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Study the Works of Peter Eisenman? Why?!

In this paper, some design applications of Fuzzy Control are reviewed and discussed. Design conveys multiplicities, contradictions, differences, into temporary hypotheses. Actual realizations, papers, are the place where reflections consist; the reflections matured in several technological ambits appear in terms of sums of experiences and solutions'shifted' from their own place of origin to the detailed synthesis that rules the assembling. We ask ourselves how fuzzy logic, that finds its reason for existence in the interpretation of the reality and exalt the 'shifts' can point towards the architectural process.

Introduction

The ancient Greeks knew that reasoning is a structured process governed, at least partially, by a system of explainable rules. Aristotle codified syllogisms; Euclid formulated geometric theorems; Vitruvius defined the criterion and referential key so that every architectural element could be proportioned according to an ideal model, symbolizing the aspirations and aptitudes of that particular civil society. In these forms of reasoning it is possible to distinguish contingent aspects with regard to the role which the use of a method and the application of a procedure play within any conceptual process: communicable by virtue of the codes and the prescribed norms, comparable in every time and place by virtue of the reproducibility of the procedures.

Euclidian logic begins with the inductive definition of very simple concepts and gradually constructs a vast body of results, organised in such a way so that each concept depends on the previous. Thus, a strong and rigorous construction is derived that makes all operations perceptible, comprehensible and intelligible. But, unlike processes that are physically constructed, Euclidian reasoning does not materially crumble if its structural elements, that is, its demonstrations, are not coherent with the reality of the empirical world. This explains why deductive-inductive logic, subtended by the philosophical-scientific thought of classical culture, has unconditionally influenced almost all fields of knowledge for almost two thousand years.

Physical-mathematical knowledge was the first to understand the conventional character that is typical of axiomatic reasoning: "...which firstly, and in the most rigorous manner, became conscious of the symbolic character of its fundamental instruments" [Cassirer, 1929]. The attempt to render Euclid's works without contradictions has caused a review of the form in which scientific work is carried out [Saccheri, 1733]. The verification of the existence of many types of points and lines has sanctioned the distinction, even in the field of knowledge, between common language and technical language, clarifying once and for all that it is the the type of link established between the symbol and the meaning that provides the symbol with its significance.

Already in antiquity, the criticism raised by the sophists against the use of a 'common' language had established the premises for the definition of a technical, or pseudo-technical, language, which would be later adopted by Euclid in his *Elements*. Here, the first twenty-eight propositions, thanks to the uniqueness of the relations that link human intuitions to the properties of geometric entities, define absolute geometry; geometry, that is, which doesn't necessitate any preformulated theorem for its enunciation. In contrast, the other propositions, formulated with the aid of the fifth postulate, have demonstrated the impossibility of any axiomatic system whatever being always coherent with the reality of the natural world. This is why nineteenth century mathematicians and humanists disputed even the most concrete of the mathematical sciences, namely the arithmetic. The 'demonstrability' was actually a notion weaker than the truth.

The logic of formal systems within architectural research

The problems of interpretation, description, prediction and synthesis, and therefore the operative choices, are in fact resolved by the perceptive capacity of the intelligence. The procedures linked to the concept of "variable linguistic" [Chomsky, 1966; Zadeh, 1978] or of "calculation with words" [Zadeh, 1965] have proved themselves more adapted to describing choices of everyday life. It is, therefore, no wonder that in every field of knowledge deductive-inductive logic gives way to other types of logic considered more fluid.

Euclidian logic is founded on the possibility of always deducing new theorems. Instead, propositional logic is founded on the possibilities of always constructing new strings of solutions free from any theorem but founded on the correct use of the few but immutable rules with which to relate symbols without 'active' meanings. This doesn't prevent any theorem of empirical experience from being inserted into the "rules of imaginations" [Hofstadter, 1979] which preside over the chosen formal system. When this happens, between one system and the other are established isomorphisms [Hofstadter, 1979] capable of revealing portions of truth that are coherent with the natural world. The result is not predictable, but is the outcome of a formative process which, by virtue of its actualizing modality, can overcome the limits of human comprehension.

Each architectural work can be considered a living organism: its life includes the definition of the idea, the law that governs it and the formative process which is realised in the material it forms [Vattimo, 1976]. The finished work is not the result of a linear process as much as the outcome of a formative process whose fluid dynamics derives only minimally from the precision of deductive-inductive logic.

"Fuzzy" logic in the projects of Peter Eisenman

In architecture it is possible to demonstrate, as Peter Eisenman states, "...all the changes can in some way refer to cultural changes... the most tangible changes... were determinated by technological progress, by the development of new conditions of use and by the change in meaning of certain rituals and their field of representation" [Eisenman, 1989]. Thus in the simple use of geometric solids, he limits himself to the promotion of a language orientated with a correspondent systematic order.

