Proactive Home Furnishings:
Inspiring from Interactive Art
for Designing Functional Aesthetics in a Space

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Abstract. This paper presents our vision of the futuristic product. Proactive Home Furnishings allows user to realize (useful) information embedded of physical objects and/or on the top of architectural surfaces. Proactive Home Furnishings also display as interactive art form through the used of interactive techniques and computer graphics in an augmented physical object. The goal of Proactive Home Furnishings is to create the combination between both the digital aesthetics and the functional information, as well as seamless with living environment in a soothing way. This paper describes five interactive artworks used biomimetic perspective to develop the interaction feature - MSOrgm, Lbskeletons, Portrait of Dandelion, Artificial Phototropism, River Space. We treat them as pioneers to investigate the ongoing relation between the user and the home furnishings in a future living.

Keywords: Design philosophy of HCI and UX, biologically-inspired computing, responsive environment, digital art, interactive installation.

1   Introduction

The creation of interactive installation is bringing diverse types of the form to combine with aesthetics and computer technologies in the field of digital art. While in exhibiting, it may shows alternative visual display mixed with multiple media such as light, sound, kinetic movement, and animation as ambient information. It also establishes a dramatic interaction to seamless relationship between the viewers, artworks, and background atmosphere in a space.

Although we have developed various smart object or system for processing meaningful information through ambient media toward smart living, most of these interface designs are neglected in appropriate embodiment because of the lack of the usability of the spatial and the interior concept, and too much foreground of input/output media requests.

This paper presents our vision of the futuristic product. Proactive Home Furnishings allows user to realize (useful) information embedded of physical objects and/or on the top of architectural surfaces by their awareness. It also display as interactive art form through the used of interactive techniques and computer graphics in an augmented physical object. The goal of Proactive Home Furnishings is to create the combination between both the digital aesthetics and the functional information, as well as seamless with living environment in a soothing way. This paper describes five interactive artworks used biomimetic perspective to develop the interaction feature - MSOrgm, Lbskeletons, Portrait of Dandelion, Artificial Phototropism, River Space. We treat them as pioneers to investigate the ongoing scenario between the dweller and the home furnishings in a future living.

2   Computer Augmented Physical Objects

The developments in research of proactive object with kinesthesia are playing an indispensable trend in contemporary spatial design. Muscle projects [1] demonstrate a real-time interactive architecture allow for multiple usability via adaptation of their spatial constituents. Bubbles [2] demonstrated that interactive installation could be aware of a visitor coming and react with a spatially pneumatic form at an urban scale. Deforming and performing dynamical behavior is generated by real time calculations. The rolling bridge [3] presents a transformable design, which opens smoothly, curling from a conventional, straight bridge, into a circular sculpture. The structure uses a series of hydraulic rams integrated into its eight segments, causing its rolling character. The expanding video screen [4] demonstrates a giant screen that can change its size and shape, morph into a 7-story high cone-shaped structure, enveloping the band as it extends in the U2's concert. And the actuated tensegrity structure [5] demonstrated a vision of building adaptability, which could change the shape of building's envelope in response to outside/inside sensors in the structure.

The field of kinetic art also offers a rich motion vocabulary and embodiment both in the functional and perceptual areas. Hylozoic Soil [6] is an immersive, interactive environment made of tens of thousands of lightweight digital fabricated components fitted with meshed microprocessors and sensors. It contains infrared proximity sensors, micro-controllers, strands of titanium nickel memory wire, and custom circuit boards to perform mutual interactions between viewers and the kinetic object. The robotic dog Aibo [7] attempted to simulate animal or human forms and movements coexisting into our living space. Outerspace [8] appears as a playful, curious creature exploring the surrounding space, looking for light, motion, and contact. To create a kinetic sculpture Ferrofluid [9], the shape-changing material that appears as a black fluid was prepared by dissolving nanoscale ferromagnetic particles in a solvent such as water or oil; it remains strongly magnetic even in a fluid condition.

