Mediated Space and Kinetic Architecture

The Synergy of Co-development

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This paper intends to explore structured approaches towards the research and development of performative architectural solutions that can fulfill the criteria of 'mediated space'. Mediated space is intended to engage occupants of its boundaries in a proactive and interactive way. Altering the local microclimate and its physical parameters as well as the dynamic, responsive audiovisual ambience are examples of many imaginable methods of providing the perceptible output layer for mediated space.

Keywords*: mediated space; synergy; kinetic structures; controlling; algorithms.*

Introduction

From a perspective of an internal process, mediated space can be discussed as a system of sensory inputs and acting outputs that are coordinated by a controlling function that performs two key tasks: interpreting the input information and commanding the outputs.

Present technology offers a vast range of sensory and imaging devices that are able to monitor the most subtle aspects of physical properties. Highly detailed information about the occupants of a surveyed space can easily be acquired and reveal the number of people, their positions, their dynamic state, the type of clothing, the type of activity they are engaged in and even provide indications in regards to their physical and emotional state.

A broad range of output effectors are also available within the boundaries of present technologies. Electro-mechanical building systems offer the capacity of adjusting various aspects of microclimate like temperature, humidity, air exchange and illumination. Embedded multimedia technology adds the audiovisual layer that is able to play sounds and display dynamic imagery. Complex actuation systems have been developed to attenuate the sway in high rise towers and automatically adjust columns to compensate for ground settling. However, the commonly available high tech building system wizardry does not quite meet the criteria needed for mediated space. The reason is the relatively limited control of their functionality. Even if sophisticated automation algorithms are implemented, the element of awareness of the occupants or their changing needs is lacking and so is the ability to actively engage them.

The Role of Controlling Algorithms

The key requirement of the controlling algorithm that may be capable of driving a truly mediated space is the ability to interpret a wide range of unique and unpredictable scenarios. The limited scope of the experimental installations is apparent when the underlying control algorithm is a simple, preprogrammed automation sequencer. To the occupant, the automated repetitiveness of the character of changes may quickly become obvious. Behavior of such space may be compared to that of an automated escalator that accelerates when stepped on or a sensor controlled gate that opens whenever

approached. In case of a complex spatial system, the initial amusement with the gadgetry may yield to annoyance once the predictability of patterns fails to genuinely engage the occupants.

It is not difficult to observe that the algorithmic concept of mediated space has strong parallels with traditional functions of architectural and urban spaces. The layer of support functions that complements the static shells of buildings and, as observed by occupants, resembles various aspects of the modern definition of mediated space, which is as old as architecture itself. Traditionally, these functions are performed by the trained staff of guards, janitors, servants, receptionists and cleaners. The visitor to a fully manned building is greeted by a receptionist, perhaps served refreshments or, perhaps, denied entry by a guard. For the visitor-observer, the inherent aspect of interactivity and unpredictability of possible outcomes of interactions with such 'mediated' system. What sets the concept of mediated space apart from the traditional, manned building systems is the implied method of managing the interactions with occupants by means of controls based on automation and artificial intelligence.

Arguably, the biggest challenge lies in the development of such controls. On the sensory side, interpretive algorithms are still more based on meticulous searches of reference databases rather than abstraction and genuine pattern recognition. On the interpretative side, artificial intelligence is still a misnomer for elimination by trial and error rather than the term for a process that is able to increase its own complexity in order to resolve an unanticipated challenge. Ongoing intensive development effort in the areas of computing and programming promises significant progress in these two areas (Penn, 2004).

Foldable Structures

The development of kinetic architectural elements may add a new dimension to the arsenal of output effects available within the dynamic boundary between the user and space. Despite the wide use of various actuation elements in building systems, the concept of 'foldable' buildings or a reconfigurable on demand functional layout is not quite here yet. Nevertheless, recent advances in design tools, materials and manufacturing methods provide fertile ground for initiating interdisciplinary projects targeting such structures, new design workflows and new applications.

The images shown below represent folding structures that provide adjustable on demand configurations.

