

The influence of human movement on the formation of adaptive architecture

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Abstract

Adaptive architecture relates to buildings that are specially designed to adapt to their inhabitants and their environments and in order to design a biologically adaptive system, we can observe how living creatures in nature are constantly adapting to various external and internal stimuli can be a great source of inspiration. The issue is not just how to create a system capable of change but also how to look for quality change and determine the incentive to adapt. The research deals with the possibilities of transforming spaces by using the human body as an active tool, and the research aims to design and build an effective dynamic structural system that can be applied on an architectural scale and integrate them all into creating a new adaptive system that allows us to envision a new way to design, build and experiment with architecture in a dynamic way. The main objective was to address the possibility of a mutual transition between the user and the architectural component so that the architecture can adapt to the user, as the user adapts to the architecture. Motivation is the desire to engage with the psychological benefits of an environment that can respond and thus empathize with human emotions through its ability to adapt to the user. The adaptive affiliations of kinematic structures have been discussed in architectural research for more than a decade, and these issues have proven their effectiveness in the development of kinematic, responsive and adaptive structures and their contribution to an “intelligent architecture”.

A wide range of strategies have also been used in building the mechanisms of complex kinematic and robotic systems to achieve convertibility and adaptability in engineering and architecture. One of the major contributions to this research is the exploration of how the physical environment can alter its shape to accommodate various spatial displays based on the user's body movement. The main focus is on the relationship among materials, shape and reactive control systems and the intent is to create a scenario where the user can move and the structure interacts without any physical contact. , the language of soft form transformation and interaction control technology will provide new possibilities for enriching human-environment interactions.

Keywords

Responsive Architecture, Adaptive Systems, Interactive Architecture, Tensegrity.

Introduction

The research deals with one of the areas that recently imposed its presence on the scientific and research fields related to adaptive architecture and its impact on architectural spaces as interest grows in kinetic properties and their compatibility with architectural spaces. One of the functions of architecture is to create a comfortable environment inside buildings that adapt to the vital environmental conditions to regulate the internal conditions of the building over different periods of time, and this ability is achieved through movement and interaction using kinetic systems and smart materials.

As our life is surrounded by the forces of nature and the ever-changing environment, we find everything in a state of continuous flow, with varying degrees of dynamism. Our lives are also always moving on and the spaces in which we live are constantly changing as well, although change is slow and occurs through immaterial circumstances. The physical state of spaces is fairly stable and not in motion. Kinetic and adaptive structures have been a part of the architectural discourse for decades, but recent technological advances have made them more feasible than academic research, so the movement of real structures is now an integral part of architectural design.

For designing a "bioavailable" adaptive system, observing how living creatures in nature are constantly adapting to various external and internal stimuli can be a great inspiration, whether in terms of their structural formation or their adaptation process. The issue is not just how to create a system capable of change but also how to look for quality change and determine the incentive to adapt. The purpose is to create spaces that can physically reconfigure themselves based on user movements like any adaptive system in nature.

As we can see, soft systems develop through internal organizing mechanisms, yet they always cooperate with forces and efforts coming from an external source. Accordingly, the main goal behind the design of an adaptive stabilization structure that responds to human movement and decision-making is to address the possibility of a reciprocal transformation between the user and the architectural component so that the architecture can adapt to the user, as the user adapts to the architecture. Motivation is the desire to deal with the psychological benefits of an environment that can respond and thus empathize with human feelings through its ability to adapt to the user.

The research examines the possibilities of transforming spaces using the human body as an active tool and the thesis aims to define the relationship between architecture and dance by using the body as a means of modifying the determinants of space.

Research Problem

1. Structures and adaptive architecture are a new form of design that was introduced several years ago and requires specialists to look at the movement of the human body and its effect on the formation of adaptive architecture without any contact.
2. The possibility of cooperation among the different scientific disciplines to reach an adaptive urban environment that responds to the requirements and needs of individuals.
3. Studying its applications in architecture and interior architecture.

Research Questions

1. How can we imagine a space that can recognize its users through physical gestures, visual expressions, and behavior rituals, and respond accordingly?
2. How can we envision a space whose interaction depends not only on pre-programmed processes, but on real-time reactions from its users?
3. How can we envision a real, interactive space whose actual form and configuration can respond to its users?
4. How can such a space affect how we inhabit our environment and change the way we live?
5. What type of structure may be best suited to transform the shape (structure), the best ways to make it adaptive (adaptation) and how to control the movement of the structure (control)?

Research Objectives

1. Study user control and interaction issues and strictly suggest them as inevitable elements of human perception and participation in dynamic structures and architectural spaces.
2. Learn about the kinetic mechanism, shaping memory alloys, digital content, fabrication and user interfaces to create a responsive structural system that can be applied across different architectural scales.
3. Design and build an effective dynamic structural system that can be applied to an architectural scale and integrate them all into creating a new adaptive system that allows us to envision a new way to design, build and experience architecture in a dynamic way.
4. Study how to create spaces that can physically reconfigure themselves based on user movements like any soft adaptive system in nature.
5. Deal with the psychological benefits of an environment that can respond and thus empathize with human feelings through its ability to adapt to the user.

Research Significance

1. Examine how the physical environment can change its shape to accommodate various spatial displays based on the user's body movement.
2. Understand the relationship among materials, shape, and interactive control systems.
3. Establish a scenario where the structure can adapt to the human movement so that it interacts with its presence without any physical contact.

4. Learn about the adaptability of the structure, the language of the soft form transformation and the technique of interaction control which will provide new possibilities for enriching the interactions between human and the environment.
5. Show the future potential of architectural spaces and performance that may enable communication between many movements of human bodies and architecture.

Research Hypothesis

The study of smart materials can be taken advantage of and embedded in a tense structure that can change its inherent properties to face dynamic external changes to create an environment that can respond and thus empathize with human feelings through its ability to adapt to the user.

Research Methodology

The research used the descriptive and analytical method, with the sake of studying how to take advantage of the properties of smart materials and adapt them to obtain an adaptive architecture with the movement of the human body without any contact.

Results

1. The dynamic structures of tension are suitable for interacting with a dynamic world and reconfiguring itself through time.
2. The possibility of transforming spaces using the human body as an active tool.
3. The paper was presented to examine these materials in order to help the adaptive and responsive movement to gain its reliability against other kinematic systems, to place itself within a broader perspective, making it perhaps indispensable in the coming days.

4. From the above, we find that we have to rethink the traditional solid architectural space by combining the changing form of lighting, responsive lighting, adaptive spaces and interactive responses, as it is an attempt to reimagine the possibilities of physical spaces and mechanical architecture.

Recommendations

Body language and movement are rich media for communication and emotional state awareness, movement may be more expressive and subtle than language or facial expression, which is easier to suppress or control. Therefore, the research recommends the following:

1. Teaching new ideologies and adaptive architecture with human body movement.
2. The importance of studying smart materials and including them in a tense structure whose inherent characteristics can be changed to face the dynamic external changes.
3. Understanding the characteristics of movement that conveys emotional content.
4. Developing mathematical models for automatic recognition of feelings from movement.
5. Adapting pre-set movement paths for emotional content overlay.
6. Studying the effect of the appearance of a moving structure, mobility and dynamism on the transmission of feelings through movement.

7. The application of these dynamic and responsive structures in architecture will lead to a radical change in the way people with special needs and the blind experience architecture and spaces.

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