td>3.67 .109</td>
<td>1.766</td>
</tr>
<tr>
<td>Campus plazas</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>928</td>
<td>3.56 .107</td>
<td>1.724</td>
</tr>
<tr>
<td>Paved driveways</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1145</td>
<td>4.39 .091</td>
<td>1.467</td>
</tr>
<tr>
<td>Pedestrian outdoor lighting</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1106</td>
<td>4.24 .102</td>
<td>1.654</td>
</tr>
<tr>
<td>Green (shaded) way</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1116</td>
<td>4.28 .101</td>
<td>1.636</td>
</tr>
<tr>
<td>Parking space distribution</td>
<td>261</td>
<td>1</td>
<td>7</td>
<td>1179</td>
<td>4.52 .087</td>
<td>1.402</td>
</tr>
<tr>
<td>Outdoor seats or seating area</td>
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<td>7</td>
<td>1159</td>
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<td>Shading tress</td>
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<td>1275</td>
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<td>Tree shading of parking lots</td>
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<td>Informal meeting places</td>
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<td>7</td>
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<td>3.59 .120</td>
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<tr>
<td>Local Palms</td>
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<td>7</td>
<td>990</td>
<td>3.79 .114</td>
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<tr>
<td>Outdoor ramps or steps</td>
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<td>1</td>
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<td>1086</td>
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<td>7</td>
<td>1067</td>
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<td>1.792</td>
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</tbody>
</table>

Source: Authors Field Survey, 2011

Generally, all the other mean results obtained reveal the rating of the quality of the landscape elements by the respondents to be above the average of 3.5 on the 7-point scale. Particularly of note are the following: Paved walkways, 4.52 (± 1.538 SD); Green (shaded) ways, 4.28 (± 1.636 SD); Outdoor seats or seating area, 4.44(± 1.379 SD); Shading trees, 4.89 (± 1.287 SD); Grass lawn, 4.33 (± 1.600 SD); Tree shading of parking lots, 4.02 (± 1.615 SD); Outdoor ramps or steps, 4.16 (± 1.713 SD). These results suggests that the respondents give high priorities to these plant materials and structural elements and are very conversant of them as they are very essential the users’ passive recreational activities of walking, jogging and social interaction within the landscapes.

Based on these findings, it is reasonable to conclude that Null hypothesis H01 cannot be true and therefore Landscape elements for passive recreation have physical qualities that are attractable to human beings to evoke affective responses.
**Null Hypothesis H₀₂**

Table 2 shows respondents’ assessment of the affective quality of the landscapes under study on a 5-point Likert scale 1 to 5 with the maximum 5 indicating that respondent strongly agrees with the fact that the landscape has the particular affective quality in question invoked in the respondent. This is to answer the research question 2 and test the univariate Null hypothesis H₀₂ which states that

Table 2.
Descriptive Statistics of Respondents’ Assessment of Affective Quality of the Landscapes

<table>
<thead>
<tr>
<th>N Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Sum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Error</th>
<th>Std. Deviation</th>
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<td>1</td>
<td>5</td>
<td>928</td>
<td>3.56</td>
<td>.072</td>
</tr>
<tr>
<td>Fascinating</td>
<td>261</td>
<td>1</td>
<td>5</td>
<td>901</td>
<td>3.45</td>
<td>.071</td>
</tr>
<tr>
<td>Enjoyable</td>
<td>261</td>
<td>1</td>
<td>5</td>
<td>906</td>
<td>3.47</td>
<td>.070</td>
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<td>Inviting</td>
<td>261</td>
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<td>5</td>
<td>868</td>
<td>3.33</td>
<td>.074</td>
</tr>
<tr>
<td>Restful</td>
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<td>1</td>
<td>5</td>
<td>912</td>
<td>3.49</td>
<td>.072</td>
</tr>
<tr>
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<td>261</td>
<td>1</td>
<td>5</td>
<td>924</td>
<td>3.54</td>
<td>.075</td>
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<tr>
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<td>261</td>
<td>1</td>
<td>5</td>
<td>936</td>
<td>3.59</td>
<td>.073</td>
</tr>
<tr>
<td>Comfortable</td>
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<td>1</td>
<td>5</td>
<td>928</td>
<td>3.56</td>
<td>.075</td>
</tr>
<tr>
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<td>5</td>
<td>950</td>
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<td>.072</td>
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<td>5</td>
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<td>.070</td>
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<td>Recuperative</td>
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<td>1</td>
<td>5</td>
<td>854</td>
<td>3.27</td>
<td>.069</td>
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<tr>
<td>Therapeutic</td>
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<td>5</td>
<td>853</td>
<td>3.27</td>
<td>.070</td>
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<tr>
<td>Restorative</td>
<td>261</td>
<td>1</td>
<td>5</td>
<td>936</td>
<td>3.59</td>
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<td>Valid N</td>
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<td></td>
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</table>

Source. Authors Field Survey, 2011

**Null Hypothesis H₀₃**

*Landscape elements for passive recreation have no affective qualities evoked in the users.*

All the affective responses are rated high by the users of the landscapes for passive recreation considering the 5-point nature of the scale used where the average would be 2.5 score. For instance, Restorative quality, 3.59 (± 1.615 SD); Pleasant, 3.59 (± 1.179 SD); Relaxing, 3.56 (± 1.615 SD); Inspiring, 3.54 (± 1.615 SD); Beautiful, 3.64 (± 1.160 SD) all indicates that the users derive high quality affective responses from the landscapes. This suggests that when built urban landscapes are designed with passive recreation of the users in mind, they serve functions primarily derivable from parks, gardens and other recreation open spaces for which the average human being does not have any plan for, aside from the bad state of the few existing ones. Consequently, it is reasonable from these findings to accept that *Landscape elements for passive recreation have affective qualities evoked in the users.*

