

---

# Floor, Come and Embrace Me!

## **Ellen Yi-Luen Do**

College of Architecture  
Human-Centered Computing  
Program, School of Interactive  
Computing, GVV Center  
& Health Systems Institute  
Georgia Institute of Technology  
Atlanta, GA 30332 USA  
ellendo@gatech.edu

## **Toward a Smart Living Environment**

"A house," is "a machine for living in" [9]. An Adaptive-Conditional Architecture includes "a sensing device, a control algorithm, a change mechanism, and a control setting" [5]. A "responsive architecture" [10] is an environment that takes an "active role," initiates changes "as a result and function of complex or simple computations" but also "knows me" and the context it is in. The best way to predict the future is to invent it [8]. For the past decade my studio laboratories at several different universities have explored the themes of adaptable, responsive and interactive architecture, or the idea of Architectural Robotics [13]. Below we briefly describe a couple explorations [4].

## **Responsive Architecture**

The Digital Animation Museum [3] explores the notion that architectural spaces and forms can be influenced by ubiquitous and wireless information technology to provide flexibility in spatial programming. Each unit space in the museum can automatically reconfigure itself to form space and change the exhibit display by identifying the preference and behavior of the viewers. Buildings and visitors can collaborate to produce a unique and individualized experience. The Flex M project [6] explores the idea of using physical or tangible interface to control and reconfigure the building form. Squeezing physical interface deforms unit shape parameters and affects changes of the whole

---

Copyright is held by the author/owner(s).

*UbiComp 2009*, Sep 30 – Oct 3, 2009, Orlando, FL, USA

3D geometry of a building model. Structures of building envelopes can be a fabric woven with modulated variable surfaces and shapes achieved by overlapping identical elements on a grid [2]. For example, variations of complex double curvature surfaces can be derived by the repetition of a series of identical elements (e.g. flat panels) and the movements of the fastener grid points.

### **Transformer Architecture**

Espresso Blocks [12] are self-assembling building blocks that build dynamic structures such as a live/work espresso stand that can respond to the occupants' needs and transforms itself throughout the day. The occupant can rearrange the blocks with a remote control to create new configurations, save them, and even trade designs with others. TransDorm [11] is a convertible multi-purpose two-person dormitory unit that supports transformation of sleeping quarter into living, study, or a place to play and entertain. Care On Rail [1] extends the functionality of a hospital ER or OR into an acuity-adaptable room by providing mobile, sharable medical resources mounted on the ceiling sliders to eliminate equipment clutter that hinder care and operations.

### **The Need for Tangible Interface**

To create structures composed of dynamic materials like Espresso Blocks, or to operate transformer architecture like TransDorm or Care on Rail, we need interfaces that are easy and intuitive. To specify a desired design form, perhaps one can demonstrate by stacking up the blocks, and a planning algorithm can automatically generate a rule set to produce that form. To transform a living space, perhaps multi-modal inputs such as voice commands and gestures, combined with

the identification of the context can invoke rule sets to run on the physical and robotic architecture.

### **References**

- [1] Al-Emam, F., Kuo, C-L., Masse, D. Care On Rail: Extendable Adaptable Sliders, ER Future 08, GaTech
- [2] Bernal, M., Do, E.Y-L. Variation from Repetition, in Proc. eCAADe (2007), 791-798
- [3] Chen, J., DAM: Digital Animation Museum, M. Arch thesis, University of Washington, Seattle, 2002
- [4] Do, E. Y-L., Gross, M. D. Environments for Creativity - A Lab for Making Things. Proc. Creativity and Cognition, ACM (2007), 27-36
- [5] Eastman, C. "Adaptive-Conditional Architecture." Design Participation, Proc. Design Research Society's Conference, 1971, Academy Editions, (1972), 51-57
- [6] Eng, M., Camarata, K., Do, E. Y-L., Gross, M.D. FlexM: Designing a Physical Construction Kit for 3D Modeling", IJAC, (2006), 4 (2), 27-47, Multi-Science
- [7] Herron, R., Harvey, B., A Walking City, in Archigram 5 (1964).
- [8] Kay, A. The Best Way to Predict the Future is to Invent It, Stanford Engineering, 1, 1 (1989), 1-6.
- [9] Le Corbusier (1923) Towards a New Architecture (original title: Vers une architecture) Eng. Trans. 1927
- [10] Negroponte, N. Soft Architecture Machines, MIT Press (1976).
- [11] Sivcevic, E. Trans-Dorm: transformable space, Happy Healthy Home 2009, Ga Tech
- [12] Weller, M. P., Espresso Blocks: Self-configuring Building Blocks, M. Arch thesis, U Washington, 2003
- [13] Weller, M.P., Do, E.Y-L. Architectural Robotics: A New Paradigm for the Built Environment, in EuropIA 11: 11<sup>th</sup> International Conference on Design Sciences and Technology, (2007), 353-362