



The aspects of efficient dynamic configurations in urban spaces

Gehan Ahmed Ebraheem

Assistant Professor, Department of Architecture, College of Engineering - Modern University for Technology and Information

Abstract

The elements and means affecting the formulation and structure of the architectural buildings have been greatly developed by man throughout different ages according to the development of technology, so the dimensions and specifications of configuring dynamic buildings can be designed and controlled in order to leave the required effects on the environment and the user to serve certain purpose or function.

Urban Environment is an important aspect in making a Livable city, Urban Spaces are mainly designed for people to improve the quality of life and encourage physical activities and social interaction between them.

Principles of Designing Urban Spaces have different aspects whether physical aspects or unphysical aspects that influences the success of making Urban Spaces which satisfies physiological and psychological user needs. But nowadays digital technology; is a consider to be the main supporter of any development, especially in the urban spaces, as it drives the development within three portions as follows; the development of materials, systems and tools, which form the intelligent space.

The dynamic innovating region needs specific inherent technological advances to aid in its specialized production, obtaining them from the so called cities of intelligence, characterized by the presence of intelligent spaces.

Dynamic configuration means the presence of motion in the urban spaces. This motion may appear in the materials, systems and tools that form the space.

The liability issue seeks to search for the main criteria which must be followed to inform the smart urban space

Key words: Urban Environment, dynamic innovations, unperceived aspects, dynamic configuration , smart urban spaces

Introduction:

Urban Environment is an important aspect in making a Livable city, Urban Spaces are mainly designed for people to improve the quality of life and encourage physical activities and social interaction between them.

Principles of Designing Urban Spaces have different aspects whether physical aspects or unphysical aspects that influences the success of making Urban Spaces which satisfies physiological and psychological user needs. But nowadays digital technology; is a consider to be the main supporter of any development, especially in the urban spaces, as it drives the development within three portions as follows; the development of materials, systems and tools, which form the intelligent space.

A dynamic innovating region may try to supply its demands throughout the technological products from

various places, or from various cities of intelligence. However, there is a tendency for these cities to develop the necessary technologies for their own regions. This means that a dynamic innovating region needs specific inherent technological advances to aid in its specialized production, obtaining them from the so called cities of intelligence, characterized by the presence of intelligent spaces.

Dynamic configuration means the presence of motion in the urban spaces. This motion may appear in the materials, systems and tools that form the space.

So the paper will study the effect of dynamic configuration in smart urban space.

Objectives:

The main thesis searching for the main criterion which must be followed to inform the smart urban space. Supposing that using techniques and tools being developed today to make complete, high performance products is one of the main hypothesis that could be followed to attain the smart urban space and the 2nd one is to establish the digital technology uses in urban areas and the physical characteristics of the urban spaces and each of them has produced various shapes of smart configurations which have to be assessed as means of efficiency (namely the environmental and economic efficiency).that fulfill all the psychological and physiological needs of users.

Methodology:

The followed methodology is the measurable one, as measuring the main approaches applied in digital technologies to deduce the main aspects that must be used to inform smart urban space. This paper consists of three parts, as the 1st. refers to the measurement of the main aspects of smart urban space, 2nd measuring the aspects of technology which form smart urban spaces that fulfill the user’s physiological and psychological needs and the 3rd. part concerns the results.

1. Smart urban spaces:

The Smart urban spaces looks at the public spaces in cities. It is the area where many things physically come together: it literally provides space for multiple functions and activities. Public space is important for the perception of safety, atmosphere and quality of life in the city, thus enabling social cohesion and interaction.