Tables 3, 4 and 5 show the affective correlates of landscape elements of built urban landscapes divided into three domains of structural materials, plant materials and enrichment items respectively to answer the research question 3 and test the bivariate Null hypothesis H₀₃ which states that “There are no significant relationships between the physical qualities of
Thirteen affective responses of humans to landscapes were studied. From Table 3, the respondents indicated that all structural elements of the landscapes have affective characters for passive recreation, however in varying degrees and peculiarities. For instance the maximum correlation coefficients for the following matrixes are: Road network and Pleasant \((r = 0.451; p = 0.01)\); Drainage and Restful \((r = 0.432; p = 0.01)\); Paved walkways and Pleasant \((r = 0.539; p = 0.01)\); Designed car park and Therapeutic \((r = 0.442; p = 0.01)\); among many others. These results can be summarized thus: Most Enjoyable structural materials for passive recreation include Zebra crossings, Road surfacing, Adequate fence scale and Informal outdoor meeting places. Also, an Inviting built landscape should have Campus plazas and good Parking space distribution. Outdoor ramps or steps enhance a Restful landscape while an Inspiring landscape should be designed with adequate Road side walks and Outdoor ramps or steps. Pleasantness in landscape can be provided through Paved walkways and Road network, Outdoor ramps or steps enhances Comfortable landscapes while Paved walkways has the attribute of evoke Beauty. Paved driveway is Exciting while Outdoor ramps, stairs and paved walkways are Recuperative, Therapeutic and Restorative.

From Table 4, in the plant materials domain, Plant hedges produces the most Inspiring \((r = 0.460; p = 0.01)\) landscape, Green (shaded) ways is Inviting \((r = 0.460; p = 0.01)\) and Pleasant \((r = 0.534; p = 0.01)\). While Shading trees are most Enjoyable \((r = 0.450; p = 0.01)\) along with Grass lawn \((r = 0.509; p = 0.01)\), Tree shading of parking lots are most Fascinating \((r = 0.534; p = 0.01)\). Exotic palms are highly Fascinating \((r = 0.602; p = 0.01)\), Enjoyable \((r = 0.575; p = 0.01)\), Inviting \((r = 0.580; p = 0.01)\), Exciting \((r = 0.521; p = 0.01)\) and Therapeutic \((r = 0.553; p = 0.01)\) while Local palms are Fascinating \((r = 0.575; p = 0.01)\) and Enjoyable \((r = 0.566; p = 0.01)\).

From Table 5, in the enrichment items domain, Water fountain and Garden sculptures are most Fascinating \((r = 0.463; p = 0.01)\) and \((r = 0.441; p = 0.01)\) respectively. Pedestrian outdoor lighting is the most Pleasant \((r = 0.481; p = 0.01)\) just as Outdoor seats or seating area produces the most Restful \((r = 0.418; p = 0.01)\) landscape. Outdoor waste bins enhances an Enjoyable landscape in similar manner as Decorative outdoor lighting \((r = 0.546; p = 0.01)\) and \((r = 0.567; p = 0.01)\) respectively.

**CONCLUSION**

The major findings of this study can be summarised as follow:

Built landscapes of urban work environments like tertiary institution campuses have quality potentials and physical characteristics for passive recreation and be suitable substitutes for urban parks and gardens and other places of active recreation;

Built urban landscapes have affective qualities for passive recreation can be enhanced by making them more walkable;
There are significant correlations among the many variables of built urban landscape elements and the affective characters that they evoke in the users when engaged for passive recreation. Therefore, to achieve the best built landscape design that will engender appropriate affective functions for passive recreation the right mix of landscape elements is required to be used.

**RECOMMENDATION**

In view of the findings of this study, it is necessary to suggest and recommend the following: Evoking the best set of affective functions is essential to the design and planning of functional urban built landscapes for passive recreation. This can be achieved by ordering the landscape elements used for the design accordingly such that structural materials are minimally used for pedestrian and vehicular circulation routes only. Deliberately made long pedestrian routes should be designed for highly-walkable outdoors while motorized circulation should be extremely minimised. Accordingly, parking lots should be centralised as much as possible except where extremely essential for goods carriage. This will force users to engage in unconscious passive recreation. On the whole, the built landscapes of work environments can be transformed to passive parks and gardens and recreation sites through conscious efforts that have potentials of producing unconscious passive recreation lifestyle adjustment for the busy modern population with the best affective benefits.

**REFERENCES**


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Table 3. Correlations Matrix of Respondents' Assessment of Physical Quality of Landscape Structural Materials and Affective Quality of the Landscapes

<table>
<thead>
<tr>
<th>Spearman’s rho</th>
<th>Relaxing</th>
<th>Fascinating</th>
<th>Enjoyable</th>
<th>Inviting</th>
<th>Restful</th>
<th>Inspiring</th>
<th>Pleasant</th>
<th>Comfortable</th>
<th>Beautiful</th>
<th>Exciting</th>
<th>Receptive</th>
<th>Therapeutic</th>
<th>Restorative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.000</td>
<td>N=344</td>
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<td>0.443***</td>
<td>0.451***</td>
<td>0.461***</td>
<td>0.378***</td>
<td>0.405***</td>
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<tr>
<td>Sig. (2-tailed)</td>
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<td>0.404***</td>
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<td>0.342***</td>
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<tr>
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<td>0.501***</td>
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<td>0.426***</td>
<td>0.435***</td>
<td>0.414***</td>
<td>0.318***</td>
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<td>0.437***</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
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<td>0.409***</td>
<td>0.419***</td>
<td>0.452***</td>
<td>0.409***</td>
<td>0.378***</td>
<td>0.382***</td>
<td>0.396***</td>
<td>0.398***</td>
<td>0.318***</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
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<td>0.478***</td>
<td>0.479***</td>
<td>0.479***</td>
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<tr>
<td>Source: Authors Field Survey, 2011</td>
<td>***, Correlation is significant at p&lt;0.01 level (2-tailed)</td>
<td>***, Correlation is significant at p&lt;0.01 level (2-tailed)</td>
<td>***, Correlation is significant at p&lt;0.01 level (2-tailed)</td>
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<td>***, Correlation is significant at p&lt;0.01 level (2-tailed)</td>
<td>***, Correlation is significant at p&lt;0.01 level (2-tailed)</td>
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Table 4. Correlations Matrix of Respondents' Assessment of Physical Quality of Landscape Plant Materials and Affective Quality of the Landscapes