Computer augmented interactive object give the electronics hardware and software a manipulated and perceptible form. The computational construction objects can self-describe the spatial organization and form a decentralized computing framework while they are assembled [10] [11]. It can combine organization with topology to form and conduct further computational behavior. In systems created by Lifton [12], each individual sensing object provides distributed and decentralized hardware/software architecture for practicing with algorithms in cellular computing and test emergent behavior with light, sound, and vibration applications.

3   Interactive Installations

There is a beauty to even the mundane aspects of the natural world, from the anatomy and physiology of life to the behavior of the animals in the world around us. The following interactive arts observe the natural mechanism from the standpoint as an architect, seeing evolution of life to its surroundings through the prism of design. We aim to combine this beauty in nature with mechanical design to create a new field of functional aesthetics, one that brings the life force of nature into the home and connects with the user, providing a sense of warmth and comfort. These artificial life artworks interact with people in a kinetic manner, much in the same way as animals do. Its use foldable structures and robotic technologies in conjunction with sensing/controlling techniques to develop self-behavior and artificial consciousness interns of physical and cyberspace, resulting in artworks that display the characteristics of life. These artworks not only demonstrate a novel symbiosis of art and design, but also bring technological art into our living spaces. With beautiful and inspiring creations we aim to re-identify the relationship between the space, dweller, and the installation.

3.1   MSOrgm

A living form can interact with other objects in the environment, especially with other living forms that notice the existence of it. With MSOrgm, we intend to present a mechanical structure that displays a kind of behavior as if it has a conscious of self. It cares about being looking at by other living forms that also have conscious, and seeks to have continuous dialogs with them. In reacting to people who are looking at it (see as Fig.1). MSOrgm raises its movable branches towards them. We designed a kind of kinetic structure consisting of "motor cells" made with plastic tubes and joints for MSOrgm. Shape memory alloys are used as mussels for each of the motor cell to shorten the cell in length when the alloy is heated by electrical current. MSOrgm is capable of displaying various motions and configurations by stimulating some of the motor cells, which in turn stimulate other cells that are connected to them.   Although it is one single object when seen as a whole, MSOrgm can be regarded as an organization consisting of autonomous cell which are capable of reacting to other

cells, and altogether, display cooperated and sometimes unexpected behaviors. MSOrgm is the first step of our experiments in seeking for ways to construct kinetic structures with interesting and emergent behavior using simple and symmetrical units that can be joined together to form more complicated forms.
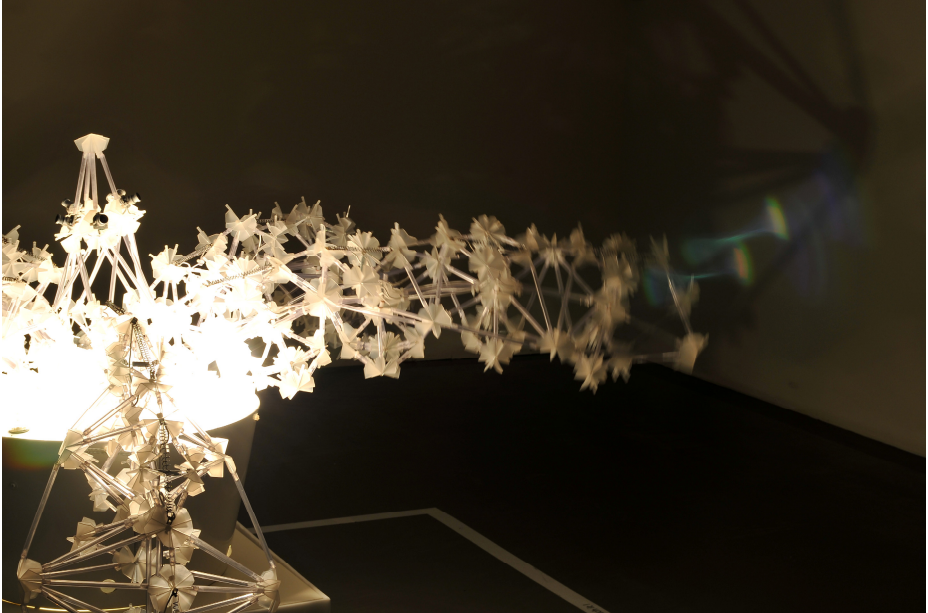

