ON THE ORIGINS OF FOLD IN THREE PROJECTS BY TOYO ITO.

Fold as generative method of new continuity.

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Abstract. The change of design methods by Toyo Ito in the course of 90’s is investigated toward genesis of fold. The origins of fold are outlined by analysis of 3 projects for cultural centers, in terms of mass-, space- and surface-elements, and relations of separation, fusion and difference between them. The fold as a result of consequent evolution of those relations is argued to be primarily a generative method, which is capable to include difference within continuity.

1. Fold.

1.1. FOLD AS METHOD.

In the beginning of 1990’s a special synergy developed between the new concepts of space and the introduction of 3d modeling techniques into architectural practice. Amidst such a situation many architects find an intensive interest in folded surface as an element of architectural form. While surface is one of the elements of form, along with mass- and space-elements, it most often bounds mass-elements (Norberg-Schulz, 1965). Folded surface seems to challenge that subordinated role and demonstrates potential beyond acting as an element of form.

While the discussion about fold had been mostly that of figurative paradigm of folded surface, few architects argue fold to be a method of relating elements by process of folding. “Rather than conceiving of folded structures as static configurations or dynamic expressions, they may instead be conceived as transformational mechanisms.” (Terzidis, 2003). Fold as a
result of folding process shows itself as a method of relating elements primarily. Fold as “a mechanism”, “a mediating device”, “a spatial instrument” (Vidler, 2000) to relate elements, rather than an element itself, can actually challenge design methods.

Folding is primarily a process of laying one part of element over another without breaking its continuity and thus folding is one of the topological processes. Topology as a way of thinking in terms of continuity of element is argued to challenge the design methods, when applied in mathematical algorithms (De Landa, 2004). The mathematical algorithms got the potential to define forms not necessarily associated with human experience or perception. In contrast to human mind with its ability to generalize and deduct, algorithms follow pure inductive reasoning. “In that sense, algorithmic processes become vehicle for exploration that extends beyond the limits of perception” (Terzidis, 2003). From that point of view, fold as a method to relate elements got special design potential, far beyond figurative properties of folded surface.

1.2. FOLD, RHYTHM AND CONTINUITY.

In order to argue that fold is a method of relating elements, the fold as a result from evolution of continuity between elements in consecutive works by Toyo Ito is investigated. The practice of Ito is exceptional here, as Ito was developing the relation of continuity from his early works and it remains one of his main concepts.

For that purpose, the definition of continuity as two simultaneous relations of succession and fusion can be useful (Norberg-Schulz, 1965). Succession is characterized by separation of elements and is counterbalanced by fusion which produces unity of elements.

On the other hand, the concept of rhythm is used when repetition is combined with lawful changes of elements, “repetition denotes the relational property of succession, while variations denotes element properties derived from a common basic source” (Norberg-Schulz, 1965). In that sense, rhythm adds to the relations of separation and fusion within continuity a relation of difference.

Fold is argued to be “a method by which homogeneity could be differentiated while remaining continuous”(Terzidis, 2003). Thus fold as method is capable of fusing elements while still keeping them separated and different. Fold enables to combine difference within continuity.

Thus in order to reveal the origins of fold, specifically the relations of separation, fusion and difference between elements are examined in three projects as follows.
2. Toward fold- analysis of 3 projects by Toyo Ito.

2.1. NAGAOKA PROJECT.

The mass-elements of halls are closed and separated from each other by the space-element of foyer. The space remains neutral ground for the masses. Moreover, in the space of foyer the small mass-elements of columns are placed. Although the distances between them slightly vary, columns themselves do not differ in terms of size and shape.

While in plan the mass-elements remain separated, there is an interesting challenge in section. In the surface-element of roof there are several openings, either “cut-outs” left after conceptual subtraction of mass-elements of halls from the space-element of foyer and the surface-element of roof, or “cut-outs” of lightings. They all relate the space under the roof to the space outside above the roof.

TABLE 1. Nagaoka project.

1) space-elements  2) mass-elements  3) surface-elements

Ito describes the method of “cut-outs” in section to achieve fusion of spaces while still separated as “(...)several openings set at random in the floor create a certain dynamic relation between the levels above and below, creating what I call “an opaque transparency”.”(Ito, 1997). That fusion in Nagaoka project is rather intentional in case of “cut-outs” of halls. However, when viewed along with the small “cut-outs” of lightings, they show themselves as a method of fusion of two spaces under and above the roof.

2.2. SENDAI PROJECT.

In Sendai project columns act as “cut-outs” in the space-element between floor slabs and surface-elements of floor slabs. In plan, columns remain separated by space-element. They are different in terms of size and they are also positioned in a different distance to each other.
However, the column-elements possess rather ambiguous properties as elements. As they are bounded by closed but perforated surface-elements, they got some properties of mass-elements, “thick” columns. On the other hand, they are “columns seemingly without mass” (Ito, 2001), as the perforated surface of wire mesh reveals the space-element inside of column. Ito expresses that intended ambiguity of surface-boundary as “blurring architecture means architecture with smudged boundaries.(…)The ambiguity of outline comes from my doubts about architectural boundaries (…).”(Taki and Ito, 2000). That ambiguous property allows interpreting them as a combination of independent surface-element and special space-element, a negative of space-element between floor slabs.