<table>
<thead>
<tr>
<th>Spearman’s rho</th>
<th>Relaxing</th>
<th>Fascinating</th>
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<th>Restful</th>
<th>Inspiring</th>
<th>Pleasant</th>
<th>Comfortable</th>
<th>Beautiful</th>
<th>Exciting</th>
<th>Receptive</th>
<th>Therapeutic</th>
<th>Restorative</th>
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<td>0.445***</td>
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<td>0.451***</td>
<td>0.467***</td>
<td>0.389***</td>
<td>0.350***</td>
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**Correlation is significant at p<0.01 level (2-tailed)**
Table 5: Correlations Matrix of Respondents' Assessment of Physical Quality of Landscape Enrichment Items and Affective Quality of the Landscapes

<table>
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<th>Restful</th>
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<td>Garden sculptures</td>
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<td>0.381**</td>
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<td>0.460**</td>
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<td>0.412**</td>
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<td>0.436**</td>
<td>0.469**</td>
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<td>Outdoor waste bins</td>
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<td>Decorative outdoor lighting</td>
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Source: Authors' Field Survey, 2011

** Correlation is significant at \( p < 0.01 \) level (2-tailed).
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Part B – Papers selected by the Editors
Patterns with a Heart

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This paper was presented to the European Association for Architectural Education (EAAE) Conference 'New Urban Configurations', held in Delft, The Netherlands, October 16th-19th 2012, and will be re-published within the Conference proceedings. We are grateful to EAAE for the permission to publish it in JBU first.

Keywords: Meaning; Analogy; Spatial Patterns; Centres; Boundaries.

THE MISSING INGREDIENT IN TYPOLOGICAL STUDIES: ANALOGY

‘What is a typology?’ the first-year student asks. The professor answers with abstractions: ‘A configuration of spaces’. ‘Then how do those spaces work together to form a building I want to be in?’ rejoins the student. The professor is stunned. He was all ready to instruct the student in how typologies come to be: through use, through the distances available building materials can easily span, through changes in the economic and social structure of the city. But the student has hit the nail on the head and hit the professor in his heart. The student asks the question we all ask, if we are honest: ‘What does a typology do for me?’

When we ask what something does for us, we’re asking what it means for us, what it does with us. We have already gone beyond use, beyond comfort, beyond economy; we have, in fact, gone beyond regarding a building as a mere thing. A thing can hardly be a source of real meaning for us. But a building that reminds us who we are: that’s a different story altogether.

If we look at what we’ve built, through time and across cultures, we find spatial patterns and compositions of building parts that speak to us through analogy. A column is not a mere support: we see in it a person standing, straining under the load he has to bear (Rykwert, 1996, 372-391). An atrium is not simply a convenient central patio: we recognize in it our innermost world, our heart (Laan, 2008, 16). A window surround is not only a means of protecting the window frame:
we stand before a complete house in miniature. The whole façade then becomes a streetscape full of houses next to and atop each other.

When we build with an architectural language that speaks to us through analogy, we build a world that comes alive for us. It comes alive because it engages our primary way of knowing: not through thought, but through encounter – through discovery, through revelation, through images. We can define aliveness: it’s when a space, a building element, a typology greets us as an other whom we can relate to rather than as a thing that we can design and manipulate.

Figure 1. Santa Sabina, Rome. Author’s photo.
PATTERNS WITH A HEART IN A BUILDING

When we experience a space as alive, we could say it’s a pattern with a heart: after all, all living beings have hearts. But a pattern with a heart can also be a physical configuration that makes and defines centres in both space and boundaries. Santa Sabina in Rome (Fig. 1) fairly immerses us in patterns with a heart.

We could come to Santa Sabina only with our head – only the parts of our brain that think. And if we did, we would repeat to ourselves an old, reductive story: ‘The basilica as type existed long before we turned it into a church. The type arose as an attempt to create a large, well-lit central space sandwiched between smaller serving spaces on either side of it. Use and technology alone engendered the basilica.’ End of story.

We could come to Santa Sabina only as Christians, but then we would be judging her exclusively in terms of how she helped us celebrate the liturgy. End of story.

Let’s come to Santa Sabina simply as human beings who know immediately how we feel and what we associate when we dwell in her spaces. What do we meet? Spaces between the columns that form a perforated wall. Spaces between the outside walls and the colonnades that define the nave. The space of the nave between the spaces of the side aisles. Within the space of the nave yet another space greets us: the garden wall around the schola. And within the space of the schola we meet its heart in the form of the altar. The story the spaces tell is a story of centres – centres bounded and contained by other spaces that exist thanks to the walls that form them.

Once we’re aware of the theme of spaces with a centre – of a pattern with a heart – we discover that the heart need not be the centre of walls or spaces: it can also be the goal, the endpoint, of a spatial development. That is exactly what we encounter in the apse. The apse plays two roles: she emphasizes the altar as the centre of our attention, and she reflects our attention back to us. Everything we see and experience outside ourselves is thus an image of everything we see and experience inside ourselves. The architectural language in the outer world we build leads us to the inner world we carry with us. We have built a pattern with a heart.