People within smart urban spaces will enjoy a quality of life in a clean, green living environment where public and open spaces are pristine and smart elements (landscape settings) are lifestyle attractions. [1]

1.1. Characteristics of the Smart Urban Spaces

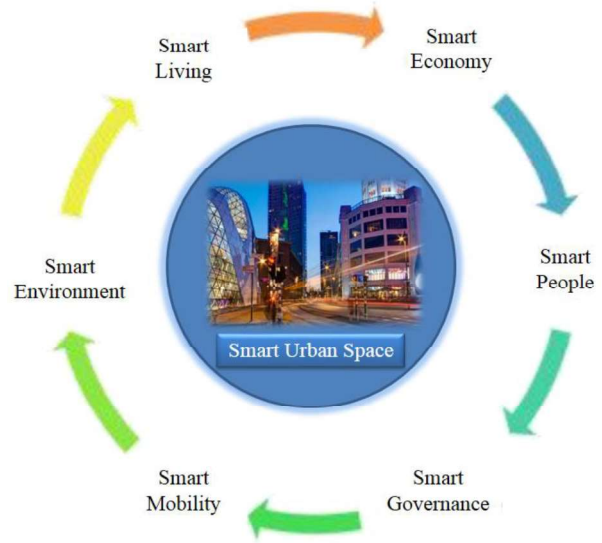
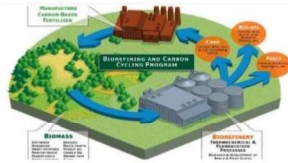

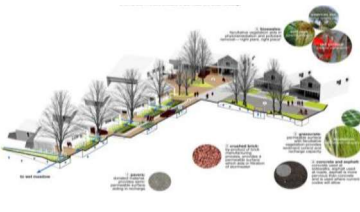





Figure 1: Smart urban model based on six characteristic:

The Smart Urban Spaces will be based on the Smart Urban Model, which is a combination of the following six characteristics: [2]

Table 1: the main criterion considering the main aspects of smart urban spaces

Basic Concept	Character	Figure
Environmental Sustainability	Attractively of natural conditions; Environmental protection and pollution control; Smart energy including renewables and energy efficiency;	
Sustainable Lifestyle	Quality health conditions; Individual safety; Accessibility to good quality building and social integration;	

Smart Governance	Involvement of the public in decision-making; <ul style="list-style-type: none"> - Public and social service; - Government transparency; - Sustainable buildings; - Waste recycling; - Water efficiency. 	Green Street Solution 
Smart Economy	Entrepreneurship and productivity spirit; An overall culture of innovation based on e-business and e-commerce; Promotion of local products.	
Sustainable Mobility	Local and national accessibility; Safe and sustainable transportation systems for public transport, cars, bicycles and pedestrians;	
Smart People	A culture of life-long learning; <ul style="list-style-type: none"> - Social and ethnic diversity; - Flexibility; - Creativity; Community participation; - Citizen awareness	

1.2 Considerable aspects of Smart Urban Spaces

When determining a smart urban space projects the following aspects must be considered [3]:

Main aspects	Criterion
Health & Safety	Does the design encourage the use of low-toxic materials and products, for both installation and maintenance? Are materials chosen to reduce the risk of slips and other accidents?
Durability	Will the products stand up to use over time? Are they right for the job at hand? Are they covered by sufficient warranties?
Reduced Maintenance	Will the materials or products result in less work over time? Are they easy to clean and maintain without chemicals or toxic finishes? Do they resist decay and moss without chemicals?
Functionality	Are the materials well suited to their intended purpose? Do they have the necessary qualities for the job? Can they be reused for another task? Do the materials serve multiple functions?
Aesthetic	Do the materials appeal to you? Will they stand up to the test of time, aesthetically? Do they enhance nearby elements, including surrounding buildings
Accessibility	Do the materials reduce or remove barriers to people with varied abilities, ages and sizes? Do they help orient the user, mark transitions and boundaries, and facilitate the safe, easy passage of wheelchairs or other green street solutions.
Smart	Acting as a clever system and doesn't stop performance:

Environment	This aspect could be measured within the continuity with nature and the flexibility with the urban context, through: <ul style="list-style-type: none"> • The Continuity • The Integration with the Urban Physical Context • Flexibility
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2. Measuring the aspects of technology configuring smart urban spaces

This part of the paper displays the shapes dynamic innovating region that may try to supply its demands throughout the technological products from various places.