In the spatial manipulations of plans and sections, Eisenman experiments with the "laws of thought" (1854) put in place in the nineteenth century by George Boole and Augustus De Morgan. In the same way that the two English logicians brought to extreme consequences the Aristotelian syllogisms which prelude to mechanised reasoning, Peter Eisenman manipulates an idea, submitting it to a sort of propositional calculation. Through probings and attempts which follow each other in a sequence of approximations made possible by a new conception of notation and representation, and beginning with elementary solids or simple internal relations, architectural space takes shape. Every element is charged with "active" meaning since it doesn't have any reference or architectural content, but lives only in relation to intrinsic order which impress energy on the formative process; this justifies the relation of one part to the other in an organic whole. The process that sustains the final construction is similar to that which regulates the axial growth of crystals. The form of the crystal, like the architectural one, is the fulfilment of an organic movement which configures the form as much in the visible structure as in the substantial structure [Zodiac, 1969]. Answering the question, What would happen if?, the fluid laws that lie at the base of the planning process inflect solutions that, if "isomorphic" to spatial necessities, can reveal themselves as architectural hypotheses, calculated but extremely free. Thus, if the first projects of Eisenman illustrate the internal virtualities of a rigorously closed, rigid cube, the following plans show the virtualities of the same shape subjected to the internal laws of deformation.

The Carnegie Mellon Research Institute (CMRI)

The plan for the CMRI (Pittsburgh, Pennsylvania, 1987-88) is an emblematic example of a process of deformation. "The fundamental element of this architectonic elaboration is the Boolian cube, a geometric model relative to the function of computers" [Oechlin, 1991]. The vertexes of the tridimensional cube, considered as solid shapes or transparent frames (Figure 1), represent all the possible terns of 0,1 by which to organise orderly strings. The organisation of the place takes shape in the mathematical functions which regulate the procedures of conjunction, separation, deformation. The process, in its becoming, makes the results as well as the objectives mutable. Once defined the interval of the space and its mathematical progression, in asintotic curves differently directed are placed as cubes at 4-N, repeated for a certain number of times. Every building is constructed from the matching of a couple of cubes (Figure 2). Every couple contains two solid cubes (visible shapes) and two cubic frames (internal structures) of 12 and 14 meters corresponding to the dimensions of the module that defines the architectural space destined to receive the offices and the laboratories of the CMRI (Figure 3). Every couple can be seen as a projection of the other, inverting the rapport between solid and frame. The wealth and the complexity of the formal result of the project derive from these simple operations [Oechlin, 1991].

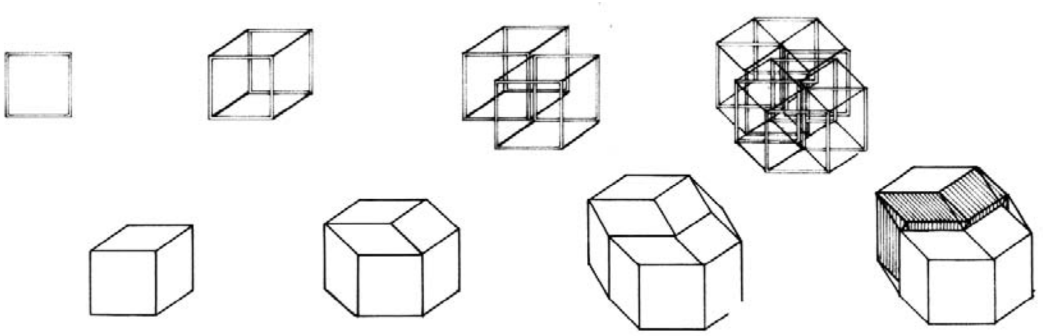

Figure 1.
Solid and frame. Author's drawing.

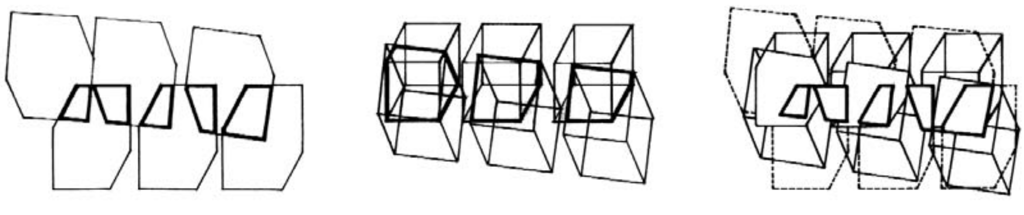

Figure 2.
The pairing of cubes to generate forms for the Carnegie Mellon Research Institute, Pittsburgh, Pennsylvania. Author's drawing.