Were we aware we built a pattern with a heart? Possibly not. But that’s not the point. The point is that we were able to build a world that speaks to us, that reminds us who we are, that embodies our own make-up.

PATTERNS WITH A HEART IN PSYCHOLOGY

Our own make-up? That’s our psychological development. Winnicott, who spent his life observing children, concludes that we contain every stage of our development in order to remember where we came from (Winnicott, 1971). First we and the world are one: we are mother and breast, brother and beast, light and dark, the figures in our dreams and the people in our waking life. We develop our awareness as an emerging person when we contain our experience
of moving from one stage of development to the next. We weave boundaries around them. We need to collect them in order to remind ourselves of our origin. We begin in an undifferentiated world that is both enchanted and threatening. We discover we can relate to that world as an other. We discover we can relate to our current world as an other.

Jung discovered that children the world over draw mandalas – patterns with a heart (Jung, 1977, 355-390). Jung concludes that the configuration of a mandala (a circle or a square with a clear centre and clearly defined quadrants or segments) reflects the development of our conscious awareness (our ego) out of our original being (our inner world of images). The mandala reminds us of our centre. Our ego is not the centre: our ego relates to that centre.

**PATTERNS WITH A HEART IN ARCHITECTURE AND TOWNS**

Now we begin to glimpse the objective basis of Alexander’s Fifteen Properties in *The Nature of Order* (Alexander, 2012, 143-296). Alexander concludes that the spaces and buildings and towns that speak to us, that invigorate us, that bring us home, embody 15 discernible properties. If we look at those properties, we discover they are all patterns with a heart. The world we build nourishes us when it comes alive for us. And it comes alive for us when it greets us as a living being. That living being is our projection of our own development and our own goal in our development, in our life.

Léon Krier arrives at a similar configuration after comparing the spatial structure of traditional cities with the spatial structure of contemporary cities (Krier, 2007, 121-170). Krier demonstrates that a single centre surrounded by unlimited suburbs is simply not sustainable or ecological: people are forced to travel long distances between their homes and their jobs, between their private worlds and their public worlds. In both his writings and his built works Krier proposes patterns of development with centres: towns with town centres within the larger city they comprise. Now the pattern with a heart is rooted not only in our own nature but in the nature of the world as well.

**PATTERNS WITH A HEART IN NATURE**

Salingaros and Mehaffy take us from the configuration of city spaces to the order of cells in living beings. They demonstrate that cells and groups of cells create wholes (Salingaros, 2012). Cells within groups of cells within groups of cells are patterns with a heart within larger patterns with a heart. It’s the nature of life, as Mandelbrot has demonstrated in his study of fractals. Fractals are structures with centres that contain structures with centres. Once a structure has contained its centre by weaving a boundary round it, it replicates the pattern. Now there are two, three, many patterns with a heart. Within themselves they contain centres. Together they contain a centre common to the larger structure.

**PATTERNS WITH A HEART IN POETRY**
Containing a centre is what we do when we discover rituals. We don’t invent rituals consciously: we find ourselves acting them out, marking a seminal or a liminal event in our lives (Neumann, 1974, 154). When Coleridge has a numinous dream, he concludes his tale of the dream by describing a pattern with a heart (Abrams, 1962, 199):

Weave a circle round him thrice,
And close your eyes with holy dread,
For he on honey-dew hath fed
And drunk the milk of Paradise.

But sometimes in our collective history, we lose touch with the pattern with a heart. Yeats paints the picture (Abrams, 1962, 1355):

Turning and turning in the widening gyre
The falcon cannot hear the falconer;
Things fall apart; the centre cannot hold;
Mere anarchy is loosed upon the world. . .

We are the falcon, Yeats reminds us after the horrors of World War I. We have lost touch with the falconer – with our experience of history, with our psychological origin, with our centre. Yeats does not discover his images through logical analysis: he receives them, just as a prophet does. And prophets, throughout history, have given us knowledge through the images that visited them. We discovered images and rituals long before we turned their messages into laws and taught ourselves to think discursively (Frankfort, 1974, 11-36 and Girard, 2001, 82-94).

THE HISTORICAL DENIAL OF ANALOGY AS A VALID WAY OF KNOWING

Images are the key to understanding how knowing through analogy works. When we meet an image, we don’t see only the image: we see what it points to, what it suggests, where it leads us as well. Two children standing across from each other clasp each other’s outstretched arms. They create London Bridge without explaining it. All the players understand immediately what they’re doing.

But when we think discursively, we inhabit a world of logical connections. The connections that images make with us strike us as illogical. We no longer trust them as a source of knowledge. The architects who devised and signed the CIAM declaration at La Sarraz in 1928 mistrusted images. Their thinking led them to conceive of town planning solely as ‘the organization of the functions of collective life’ (Woud, 1991, 210). Their vision continued at the scale of the building: the signers aimed at ‘replacing architecture on its true plane, the economic, and sociological plane’ (CIAM’s, 2011). Where are the images – the analogies – in a vision based on use alone?

Professional architects have themselves become the ego alienated from its own source, its history, its centre. In denying the validity of meaning in all inherited architecture, they have taught
succeeding generations to design buildings and towns we can only experience as things. Such buildings and towns fail to come alive for us because they fail to create analogies that remind us who we are.

**REDISCOVERING HOW TO BUILD PATTERNS WITH A HEART**

**Acknowledging our need for analogy**

Once we acknowledge that the spaces we build become analogies for us, we want to know how we can build them, how we can design them. The first step is our realization that we can build more than things alone: it reconnects us with our experience. Without consciously working to learn a new architectural language, we might see it emerging as we sketch.