Table 2: Classification of the smart urban spaces according to their landscape settings and smart

Smart Urban Space			
Landscape elements		Technologies configuring smart Urban Spaces	
Land	Planting	al Tech	Digital design tools

	Paving	Paving materials	Nano Technology	Digital design techniques
	Lighting	Lighting techniques		Kinetic Effect
	Furniture	Water feature		Multi-functioning
		Benches		
Signage				
		Public Art		

Previous works have discussed the discourse of smart urban landscape. Within these works, it has been agreed on classifying landscape elements into softscape features such as pavements material, waterscape features and finally complementary features as furniture, lighting, art work, which can be referred to as space furniture. [4]

2.2. Technologies configuring smart urban spaces





There are different technologies to create innovative and speculative design features that configuring smart dynamic urban spaces as follows:


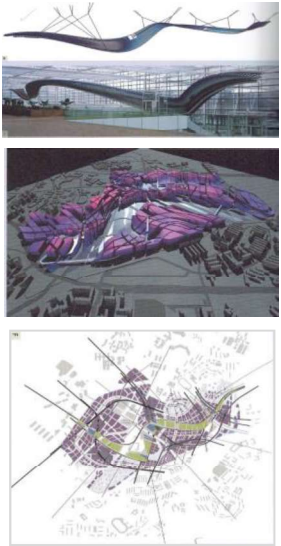
2.2.1 The development of design aspects and techniques

This kind of development aided in the presence of new version of complex designs and configurations [5], and it can be displayed as follows:

2.1. Landscape elements forming an urban space

Table3: Shows design tools and techniques

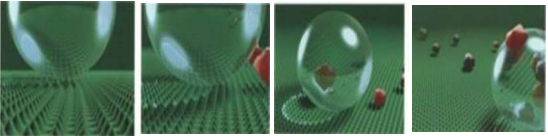
Digital Design Tools		Technique (Fabrication process)	Shape Of urban space	Example
1- CAD	Is used to allow architect to thoroughly test and understand their creative ideas from concept to fabrication.	A CAD file is required to control a CAM machine	Architect discerns the need for geometry to create, manipulate, and refine their design ideas. In contrast to physical model making through which we manually alter the shape, form, and geometry of a material depending on its properties.	 
3-Meshes	Meshes as interactive to generate artificial intelligence, synthetic biology, and interactive technology to create an environment that is nearly alive. This process refines and improves the structure in specific ways- strengthening a local weakness, preventing a joint cracking or increasing range of motion	FEA) finite element analysis this software facilitates detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacement	The interactive geotextile mesh “senses” people in proximity to it and responds with peristaltic wave movements, appearing to “breathe” around its occupants.	 

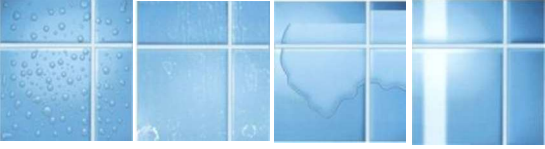
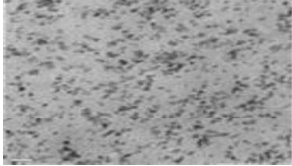




4-Curvilinear Formation	The reason for this surge in popularity was that prior to development of CAD and CAM technologies.	(FDM) Fused Deposition Modeling which forms layers by extruding	Visual-kinetic installation, inter active wall, double curvature surfaces, curvilinear geometry supported on curved ribs and straight beams.	
Digital Design Tools		Technique (Fabrication process)	Shape Of urban space	Example
4-Curvilinear Formation	Curved surfaces and forms were very difficult to design and fabricate .this led to an experimentation with tectonics that continues today	Small beads of thermoplastic material that hardens immediately after extrusion.		
5-Parametric Generative Design	Parametric urban design :the gently undulating overall form accommodates a wide range of built volumes and public realm in tandem with infrastructure and connective tissue with neighboring urban districts. The design was developed parametrically as a free curvilinear and malleable series of deformations pliant city district.	A CAD file is required it create a series of relationships allowing elements to connect and build up the design.	Conceptual mass/form as developed implementation	

2.2.2 Nano Technology

Nanotechnology- Nano composites as Nano particles or other nanomaterial’s with new properties are integrated into conventional materials so that the characteristics of the original materials are not only improved but also new

functional properties can be gained or even be made multifunctional. The shown table.1 below investigates the Nano materials as form of benefits, uses and properties within the new effects appeared in materials by using Nano particles [6]:

Nano Material Effect	Figures
<p>1- Lotus effect: This can usually be achieved using special fluoro chemical or silicone treatments on structured surfaces or with compositions containing micro-scale particulates. Uses: The Lotus-Effect is most well suited for, coatings, paints, roof tiles, fabrics and other surfaces that can stay dry and clean themselves</p>	 <p>The visualization illustrates the knobble structure combined with reduced surface makes water form droplets that washing away dirt deposits.</p>

<p>2- Photocatalysis : Kinds of products. At a Nano scalar dimension, titanium appears no longer white but transparent, and it's also hydrophilic. Uses: Photocatalytic surface coatings are often applied to façade panels made of glass or ceramics or to membranes.</p>	 <p>Water forms a film that runs off taking any loose dirt deposits with it</p>
<p>3- UV protection: A prerequisite of protective coatings is that they are transparent so that the coloring and structure of the material beneath is preserved. Uses: Lasting and highly transparent protection.</p>	
<p>4- Solar protection: The sunlight causes the glass to darken automatically without using the switch. The switching process itself takes a few minutes. Uses: Photo chromatic glass is solution for darkening glass panels.</p>	 <p>Electro chromatic glass with an ultra-thin Nano coating</p>
<p>5- Anti-graffiti and reducing dirt Nano based coatings can be used to protect highly absorbent materials such as brick, lime sandstone, concrete and other similar materials. Uses: Anti-graffiti coatings are used to make building materials water-repellent.</p>	 <p>The UEFA headquarter in Nyon, Switzerland, is fitted with flooring that makes it</p>
<p>6- Anti-reflective Improving solar transmission, offer a cost-effective and efficient anti-reflective solution, Anti-reflective glass used to increased efficiency of photovoltaic systems as the entire spectrum of solar energy</p>	 <p>Silica glass capsules are used in Nano porous anti-reflective coatings</p>
Nano Material Effect	Figures
<p>7- Anti-fingerprints Anti-fingerprints lead to a reduction in cleaning costs. It enables glass and steel to be used for interiors without being impaired by visible finger –and handprints and obviate the need for regular cleaning. Uses: Anti-fingerprint coatings are useful for stainless steel and sandblasted glass wherever one can expect people to touch them.</p>	 <p>The effect of the anti-fingerprint coating on The critical area around doorknobs stainless sheet is</p>
<p>8- Scratchproof and abrasion-resistant Improvement of scratch and abrasion resistance, transparent coating and creating a basis for durability. Uses: scratchproof paints and varnishes are desirable, to protect the varnished surfaces of wood landscape furniture or the surfaces of other gloss lacquered surfaces.</p>	




2.2.2.1. Measuring the smart urban space within the main criteria applied in Nano materials






2.2.2.1.A The kinetic movement in the smart urban space:

Some architects are seeking to use the effects of Nano elements as a formal element in their projects. In recent years more work has been done on so called adaptive urban space, which in the ideal

are able to react to their immediate and adjacent surroundings depending on their design and sensory systems, and their passive and active components, they are able to react reversibly to their surroundings over a long period of time. Therefore in public urban spaces the definition is more than streets, parks, beaches, and include waterfronts, stations, and other places that serve recreational, political, religious or social gathering functions or sometimes merely movement corridors connecting different parts of the surrounding space. [7]