They are inserted between two separated floor slabs, but at the same time they are fusing them. Thus, when observed from one level, the space-elements of adjacent levels above and under are fused “through” the space-element revealed inside the column.

The columns are different in terms of location and size on every level. However they are fused into one vertical space-element, while preserving their own character on each level. The surface-element of column reconciles those differences by bending and shrinking.

2.3. GHENT PROJECT AND FOLD.

In the section of Ghent project the space-elements of circulation on two separated levels are fusing “through” the space-element of the level of halls between them. Alternatively, the space-elements of hall levels are fusing through the level of circulation, which separates them.
Moreover in plan, the space-elements of circulation are fused, while still separated by space-elements of halls. On alternate floors the situation inverts and the space-elements of halls fuse with each other, while separated by constrained space-elements of circulation. As a result, both of the space-elements are continuous vertically and horizontally. The relations of separation and fusion within each of them are changing reversely to the relations within the other element. They are inseparably interwoven with each other.

The interplay of horizontal and vertical separation and fusion within one space-element is supported by eliminating the junctions between vertical and horizontal elements, what is referred as: "To create smooth, boundary-free transition we dissolve the junction between walls and floors." (Cellarius, 2005).

Moreover, in plan the elements of hall and the elements of circulation differ in terms of size. Also in section their position differs on alternate levels. The smooth surface-element of shell negotiates between those differences. And consequently, both in plan and section the fold is employed to separate and fuse various elements.

3. Fold as generative method of continuity.

3.1. ORIGINS OF FOLD.

The comparison of relations between elements in 3 projects indicates that the fold originates from the work on the relations of separation, fusion and difference. The fold finally appears as an ultimate method of fusing while still keeping separated and different elements.

In plan, the fold appears when separated mass-elements of columns in Nagaoka vary in Sendai project and finally fuse in Ghent project.

In section, the origins of fold can be traced back to the conceptual “cut-outs” in the space of foyer and surface of roof already in Nagaoka project. In
Sendai project due to ambiguous character of mass-elements of columns, the “cut-outs” work along with the space-element inside of column and fuse spaces on separated levels. In Ghent project the spaces on separated levels are fused alternately “through” each other by means of cylindrical space-elements.

Consequently, a germ of folded surface in Ghent project can be found in the surface bounding mass-elements in Nagaoka project. The ambiguous surface-element of columns in Sendai project gives way to the surface-element of cylinders in Ghent project. It is finally fusing with the surface-element of floor slabs to form a folded surface.

The comparison allows arguing that the element of folded surface in Ghent project, which indeed possess strong figurative properties, results from the methodological relations of fusion and separation of mass- and space-elements. Thus fold in Ghent is primarily a method of relating elements, before it can be considered as a figure of folded surface.

**TABLE 5. Comparison of relations in 3 projects.**

![Diagram showing comparison of relations in 3 projects](image-url)
3.2. FOLD AS GENERATIVE METHOD OF CONTINUITY.

The fold is a method, which Ito employs finally in his constant work on the continuity. Ito had been working with the concept of continuity from his earliest works, recalling that later: “I felt that architecture should provide a space that was both continuous and also changing at every turn (…). Space was something that should neither be broken up nor partitioned.” (Taki and Ito, 1994).

In Nagaoka project, Ito started to work with the archetype of “free plan” continuity, which F.Kiesler describes as an “infinite” continuity by introducing contrasting type of “endless” continuity in the early 1960’s, where “(…)endlessness it inherently undecidable, intricate and unpredictable, where infinity is decidable, generalizable and identical.” (Lynn, 2001). In terms of methods, infinite continuity is deductive, while it results from general and universal and endless continuity is inductive, while it results from local and different.

Fold as a method of relating elements locally and specifically is an inductive method. In that sense, fold generates new continuity which is a type of “inductive” continuity. The new continuity it is a system of locally interrelated space-elements. The method of fold allows reconciling the difference within the continuity of “geometry that is systematic but which allows great freedom of shaping and distortion” (Cellarius, 2005).

Thus, the investigation into origins of fold outlines the evolution toward inductive methods of design. Fold as an inductive method got a potential of an algorithmic design method. Like in Ghent project, the generated forms are associated neither with human experience nor perception. “Fold creates kind of affective space,(…)in which there is a possibility of the environment looking back at the subject, the possibility of gaze” and moreover “(…)gaze is that possibility of seeing which remains covered by vision.” (Eisenman, 1996). It is inductive algorithmic potential of fold which enables “to see” what remains hidden to deductive design methods.

References