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**Figure. 2. Centro Rural, Muskiz. Cenicacelaya y Saloña, Bilbao. With permission.**

**Employing an adequate architectural language**
Architectural language is in fact the clue. Throughout our history as builders, we’ve built patterns with a heart. We’ve seen living forms in the elements that build our buildings. We do it automatically – unless we’ve been taught not to. And so the second step is to take a new look at the architectural language we call traditional. Experiencing what the language does with us and for us means we distance ourselves from any ideology that tells us that each age must give rise to a single language appropriate to it.

The Centro Rural in Muskiz, País Vasco, (Fig. 2) gives us patterns with a heart in the language it speaks. In this contemporary building, columns and beams describe and form modules of space that contain our body just as a window surround contains its window. Together the modules of space contain the main building. They make a centre of it even though it’s not the geometrical centre of the complex. The modules are fractals that contain a larger space whose size is based on the original module. Columns greet us as living beings, standing proud as they support their loads. And the pitched roof shelters the main space we occupy.

We experience the building as we walk through it, as we meet it and discover it. The smallest spaces contain our body, form a primordial hut for it. Our body is in fact the centre of the composition and therefore the generator of the composition. If we place our body at the centre of our designs, then the centre of who we are as body necessarily directs our designs. Our centre is our original experience: the centre that gave us life, the centre our ego developed from. The building reconnects us with our own developmental history. At the same time the building teaches us how to be members of a group. The individual modules of space work together to bring a larger space into being.

Testing the discipline of Dom Hans Van der Laan

If individual modules of space work together to bring a larger space into being, then we’ve become aware of how we perceive and experience space. Quite naturally we’ve arrived at a third step in our awareness of how we can build patterns with a heart: it’s the tradition Van der Laan founded when he examined our limits of perception and our need to connect the outer world we build with the inner world we dwell in.

First, reasoned Van der Laan, we need not only to see the space we inhabit: we need to feel it as something tactile (Laan, 1983, 35-47). We can only feel the size of the space if we can feel and see the depth of the walls that contain it. Surfaces alone will not do because they lack depth. The depth of a perforated wall is the measure that allows us to experience the measure of the space between walls. We relate with our bodies to a space if we relate to the massive elements that form that space. Those elements – the walls, the columns – greet us as bodies. We come to know our world through analogy.

Space literally comes to life for us between two massive borders. Standing opposite each other, the borders form a pattern with a heart. The heart is the space we inhabit, move through, and meet not as an abstract thing but as a living actor. But if the actors who form the walls stand too far apart from each other, they can’t communicate with the actors on the other side of the stage.
What, then, is the ideal distance between the actors, based on our perception? A space of seven times their thickness (Laan, 1983, 154).

Figure 3. Abdij Roosenberg, Waasmunster. Archives Sint-Benedictusberg, Vaals.

In Roosenberg Abbey (Fig. 3) Van der Laan tested his discoveries, his compositional tools (Laan, 2008). He divided the depth of the site into seven segments. Then he divided a component segment again by seven. He let this measure form the spatial building block of the whole abbey –
a town in miniature. And the spatial building block – the module of space – came to life thanks to perforated walls that measure a seventh of the width of the space, on centre. A pattern with a heart was both the beginning and the goal of the design.

Van der Laan began with the largest measure in order to arrive at the smallest. The smallest measure then formed the material building block capable of containing the smallest module of space in the composition. And that module is present in larger spaces as well. Two parallel walls contain the space between them. The module of space so created spreads itself out in three dimensions. Spaces between walls contain the space of the cloister. The cloisters contain the space of the inner courtyard, just as they define the space of the entry courtyard. The culmination of the design is the chapel – not at the heart of the complex but at the end of the route through it. And the chapel is not only a heart within the heart of the composition: she is a building within a building within a building.

A PATTERN WITH A HEART SHAPES US AS WE BUILD AND THINK

A pattern with a heart arises in the way we perceive space. A pattern with a heart then guides us in designing a complex building, a neighbourhood, a town. And a pattern with a heart puts us in touch with our own heart: our interior worlds, the worlds that gave us life to begin with, the worlds that give us life now. We have reintroduced meaning in our pursuit of typologies that answer to how we perceive space literally and how we experience space analogically.

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Book reviews

EARTHQUAKE ENGINEERING IN ROMANIA


review by Mirela Adriana Anghelache

The “World Housing Encyclopedia” (http://www.world-housing.net/), a project of EERI and IAEE, was launched at the World Conference on Earthquake Engineering in 2000 in Auckland, New Zealand. It was a project in frame of the International Decade for Natural Disaster Reduction. The Encyclopedia is available online and is open to anyone who is going to use the information, while information on construction types can be contributed by professionals and is peer-reviewed. A summary publication with the reports to date was done in 2004 and also several tutorials on construction types by material are available as hard copy. This book makes a geographical-wise completion: it is a collection on the reports from Bucharest, Romania. The book was published by Cuvillier Verlag, Göttingen, Germany, in 2010, where it is still available and also available over Amazon Germany (http://www.amazon.de/). It costs 58,80 euro.

It is a thick book of 454 pages, in A5 format, richly illustrated with photos and drawings, some of them in color. Being a text book it doesn’t use photographic paper.

In a geographic distribution related approach, in the book introduction there are provided maps showing the representative building types, chosen chronologically as they were constituted and which can be found in particular areas of Bucharest. There is a total of 10 reports from 7 architectural time periods. For Bucharest there is no city-wide survey of the building stock and the census does not account for detailed typologies, but merely for materials of the structure and age and height of the buildings. Thus, all relevant types could be identified following a historical, and not a geographical approach. It is a so-called typological survey. The relevance of the typology has been tried out in the German project SFB 46, as it is shown in the introduction by means of some maps of a protected zone in the city centre and of the questionnaire for mapping the built stock. Such approaches are valuable in the context in which the “World Housing Encyclopedia” is now leading partner in the Global Earthquake Model Taxonomy and Ontology project. It allows to see in how far the taxonomies set by the Encyclopedia can be applied in local context to characterize the whole built stock.