Fig. 1. MSOrgm presents the viewer with self-contained and graceful gestures, uses cameras to track viewers' movements through facial recognition software— lifting or drooping as it responds to human interaction

3.2   LBSkeletons

LBSkeletons is an interactive illumination composed of the transformable lampshade and embedded of the computing mechanism to generate diverse forms through the proximity contact (see as Fig.2). The transformable lampshade form is articulated in the reference of origami technique. From foldable structural design to connecting dense replicated spatial frame to pneumatic cylinders and processors, to build a kind of decentralized computing framework. LBSkeletons creating an alternative ambient display from a magnificent shadows and blend of pneumatic sound, and showing an emotional communication between viewer and the illumination object. The LBSkeletons detects one or more audiences and reacts through a change of shape, sound, light, and enables the audience to immerse and control a harmonious musical environment and shadows through their body movement. The grace summons

immersion in a harmonious environment as well as bringing in the imagination that life in the future, furniture built with artificial intelligent may detect the dweller's mind and responses with meaningful behaviors, and that our space would become an ecosystem filled with sensations and emotions, the representations of life and the surroundings that we live in.

Fig. 2. LBSkeletons creating an alternative ambient display from a magnificent shadows and blend of pneumatic sound in a space

3.3   Portrait of a Dandelion

Portrait of a Dandelion demonstrates a novel symbiosis of art form that brings functional aesthetics thinking into our living spaces. The virtual plant is created by computer graphics using the morphology of dandelion flower as a model based on the techniques of fractal and recursive algorithm. Depending on the "seed program" from which the virtual plant grows, it may display characteristics of life as an adaptable structure, follow set growing process, or develop in abstract form (see as Fig.3). It presents the scene of the life contains unlimited possibilities and promise, that was begging from a seed and growing with diverse nature. In exhibition, this work used attention meter toolkit to analysis viewers' attentive activities on the screen,

translating the attention level into parameter changes for stimulus of the internal recursive structural works. The Dandelion interacts with the viewer, changing morphology in response to the viewer's input.
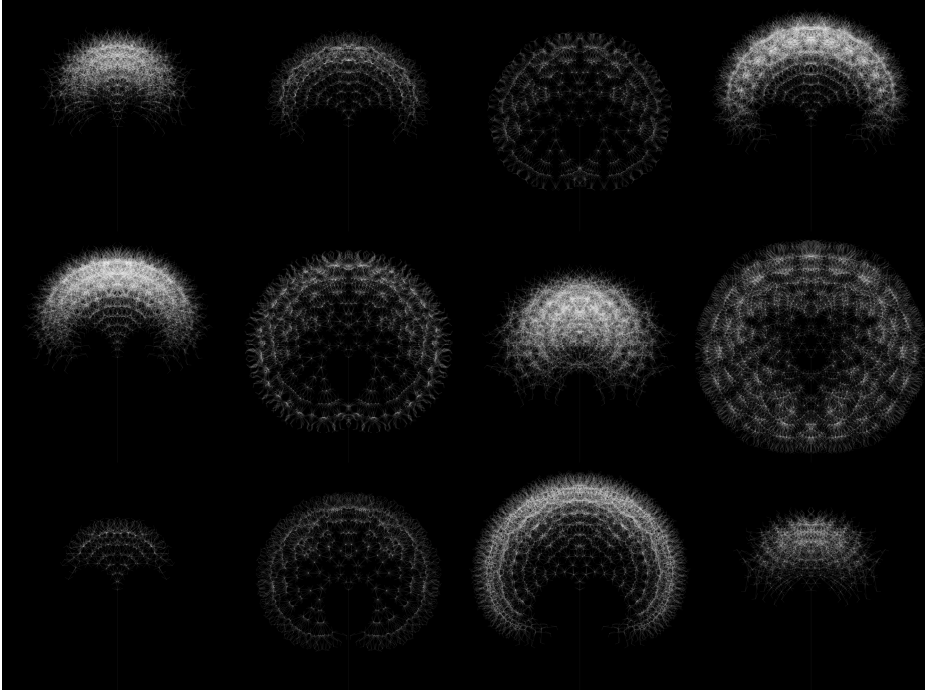

