

Chapter 15

On the Designing and Prototyping of Kinetic Objects

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ABSTRACT

MSOrgm (Huang, 2009), SSOrgan, and LBSkeleton (Huang, 2011) were created to contain computation, aesthetic, and structural characteristics to employ physical kinetic motion to embody and communicate to people. MSOrgm raises its branches when it senses someone who is looking at it. MSOrgm was developed as a robot plant to interact with the viewer in a soothing way; it uses transformable module to build interconnected fabric and produce unexpected behavior. SSOrgan provides a novel tangible interaction, which generates color in response to touch. SSOrgan is an artificial skin system composed by dense individual sensing module; it creates the responsive behavior executed by its external contact and its internal computing mechanism. LBSkeleton explores a mutual interaction that happens between “the piper and the snake” — through the change of the sound performance that should triggered by body movement reflectivity. LBSkeleton shows a kinetic structural system, which is engaged with the sensor networked framework and the origami tessellation module to perform a kind of growling behavior with sound. These works bring the specific type of modeling, controlling, and interacting on the designing of the kinetic creatures. The artworks are bringing novel user experiences with the biomimetic mechanism in a space.

INTRODUCTION

The development of computer-augmented physical kinetic objects has changed the relation between the viewer and the artwork. To discover the feature of kinetic object, this chapter used biomimetic aspect to develop modular design

method in the three digital artworks. Physical computing (Sullivan & Igoe, 2004) is bringing new opportunities to develop diverse and multiple design forms in the field of new media art. It integrates traditional fine arts and modern art forms with computational features and creates a closed relationship between the viewer and the

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artwork. In approximately 1820, modern materials of electric and machine technology came to be used into kinetic artworks. Since then, numerous artists, designers, and architects have created kinetic objects involving the representation of illusion and natural movement. From 1960, during the introduction of the computer graphics and interactive techniques, several research directions have been attempted to take computational resources from the cyber space into the physical world, such as Augmented Reality (AR) and robotics technology. These novel technologies, which are used as design media, bring new possibilities for designing computer-augmented physical objects in the space (Liu & Lim, 2009).

This chapter used a biomimetic aspect to develop a modular design method in three digital art works. MSOrgm (Huang, 2009), SSOrgan, and LBSkeleton (Huang, 2011) contain computation, aesthetic, and structural characteristics to employ physical kinetic motion to embody and communicate to people. We treat them as pioneers to investigate the ongoing relation between the viewer and the artwork – the digital artworks' body and behavior may change dynamically and lively as if to reflect echoes of environment and human communications.

Computer-Augmented Physical Kinetic Objects

The developments in research on kinesthesia are playing an indispensable role in contemporary spatial design projects. Bubbles (Fox & Kemp, 2009) 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 (Ahlquist & Fleischmann, 2009) 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 (Hoberman, 2010) 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 (Sterk, 2003) 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 offers a rich motion vocabulary both in the functional and perceptual areas. Hylozoic Soil (Beesley, 2010) is an immersive, interactive environment made of tens of thousands of lightweight digitally-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 (Otsuki, 1999) attempted to simulate animal or human forms and movements coexisting into our living space. Outerspace (Andre Stubbe and Markus Lerner, 2007) appears as a playful, curious creature exploring the surrounding space, looking for light, motion, and contact. To create a kinetic sculpture Ferrofluid (Kodama, 2008), 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.

Computation embedded interactive objects give the electronics hardware and software a manipulable and perceptible form. The computational construction objects can self-describe the spatial organization and form a decentralized computing framework while they are assembled (Gorbet, Orth, & Ishii, 1998; Aish, Frankel, Frazer, & Patera, 2001; LeClerc, Parkes, & Ishii, 2007; Schweikardt & Gross, 2010; Weller, Gross, & Goldstein, 2010). It can combine organization with topology to form and conduct further computational behavior. In systems created by

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