Actually, the author signed in several publications, for example Bostenaru (2004), that the World Housing Encyclopedia has the potential of becoming from an information system an expert system through the included assessment criteria and gave decision weights (Bostenaru and Pinho, 2006) to the questions in the Encyclopedia which were assigned to the actors: “architect”, engineer”, “investor” and “inhabitant”. The taxonomy proposed in the questionnaire is exemplified in some tables with the whole range of historic building types and also with the relevant building elements in the survey. Other maps that were included in
the introduction are related to a common zone in central Bucharest, thus mapping the difference between the central area, in which interwar reinforced concrete constructions predominate, and a low rise low density area with predominantly vernacular so-called “wagon” houses.

The typological classification presented in this book was employed as so-called World Housing Encyclopedia classification, recently completed research projects dealing with the built stock of Bucharest such as “Multihazard and vulnerability in the seismic context of the city of Bucharest” HERA, run by a consortium led by the University of Bucharest (http://www.hera.ase.ro/).

Five of the reports included in the book were co-authored by the author of the book with eng. Ilie Sandu, who passed away afterwards. Two of the reports are new with regard to the online encyclopedia: the multi-storey masonry construction and the Modernism building with commercial ground floor. The book however does not cover all types, a typology before 1850 not being presented in detail. This might be a further contribution to the online encyclopedia. Also, the post-communist housing in the 21st century is not included, as the book deals only with historic types. Post-communist single-family housing has been the topic of a recently published book with the contribution of the author and that might be as well a further contribution to the online encyclopedia.

From the reports the most valuable part is providing two types of tables:

- one on the “seismic deficiency”, “earthquake resilient features” and “damage patterns” for each structural element – the “seismic features” table;

- one where for each “structural deficiency” a “seismic strengthening provision” is provided.

This way the principles of strategic planning are translated to building scale and made possible a structural pathology and diagnosis, and also the formulation of a so-called “mission” (Bostenaru, 2005). These might build further developments of the mentioned taxonomy. The tables are very well made and for their publication is necessary a format of a book as their size is more than what a journal or a book article would allow. Also the drawings are valuable, partly of them in 3D, done with archiCAD®, which visualize the structural type in plan, (3D) section and axonometric view. A lack might be that the provided plans do not correspond to the buildings which are photographed, as archive research did not allow to identify all those buildings and some of them were taken from the experience of the authors. But nevertheless the building plans are a valuable resource for research on the functional structure of building typologies in this part of the world. Compared to the online version the reports don’t include few photographs and drawings based on the book edited by Bălan et al (1982), due to permissions reasons. But even without, also for this book it is valid what was said about the Encyclopedia as a whole: “For some construction types, this is one of the few, if not only, places where such detailed information is available in English (Brzev et al, 2004).”

The book follows the layout of the World Housing Encyclopedia from 2007, which has been changed twice since. Maybe it should be wished for having a fluent text instead of the question and answer format of the form, which has been partly implemented online since.
Otherwise not all numbered information is suitable for this and it might have required organizing some of the information across the building types.

The book finished without conclusions, although the conclusion that interwar buildings are the most vulnerable will have been drawn in the further research of the author and other scholars. These buildings are now subject of expert evaluation and retrofit. Good conclusions are drawn by the publications mentioned.

Maybe the sub-title is too restrictive: the book is not only about vulnerability, but also retrofit is subject of each report.

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TRITTICO OF BEAUTIFUL GEOMETRIES


Review by Stefano Serafini

Adriano Ugo Graziotti (Carpenedolo 1920 – Castenedolo 2000) can be considered an Artist, in the Renaissance sense of the word. He was painter, sculptor, mathematician, expert in archaic geometries, polyhedra discoverer, and creator of amazing magic squares. He spent
part of his life in U.S.A. as an appreciated drawing professor (anatomy and nude drawings) at the American University of San Francisco. Being a well-learned, energetic, brilliantly ironic man, though always distant from any social-political affiliation, he experienced a climax of glory, and periods of complete oblivion.

He has left a unique mark in all his original works, that can be admired in the collection of 120 large polyhedra donated to the Capitoline Museum of Roma. Claudio Lanzi (engineer), Graziotti’s friend and follower, has been the editor, together with Silvio Maracchia (math professor) and Biagio di Carlo (architect), of three books dedicated to him, which collect the artist’s plates and their original comments: the first book, *Hermetica Geometria* (2002) is about the partitions of the Euclidean plane as commissioned to him by the Pacific Science Center of Seattle (Washington); the second book, *Cupole Geodetiche* (2012) is about Graziotti’s work on geodetic constructions, highly appreciated by Richard Buckminster Fuller; the third one, *Polyhedra* (2012), collects drawings and projects of Pythagorean, Platonic and Archimedean polyhedra. The three books have been edited by the small Italian publishing house Simmetria (Rome), with an effort that deserves admiration.

To plunge into Graziotti’s planes and works is like rediscovering Leonardo’s world, Piero della Francesca’s perspectives, and Luca Pacioli’s proportions. Scrolling through such beautiful and surprising pages, results in an enriching experience for mathematicians, solid geometry experts, architects interested in the logics of forms, and even scholars of Platonic philosophy.

**FASCISM AND THE CITY**


Review by Stefano Serafini

Professor at the Berlin University of Technology, and Author of relevant researches, such as *Renaissance der Mitte: Zentrumsumbau in London und Berlin* (Salenstein: Braun, 2005) and *Stadtvisionen 1910/2010: Berlin, Paris, London, Chicago / 100 Jahre Allgemeine Städtebau-Austellungen in Berlin* (Berlin: DOM, 2010), Harald Bodenschatz is one of the major experts in the Italian architecture of the first half of the 20th century. In this book, collecting contributions by himself, Uwe Altrock, Lorenz Kirchner, and Ursula von Petz, and a surprising iconography (more than 600 illustrations) he presents a deep study about Italian architecture at the time of Fascism.