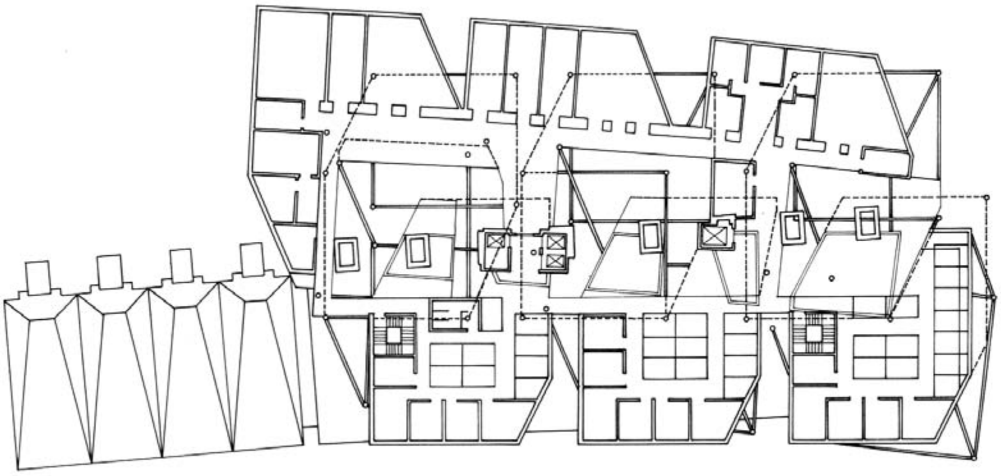

Figure 3.
Plan detail of the Carnegie Mellon Research Institute. Author's drawing.

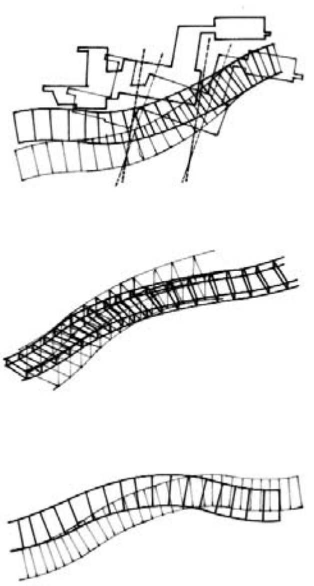

Figure. 4.
The double curve, deviated, redoubled and deformed, transferred into tridimensional space.
Author's drawing.

The Aronoff Center at the College of Design, Architecture, Art and Planning (DAAP).

Whatever the subject, in the era of information dominated by the media, teaching has a moral obligation to describe how and why it works. Convinced of this, Eisenman makes the plan for the Aronoff Center at the College of Design, Architecture, Art and Planning (University of Cincinnati, Cincinnati, Ohio, 1988-1983) a sort of manifesto of the education imparted by the University of Cincinnati [Ciorra, 1993]. Here, the structures that already existed are related to the orthography of the place: a double curve, deviated, redoubled and deformed with the help of computer simulation, is transferred into tridimensional space (Figure 4). The configuration that descends from it contains within itself the figurative force structuring the compositive solution. The procedure reminds one the traditional cut of precious stones or the formal reasoning applied by Lewis Carroll to the studies of Hilbert [Hilbert and Cohn-Vossen, 1932]. The finished work is an unconventional image that pushed the architect himself to define his project as "a weak configuration", calculated but aesthetically free [Vattimo, 1976] (Figure 5).

A representation of the works of Peter Eisenman

Eisenman shows how it is possible to proceed from an abstract idea to a concept that is anything but abstract, to show how the generative dynamic of all his plans can be described or, if necessary, rebuilt in every minimal detail. The study induces, therefore, a reflection on the possibilities but also on the limits that characterise the uncertain logic of formal systems applied to the new knowledge of notation and architectural representation.

The space of architecture can be declined at different scales of reading and intervention, permitting a gamut of representations that ranges from maximum abstraction with respect of the concrete space, to maximum detail. Each path allows for the rediscussion of the outcome of a formative process which orientates solutions and objectives. The result reflects Colin Rowe's [Rowe, 1984] teaching of Chomsky [Ciorra, 1993] or the mathematical logic laying at the base of the "variable linguistic" or of the "calculation with words" conceived by Zadeh [Zadeh, 1978].