Fig. 3. Based on the techniques of fractal and recursive algorithm, the "seed program" real-time generates the diverse forms according to viewers' attentive activities

3.4   Artificial Phototropism

Light induces growing points in plants and the secretion of growth hormones by leafstalks, which flow behind the tissue in the light creating the phototropic nature of plants. Artificial Phototropism allows those who participate to experience first-hand biologic interaction (see as Fig.4). It is through this dialogue of flowing light and shade that the growth of a beard-like mechanical component is initiated, reconstructing a scenario of beauty between the environmental atmosphere and interactive installation as it creates minor formative changes which symbolize the pursuit of lightness.
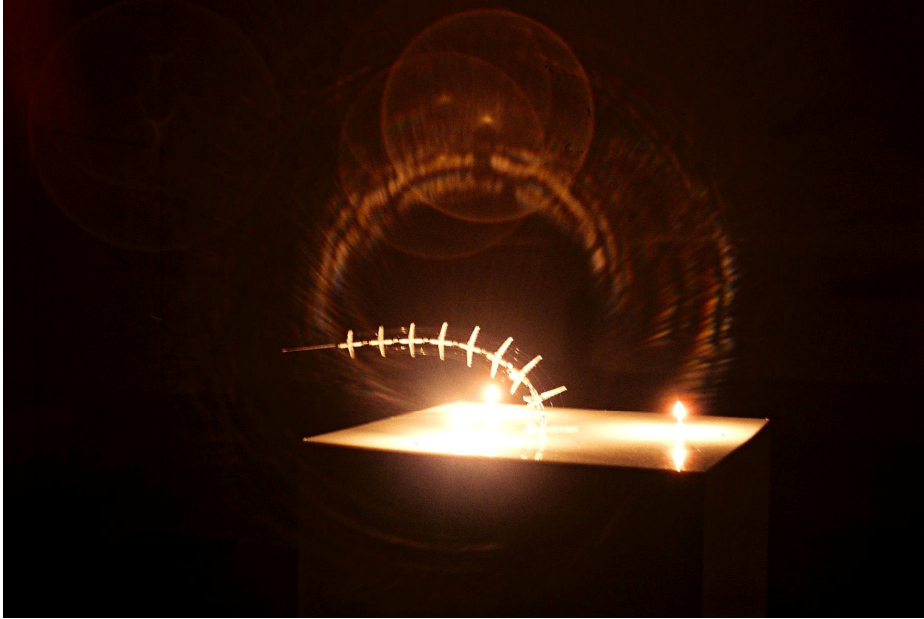
Fig. 4. Artificial Phototropism simulates the natural mechanism that light induces growing points in plants and the secretion of growth hormones by leafstalks in a computer augmented kinetic sculpture

3.5   River Space

River Space was consisted with a crowd of mechanical tentacles hanging from ceiling. Each piece may be detect the dweller under it, and collaborate with neighbor pieces to form a reaction-diffusion model (see as Fig.5). It may generate emergent patterns of light and behavior while one of each was stimulus by. It consists of dense individual processor as basic life objects working together. PWM (pulse width modulation message) is used for exchanging and disseminating information through the connection between node-to-node. Full-color LED is used to express the stimulated information on each piece through whole organization processing in a direct way. River Space serves a novel lighting system, which generates both the patterns of color and kinetic behavior following the people stand by. It is also make people imagine a crowed interconnected organization that works like the group behavior, and make people feel a new contact experience between human and kinetic lighting sculptures.