Not many people know, that Italy had developed more urban planning projects than any other Country, between the ’20s and the Second World War; a fact that historians of architecture begun to evaluate in the last twenty years only. Yet, they are inclined to focus not on the ideology of Fascism, and its role in urbanism and aesthetics.
Professor Bodenschatz’s work, provides instead a clear and systematic overview of fascism city planning, digging down to the political roots of Italian Rationalism. Most importance is given to the main construction site of the regime, that is Rome, and to the different schools at work there, from Gustavo Giovannoni to Marcello Piacentini. Mussolini in fact longed to give birth to a New Eternal City, meant to become the glorious symbol of Fascism as a new imperial era.

Fascists were also engaged in founding new cities as such, as they actually did. Just during the huge reclaiming of the Pontine Marshes, Littoria (1932, now Latina), Sabaudia (1934), Pontinia (1935), and Aprilia (1935), have been built between Rome and the Tyrrhenian Sea – an effort that resulted in international admiration for the regime. Cities of foundation were established in the Regions of Veneto, Friuli, and Emilia Romagna also.

A relevant part of the book is devoted to the urban policies in African colonies, stressing the demonstrative role of architecture and city planning, as expression of power. An effort, though, that often gave rise to beautiful results.

Particularly interesting, it’s the analysis of parallel contexts in urban planning. So, the Author compares the urban designs of Mussolini’s, Stalin’s, and Hitler’s regimes. It may sound surprising, that autocratic urbanism (of which Bodenschatz shows the biopolitical issue), had a wide international consensus among urban planners at the time.

On the other hand, Bodenschatz stresses several time the value of some architectural and urban solution, despite the ideology they were apparently coming from. An observation, that has been shared by Pier Paolo Pasolini, whilst commenting on the human quality of such cities as Sabaudia, especially if compared to post World War, “democratic” planning. In fact, as Pasolini also stated, urban planning during the Ventennio did not represent an unconditioned product of Fascism. Rich debates, and differences in schools, contributed so far to the quality of regime’s urban programs. “Mussolini had to work with the people who were available and who were willing to serve him – or, as graduates of the new universities, might be willing to serve him in future. His rewards for individual experts were motivated by the need to encourage the commitment of the profession as a whole.”

THE BUILDING AND THE ROSE

Maria Bostenaru Dan, *Spațiu verde redescoperit / Der wiederentdeckte Grünraum* [The Rediscovered Green Space], Göttingen: Cuvillier, 2010

Review by Cristina Enache

This charming book (in Romanian and German), combines Author’s professionalism and artistic sensibility, whilst offering nostalgic childhood memories, that resemble Proust's madeleine of *In Search of Lost Time*. *The Rediscovered Green Space* invites to meditation, addressing sensitive and delicate subjects. It is without question a book from Author’s soul, evoking fairytale topics in a lyrical way, but also a number of concrete situations – starting
from school projects (thus achieving the educational side of the work), to implemented projects (case studies carefully chosen and illustrative for the subject matter).

A wide range of urban situations that seem at the same time part of myth and reality, are presented in order to rediscover nature in built world, a world in which we cannot see the roses that are beyond the thorns, as Grimm’s story beautifully reminds us. Small parks, urban places, green belts, and landscape outside the city, represent a gradual shift from artistic to professional topics, aiming at rediscovering the fairytale’s "Princesses", imprisoned in the forgotten asphalt castles of the city. Maria Bostenaru Dan seeks the poetry of nature in the urban canvas. Thus, at the end of the reading, we want, like the children, that "once upon a time" turns into reality.
News and events

THE INTERNATIONAL SOCIETY OF BIOURBANISM SUMMER SCHOOL IN NEUROERGONOMICS AND URBAN DESIGN. BIOURBANISM FOR A HUMAN-CENTERED SUSTAINABILITY AND EFFECTIVENESS (ARTEANA, ITALY, JULY 15TH-23RD 2012)

A note by Cecilia Rossing, Student of architecture and civil engineering at the Chalmers University of Technology, Gothenburg, Sweden

In recent years, as a student of engineering and architecture, I have been exposed to the concept of “sustainable development” in various contexts and with more or less credible motivations. There came a point where I began to look for solutions beyond sustainable development, with the aim of understanding what good architecture and urban design is really about. As I suspected, I was not alone in my search.

Sometime in the early spring of 2012, an e-letter from Artena caught my attention. As a student at the Chalmers University of Technology, I get several emails every day, some of which are more interesting than others. Nonetheless, this one captivated me... Biophilia, Neuroergonomics, Algorithmic Design! Could those concepts, still somewhat abstract to me at the time, take me a step further in my search? I had to give them a try.

On the 15th of July, I arrived in Artena and met the organisers, teachers and other participants. They were a colourful crowd, with a wide range of ages, professional backgrounds, interests and aims. The diversity of the group was wonderful.

Sunday evening was the starting point for what would be a week of long days filled with discussion-based discovery, searching by drawing, sketching, experiencing and finally investigating the proposed case study. As an architect, urban planner or simply as a human being, it was difficult to avoid being moved by the ancient city centre on the top of the hill. Prof. Vittorio Frosi took us through the steep, narrow streets late that first evening, telling historic tales as well as giving us in depth details about the city of Artena. This was our first experience of the city.

