FOLDING SPACE WITH TIME-BASED OPERATIONS

WEI-TSANG CHANG, TENG-WEN CHANG
Graduate School of Computational Design, National Yunlin University of Science and Technology, Yunlin, Taiwan, R.O.C.
mile@mail.gcd.yuntech.edu.tw, tengwen@yuntech.edu.tw

1. Introduction

Folding is not only a design operation of shaping but also a philosophy theory from Deleuze (Deleuze 1988) which was adopted by architecture. Basically, folding constitutes to forming and topology, which often delivered a mathematical and philosophical expression in generating 3D architectural form. For instance, the work of Eisenman (Eisenman 2003), Libeskind and Lynn (Lynn 1998), they use folding as inspiration to explore the textural folding and bifurcation meaning in the process of form-making. While exploring the meaning of folding, their ideas are expressed by the form using computational tools. Therefore, if a suitable or inspirable tool like our Folding Space (FoS) could be available, such action –fold can be expressed further in the form exploration process.

2. Objective

In FoS, locating the possibilities of form is the main concept and we try to grasp the consequences of becoming during the form exploration process. Without time involving, the whole procedure would be broken into fragments. According to our analysis, we would use a term “time-based” folding to emphasize the important role of time in this design process.

3. Time-Based Folding Mechanism

There are also several operations to control shape by means of parameters (Kolarevic 2000;(Braha and Maimon 1998). Considering time factors, we could enlarge the in-between transformation of form through time parameter. Hence, we can take folding operators, which determine the process of

form-making into parameters. In other words, the duration of valid operation must be set up. As long as each operator has the attribute of time, it also has parameters: start/end which defines a valid period to influence forming. As a result, designer could trigger another operation between transformations, not until one operation has been accomplished, which we must manipulate form one by one.

The influence of time-based folding operator is illustrated in [Figure 1] and contributes to alternative forms. The time point (solid dot) represents when designers want to add another operation into original transformation processing. Before the time point, operation is applied on gradually with time passing. But after time point, the result will be leaded to new one.

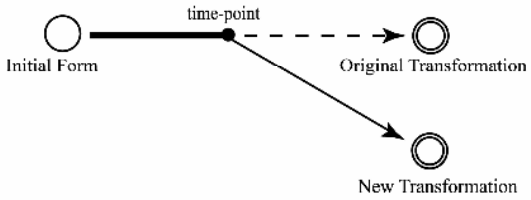

Figure 1. Different transformation by redirecting at certain time point.

On the other hand, we would skip the internal forms to next form and could not manipulate them without time factors converting one attribute of operation. Namely, the result of operation with dashed line is discrete processing, not continuous one.

4. Implementation and Example

Consequently, in this research, we implement a computational tool that will have the ability to fold the space virtually and intuitively. An interactive "folding process"- a sequence of folding actions will help to release the fixed form of space and make the space "becoming" alive beyond its boundary. FoS is implemented at the top of Maya with MEL/C++ extension, and the paper-folding mechanism is simulated and implemented by means of dividing topological surfaces and control points. Briefly, we put mathematical description—equation into folding operation and the time factor is regarded as variable of equation. One example which FoS generated is shown in [Figure 2].

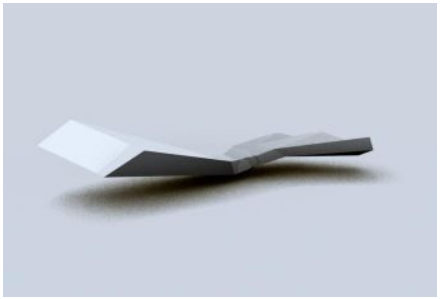

Figure 2. One example of folding space.

References

Braha, D and Maimon, O: 1998, *A Mathematical Theory of Design: Foundations, Alogrithms and Applications*, Kluwer Academic Publisher.

Deleuze, G: 1988, *The Fold: Leibniz and the Braoque*, T Conley, translator, University of Minnesota Press.

Eisenman, P: 2003, *Blurred Zones: Investigations of the Interstitial: Eisenman Architects 1988-1998*, Monacelli.

Kolarevic, B: 2000, "Digital Morphogenesis and Computational Architectures." SIGraDI

Lynn, G: 1998, *Animate Form*, Princeton Architectural Press.