The use of a method and the application of a process as "the art of thought" remind one also of the geometric experiments of Francesco Borromini or of his greatest admirer, Guarino Guarini. Borromini chose a geometrical figure, an equilateral triangle, to demonstrate how the unconventional use of this shape-structure could become the matrix of new architectural conceptions. The church of S. Carlo alle Quattro Fontane (1637-41) and the church of S. Ivo alla Sapienza (1643-60) show how the geometric-mathematical language is able to drive the formative intentionality over the conventional aspects. In the same way, the process of geometrical deformation, brought to a head by Guarino Guarini treating the section of a cylinder, reveals how geometrical language can be a 'weak' structure of thought able to investigate "...against the certainty of reason... an anguished passion and working thought... suspended in time" [Griseri, 1967] (Figure 6). In our century, Jacques Deridda has clarified better than any other intellectual how the lay-out of geometric research, in grasping the original sense of the constituent act, can succeed in expressing a new image of the world [Deridda,

Figure 5.
Plan view of the model for the College of Design, Architecture,
Art and Planning, University of Cincinnati.

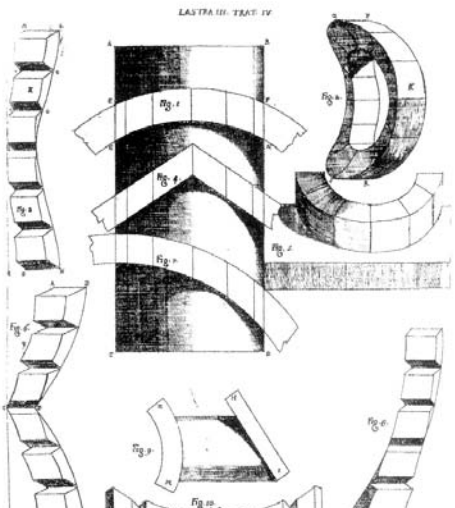

Figure. 6.
Guarino Guarini's treatment of the section of the cylinder, from Architettura civile, Turin, 1737.

1962]. In the architecture of Peter Eisenman, but also in that of Borromini or Guarini, almost nothing remains of the hermetic exactness of geometric reasoning, but much of the geometric language shines through.

In conclusion, a question mark

No design reproduces the reality, but rather builds up a logical model in order to organize a system of relations that are either observed, hypothesized or planned. The consequent schema re-presents, according to an intentional design for its reading, the set of characteristics that are, time and time again, selected and destined to become a sign [De Rubertis, 1994]. Let us quote the following superb motivations that are basic for the theory of description and meaning inside the theory of fuzzy sets:

> *An exact description of any real physical situation is virtually impossible. This is a fact we have had to accept and adjust to. As a result, one of the major problems in description (essential to communication,decision making, and, in a broader sense, to any human activity) is to reduce the necessary imprecision to a level of relative unimportance. We must balance the needs for exactness and simplicity, and reduce complexity without oversimplification in order to match the level of detail at each step with the problem we face.*
> *The inexactness of the description is not a liability; òn the contrary, it is a blessing in the sufficient information can be conveyed with less effort. The vague description is also easier to remember. That is, inexactness makes for greater efficiency.* [Goguen, 1969]

Finally, let us mention the so-called "principle of incompatibility". The essence of this principle is that, as the complexity of a system increases, our ability to make precise and yet significant statements about its behaviour diminishes until a threshold is reached beyond which precision and significance (or relevance) become almost mutually exclusive characteristics. It is in this sense that precise quantitative analyses of the behaviour of humanistic systems are not likely to have much relevance to the real-world societal, political, economic, and other types of problems which involve humans either as individuals or in groups [Zadeh, 1973].

It isn't difficult to intuit how the limits and complexity of our present culture tend to displace our attention from the conceptual area of production to that of transformation. Design, as much in the overall specifications for a project as in the design of the details, presents itself with reference to knowing displacements, that is, the conveying of multiplicities, contradictions and differences to temporary equilibriums. Actual realizations and designs on papers are the place where reflections consist; the reflections matured in several technological ambits appear in terms of sums of experiences and solutions "shifted" from their own place of origin to the detailed synthesis that rules the assembling. [De Rubertis, 1994]. We pose the final question: how can fuzzy logic, which finds its reason for existence in the interpretation of the reality and exalts the "shifts", point towards the architectural process?

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Adriana Rossi is an architect and researcher at the Department of "Cultura del progetto", and teaches representational techniques and automated design at the University of Naples II. Since her years as a student, her research activities have focused on the rationalization of the ideative processes. Her doctoral thesis on the ad quadratum was entitled, "Il costruito ad quadratum tra memoria e ragione" (Palermo, 1992). Through various thematics, the theoretic reflections on procedures founded methodologically tend to undergo a cognitive process whose relationship with creativity is far from resolved. Her didactic experiences, converging on the themes of topological surveys and architectural representation, reflect her search for the conditions necessary for the release of creativity and which are the precursors of innovation. She is the author of various essays and texts, and writes for scientic journals that specialize in representation.