Despite this somewhat romantic introduction, the early morning of the next day was more pragmatic and organised. We now began the theoretical section, which introduced us to the topics that we would encounter later in the case study. Being the group that we were, it was hard to maintain an hour of class without intense discussions breaking out, dealing with everything from contradictions we found in the theory, to our experience of viewing things differently in relation to our professional backgrounds. Discussions that started in the conference hall did not stay within those walls, but accompanied us on the dining terrace and continued over the tortellini, pecorino and local red wine, until late in the evening.
The lectures spanned the purely theoretic level to a more hands on approach. Yulia Kryazheva managed, with her simple sketches and thoughts, to motivate us to take a step back from our “architectural” point of view and to consider why architects and planners design as they do. Also, we were encouraged to think about how our experience of the built environment might have more of a connection to our education than we might be aware of and thus differ from the experience of the general public. This, to my mind, is a very important insight. It might seem to be a simple concept, but do we really reflect sufficiently on the “understandability” and the complex beauty of the built environment? Do we, as designers, always have the tools and the understanding to deal with the well-being of the future users? Where does the conflict appear? What tools do we use in order to bridge the gap? Awareness is the key, but how do we attain it?

Clearly, in this context, the topic of neuroergonomics and how human beings mirror the surrounding environment becomes relevant. How are we programmed to react to different patterns, levels of scale and typologies? Ultimately, it all comes down to how architects and urban designers can contribute to the creation of urban environments that support human well-being. References to the work of Christopher Alexander were present at all levels of the course and, to me, the “Algorithmic design” taught by Nikos Salingaros, was a thrilling discovery, providing a tool that actually has the potential to deal with the complexities of the urban environment in the design process.

However, if we thought that we were to confine ourselves to these beautiful lectures on theory, we were wrong. From the first day, we attended body-mind sessions, where we focused on trying to feel and experience the room with our bodies, by moving through it in different experimental ways. This connection between the theory and the physical experience becomes more interesting the more I think about it. How our attitudes as participants evolved through these sessions, from initial stiffness to the point where we dared to let go, take in and really try to mirror the full experience of our surroundings, somehow reflects the theory that was propounded during the course. The sessions lead by Prof. Gilberto Scaramuzzo and Jenny England, where we actively explored and experienced a square in the old city of Artena in our own chosen manner and then tried another participant’s method, were extremely interesting as we really got the chance to experience the different ways in which people approach and discover urban spaces.

The case study part of the course started by an excursion to the cities of Sermoneta and Sabaudia, where Sermoneta is a town of intact medieval structure and organization and Sabaudia is typically modernistic. Using walking and sketching as our main tools for discovering we went off to explore these two completely different urban environments. What we produced during our excursions, we brought back to Artena for common discussion, and so we prepared ourselves to the case study of Artena itself. Various interesting sketch proposals were produced during two intense days of work, all of them with a common aim; to revitalize Artena by creating connections between the old and the new parts of the city.

I know that Stefano Serafini and other devoted people are working hard to bring the project further, and the recent full-day conference “Project Artena. Reviving Italian villages” that took place on October 21st is an important step in the right direction.
What I brought back home from the summer school experience is far from being a complete understanding of all the complex issues that we discussed. However, I have loads of inspiration and references for my studies and my future professional life, as well as a network of wonderful people who all strive to understand how to create beautiful urban environments that truly support human well-being.


ANNOUNCING THE VOLUME GEOGRAPHIC INFORMATION SYSTEM FOR SMART CITIES, EDITED BY PROF. T. M. VINOD KUMAR, COPAL PUBLISHING GROUP TO BE PUBLISHED IN EARLY 2013

Smart cities are knowledge based cities, that develop extra ordinary capabilities to be self-aware, function 24 hours and 7 days a week, and communicate, selectively, in real time knowledge to citizen end users for satisfactory way of life with easy public delivery of services, comfortable mobility, conserve energy, environment and other natural resources, and create energetic face to face communities, and a vibrant urban economy even at a time there is National economic downturns. Twenty six international scholars explore the possibility of developing Smart Cities from experiences of many countries.

This book gives prime responsibility of City being self-aware to Geographic Information System, and its future development. Mukund Rao explores this transition from existing GIS to Smart City GIS; Mahavir, and Prabh Bedi, look at GIS and Smart urbanization, M. Priya, and Shirish Gadam, explore GIS for Sustainable Urbanization, Andrea Vega, Priya and Ravi Kumar, explore practical difficulties of implementing and maintaining of such self-aware GIS. Miguel A. Calero explores Open large scale geo-data management and web Map Services to achieve the Smart city goals, and Ashmita Karmaker looks GIS in community development.

Cities are mostly located in sea coasts and are vulnerable. While Bernd Gundermann explores Adaptive Urbanism for sea level rise, Anil Kumar postulates environmentally sensitive land use allocation for coastal smart cities. While Vijay Neekhra explains use of GS for management of Slums in Smart Cities, V. Sursh discusses the role of Smart buildings in Smart cities.

Highest level of mobility assumes importance in Smart Cities. While Bimal P. looks at the role of using Intra-day trip generation and travel management for a Smart city, M. A. Naseer explores Intelligent Goods transportation system. Shivani Aserkar Naik postulates a GIS based land use suitability and transportation model.

Conventional Land Use planning needs to be strengthened with GIS based modeling, and alternative approaches are required to be developed for Smart city planning. Gonzal A. Aranda Corral and Joaquin Borrego explore agent based simulation, focussed on natural disasters and safe location. Walter Barberis conceives a new discipline of Smart Planning.
Antonio Caperna and Stefano Serafini advocate biourbanism as a new framework for smart cities studies.

Richard Sliuzas, Mark Zuideest and Ngoc Quang Nguyen explore Smart cities future, opportunities and barriers through scenario based urban planning support system. M. Ramchandran looks at the past of Indian experiences, and how this experiences can be extended in future for Smart Indian cities. T. M. Vinod Kumar surveys limited Smart city experiences of India and identifies existing cities for Smart city upgrade, ways, and means of activation of Smart Communities, Smart institutional framework, Smart economy and deployment of Smart urban Technologies.

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