Rectilinear deformable grids allow for expansion and contraction as well as for infinite arrays. Converging grids provide for circular arrays and fan like folding. We developed these structures as a possible solution for the increasing density of development,

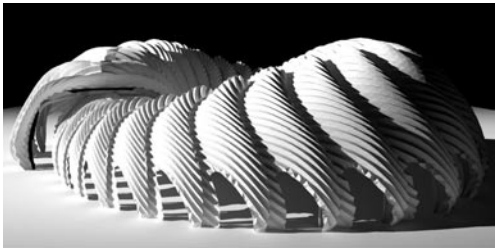

Figure 1
Unfolding structure, Circular

Figure 2
Unfolding structure, Interior

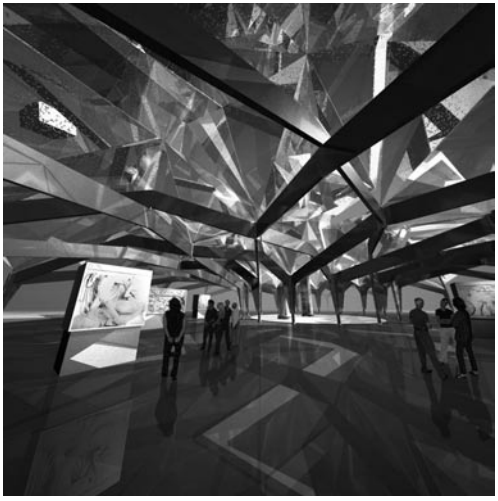

Figure 3
Unfolding structure, Expo

better space management and lesser environmental impact.

Evolution of Adaptability

Functionally, buildings form static and non-adaptable infrastructures that are intended to support social processes. Decisions regarding function, aesthetics and lifecycles of buildings and the resulting urban grid are a part of the initial planning and design process. Once buildings are erected, they form a permanent and unchangeable manifestation of these decisions. From that moment, inhabitants and authorities have to conform their needs to such fixed civil infrastructures. The inertia with which these systems can respond to changing requirements or functional conflicts and exclusions (Vaughan, 2005). In this context, the potential benefits of structures that offer aspects of adaptability become evident. Even more enticing are the prospects of comprehensive architectural solutions that effectively integrate kinetic, morphing structures with the concepts of mediated space.

Kinetic structures offer a possibility of creating urban systems that are functionally dynamic and adaptable (Kolarevic & Malkavi, 2005). The time cycle of adjustments can vary according to the requirements and can accommodate daily as well as seasonal changes. As an example, this would allow the reconfiguring of building space and access topology to fit different functional requirements as often as necessary, even a few times a day. Adjustments to the external shell can mitigate the effects of seasonal climatic changes and improve occupant's comfort and energy efficiency.

Configurable, on-demand, large scale architectural structures could facilitate the patterns of efficient use of core urban areas and decreased functional stratification. As a result, a closer integration of various urban functions and mixed-use occupancy would be encouraged together with consequent strengthening of neighborhoods and increased sense of ownership of the urban setting on the part of inhabitants.

A due consideration must be given to the functional aspects as they raise the questions regarding the purpose of mediated spaces and the role of controlling authority. Intriguing questions can be raised about the potential of detecting violence or assault and possible ways of responding to it. Careful consideration needs to be exercised when developing environments than may have the capacity to perform enforcing and restrictive tasks.

An environment that is able to detect and interpret complex human interactions is already being studied by many professionals (Mark, 1999). Mediated space may soon start playing a role of an active partner to human occupants and consequently the potential of turning into a proactive, leading and controlling tool. Users may have the illusion of interacting with a space that exhibits traits of self-awareness. Developing of social acceptance of the mediated environments will be probably the most important condition to satisfy before such visions may be deemed feasible. Dynamic and interactive environment may bring a range of unanticipated annoyances and nuisances for the user. Nevertheless, traditional architectural means may often feel inad-

equate when faced with increasing population densities and demanding usage patterns. The concept of mediated space opens new possibilities of planning and designing of urban infrastructure of the future.

Discussion and Future Work

In recent years, the study of social physics occupied an important place in connecting both humanistic and scientific aspects of urban discourse. Space syntax, might be thought of as a tool of furthering the academic research and the theoretical integration of the inter-disciplinary study of cities.

We have established a framework that focuses developing new kinetic structures topologies in synergy with integrating of physical reality computation, and inhabitants.

Mediated Spaces and kinetic structures offer a possibility of creating infrastructures that are functionally dynamic and adaptable. The time cycle of adjustments can vary according to the requirements and can accommodate daily as well as seasonal changes. Effective utilization of such infrastructure will need to rely on high levels of participation from the habitants in the logistics of space management as well as social acceptance and proactive ownership. Deeply rooted perceptions about urban infrastructures as fixed, static and inert shells and grids will need to be reconsidered and redirected.

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