Table5: Examples shows the kinetic movement in the urban space

Elements	Example	Figure
Furniture	<p><u>VIVA Vancouver</u> project. The modular bench seating is built from computer-designed and CNC-cut wooden segments that gradually morph to create a variety of engaging shapes. Sit on the bench segments, lounge on flatter areas or stand next to taller segments to eat street food from nearby vendors. The three benches curve around informal performance spaces and encourage socializing and engagement. The segments were efficiently <u>prefabricated</u> off site to minimize waste, and off-cuts of the locally-sourced wood were donated to a local art school. Once on site, the segments were put together quickly and reduced overall construction time. Once summer is over and <u>Robson Street</u> is returned to the cars, Urban Reef can be moved to another park for permanent installation</p>	 <p>[8]http://assets.inhabitat.com</p>
Steps	<p>Circle steps in backyard Cool! Outdoors is great choice with trees and greens around Tree symbol, Ford Care Program/"Wheels" by FF/Axelrods/Ellen & Portia.</p>	
Solar lighting	<p>Futuristic furniture –self Recharge electronics with KVAs Solar-Powered soft Rockers Chairs! Find this Pin and more on SMART! Recharge solar bench "Soft Rockers" are solar-powered lounging chairs that recharge your electronics. Holy shit, these are awesome!</p>	

Elements	Example	Figure
Pergola	<p>Brian Lee Blurring the boundaries between architecture and furniture this work dissolves the abstract relationship between architectural form and the body into one of a more direct experiential correlation, questioning architecture</p>	 <p>[9] https://s-media-cache-pinimg.com</p>
	<p>Ralfonso Gschwend's kinetic wind sculpture Magic Tree was unveiled October 2012 in the Wuhu International Sculpture Park, China. Ralfonso was invited as a special guest artist for the 2012 Liu Kaiqu International Sculpture Exhibition</p> <p>The Singing Ringing Tree at Burnley. The Singing Ringing Tree is a wind powered sound sculpture resembling a tree set in the landscape of the Pennine mountain range overlooking Burnley, in Lancashire, England.</p>	
Water features	<p>This fountain project is located at Rotana Hotel, Kingdom of Bahrain. The total size of the water pool is diameter 30m. This design combines 10 groups of water features and 394pcs of lights, adding 4 sets of fire jets in this design, its performance is very dynamic and interactive.</p>	
	<p>Office hurts mountain - autostadt summer staging 2014- office pain mountain, Hamburg. -The LA Team</p>	
Elements	Example	Figure
Paving	<p>Highway users have an increased awareness of pavement quality. To help agencies and contractors meet the demand for high-quality pavements, NAPA's <u>Asphalt Pavement</u> magazine regularly provides articles that directly address issues such as mix type selection and statistical specifications.</p>	

2.2.2.1.B The multi functioning in the urban space:

Referring to space as a functional act It seems to be an environment where people live in under several conditions by applying several systems to sustain the physiological and the aesthetics satisfaction, whereas these systems mainly concerns the thermal comfort, aesthetic parameters and construction within the economical aspect referring to the technology suiting the level of the society .and finally as Driven by a commitment to reduce energy consumption and built space considering the efficient use of space, materials, and resources. As shown in table.4 [8]

3. Conclusion:

Nanotechnology offers much and Nano science has a role to play in addressing many of the key issues society faces.–Energy–Healthcare–Environment–Security–urban space..... All relevant to the Modern smart dynamic urban space!

- Mainly the main objective of Nano materials agreeing with sustainability in architecture seems to be the

creation of a knowledge base and facilitate the integral, cross-disciplinary approach with high levels of occupant comfort without increasing initial and running costs.

- The criterion from which the unit space could be called a Nano one is when Nano referring to two main levels of application, which are:

The first concerns the main effect of the Nano technology on a matter to convert its properties or gain it too much properties to attain the meaning of kinetic , and the multifunctioning of this technology as the kinetic movement appears within the matter specially in the initial reaction or mainly as a smart manner that could be achieved. So by applying these tow criterions the space could carry the gens of the Nano application.

The second concerns the usage of the Nano materials in the space as they could reduce the build systems or the compound systems could be used to reach the utmost eco-efficient space. So the following table.6 could be considered the criterion used to design an efficient dynamic smart urban space:

Table 6: Shows the criterion used to design an efficient dynamic smart urban space

Criterion of smart urban space			The kinetic configuration in the urban space							The completely movement of the space	The multi functioning	
			The partially movement in the space								Thermal comfort	Aesthetic parameters
			Furniture	Steps	Solar lighting	Pergola	Sculpture	Water features	Paving			
Kind of efficiency	Economic		Flexibility									
	Efficiency of technology	Nano technology	Elements									
			Materials									
	Digital techniques	Tools										
		Implementations										

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