The creation of interactive installation is bringing diverse types of the form to combine with aesthetics and computer technologies in the field of digital art. While in exhibiting, it may shows alternative visual display mixed with multiple media such as light, sound, kinetic movement, and animation as ambient information. It also establishes a dramatic interaction to seamless relationship between the viewers, artworks, and background atmosphere in a space.
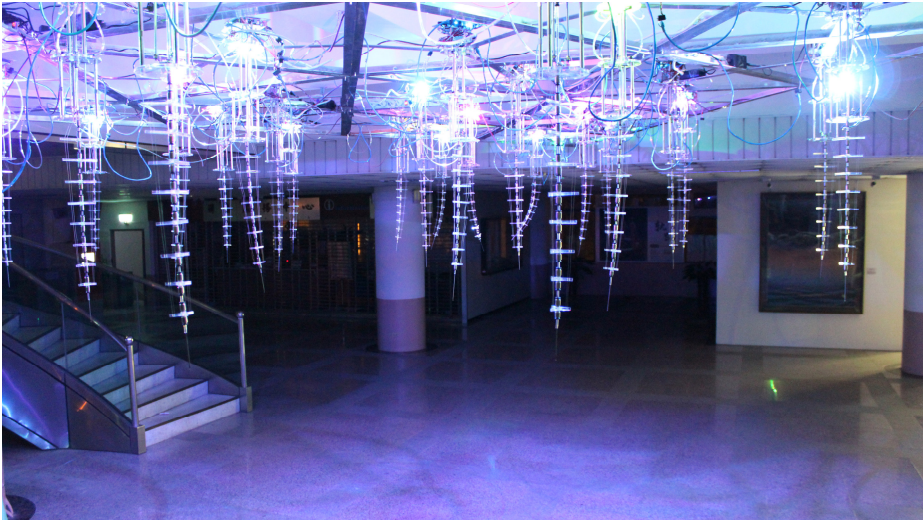
Fig. 5. River Space was consisted with a crowd of mechanical tentacles hanging from ceiling, it may generate emergent patterns of light and behavior while people standing below of it

4   Conclusion

Biomimetic perspective is bringing new aspect to use computer technologies as a mediated matter to study dynamic form and behavioral animation. Through the use of program for defining the expect rule, and then utilize the algorithm to produce unexpected result of both the generated modeling and emerged behavior, it is able to assign the biomimetic features into the design outcome. Ambient interface is enable designer to display and grasp information in any types of interaction they wish. Through the custom of their own mechanism for establishing appropriate mutual relationship between human and computer augmented object, the new matters combined of digital aesthetics and the functional information is able to seamless with our living environment.

MSOrgm is a robot designed to interact with the viewer in a quiet and soothing way. LBSkeletons is an interactive illumination composed of the transformable lampshade and embedded of the computing mechanism to generate diverse forms through the proximity contact. Portrait of Dandelion is a virtual plant created by computer graphics using the morphology of dandelion to display characteristics of life as an adaptable structure. Artificial Phototropism simulates the natural mechanism that light induces growing points in plants and the secretion of growth hormones by leafstalks in a computer augmented kinetic sculpture. River Space was consisted with numbers of mechanical tentacles hanging from ceiling, it may generate emergent patterns of light and behavior while one of each was stimulus by. These works bring the specific types of smart material, sensing/actuating techniques, computer animation, and decentralized computing framework for building specific functional

aesthetics. Following the result, futuristic furniture and interior design can be extended.

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