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Experimentation as a method, the project as a production of knowledge: Theory and Practice according to Buckminster Fuller

Abstract:

Research by design opens on two news fields regarding research. On the one hand, it is about the specifics methods through the project design as a place of research, on the other; it is about the knowledge production which is possible by the way of the project itself which is neither a research object nor finality. The basic postulate is that the knowledge production by design project is possible thank to the experimentation.
This method seems to be more empirical than scientific which is, after all, common to several disciplines as physics, astrophysics... The method is in experimentation, conception and knowledge production in the project. As Buckminster Fuller projects show, thanks to his Dymaxion Chronolife, place of consignment of his experimentations and projects, that he realizes the constitution of used and usable knowledge.
Keywords: Buckminster Fuller, research, experimentation, method, project, knowledge

Research into architecture through design is today one of the major factors in the construction of the architectural discipline. This search for disciplinary legitimacy has not arisen for a long time in the international context, and yet it seems that in France it has not yet been acquired. So, in order to step out of a purely Franco-French debate, it seems important to ask oneself questions, not about a legitimacy or even about the capacity of research through design to produce knowledge, but rather to observe the mechanisms which make up the specific characteristics of this research.
We will take as a basic hypothesis that what is the basis of the specific characteristics of research through design is set out around two major elements defined by *Theory and Practice* which is expressed in terms of knowledge by a link between *Knowing how to think and Knowing how to act*.

The link between the two is then made by *experimentation as a method.* It is precisely thanks to experimentation linking theory and practice that the project becomes a producer of pieces of knowledge. The project is not the aim of the research, it does not constitute the result, but takes place at the heart of the research thanks to experimentation. It is in this aim, and because architecture is by its nature interdisciplinary, that the project takes its place at the centre of the research. In this perspective the project becomes the vector for ideas which cross over between these fields of knowledge. Interdisciplinarity in architecture is not therefore based on a mimetism of the disciplines, but, on the contrary, on a culture of cross-fertilisation, and an awareness of the differences.

And it is indeed in the field of experimentation that the project finds its place. Renzo Piano writes: *"To devise a project is not a linear experience during which one carries out what one has designed. On the contrary, it is a circular process: one starts by designing, then one does trials, one rethinks one's idea, and one redesigns, constantly coming back to the same point. That may seem very empirical, but it is in reality a method common to numerous disciplines, such as music, physics and astrophysics... Thus, in the field of scientific research where the variables are countless, one establishes an equation according to an intuitive idea born of one's own experience."* [1] It is this reversibility of the experimentation which is an essential tool connecting knowing how to think and knowing how to act.

To illustrate this hypothesis we are going to rely on the works of Richard Buckminster

[1] Renzo Piano, 1997. Carnet de travail. Edition. Seuil. p.18

Fuller. The person himself reveals a posture which refutes a classic academic model, rising up against plans for the transmission of knowledge that he considered inadequate with the evolution of society and in fact little inclined to train the thinkers and players who would make up tomorrow's world.

Richard Buckminster Fuller, who was self-taught, contributed to and fundamentally transformed the perception of both architecture and also physics and biology[2], specifically in regard to environmental questions. He was able by his works to bring a global approach to the elements studied. He is sometimes considered the initiator of contemporary ecology. Often presented as a visionary, he is above all an inventor of genius, with a remarkable cognitive capacity, and completely free in his thoughts and actions.

It was at the age of 32 that he began a new life after several professional set-backs. He immersed himself in reading and put the finishing touches to his scientific training. *"In 1927, I decided to follow my own path, I wanted to know what an individual like me, without any credit – considerable discredit even, but rich in diverse experiences – what an individual, with a wife and a young child, was capable of doing for people like himself… It had become clear to me that the individual was, alone, in a position to find the time to think globally, in harmony with our universe."* [3] Thus to undertake his work, he had first to "unlearn everything"[4]. For him, the language and concepts used in the teaching he had received were inadequate to describe the new world opening up before him[5]. He often took as an example the expression "To explore the four corners of the earth", which still contains the idea that the earth is flat and even square… In order to conduct his experiments and be in tune with this new world, he had to start to think by himself, forgetting everything he had learnt and basing himself only on his personal experiences. Thus over two years, he took the

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[2] These works have had an influence on the discovery of an atomic and carbon molecule discovered in 1985 by the British and American physicists Sir Harold Walter Kroto, Robert Curl and Richard Smalley. Because of its spherical structure they called it "Fullerene" in tribute to Buckminster Fuller.

[3] Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario. First Edition. St Martins Pr. French translation by Didier Semin. Éd. Images Modernes, Coll. Inventeurs de Formes, Paris, October 2004, p. 51

[4] According to his own terms.

[5] Buckminster Fuller was a contemporary of Einstein, and it is in regard to these new discoveries that he found his environment of concepts outdated and the language used too often inappropriate.

decision scarcely to speak, in order to be certain of the meaning of the words he was saying. *"I had to disconnect everything, so as to be able to begin to think by myself."* [6]
It was therefore from his experience that he would draw his reflections and innovations. He created a sort of logbook, to which all his reflections and experiences were consigned, and he assembled in it a very important mass of information that was as diverse as it was varied. He called it the *Dymaxion Chronofile* [7], *Catalogue of the resources of the world, of the great orientations and of the needs of humanity*.

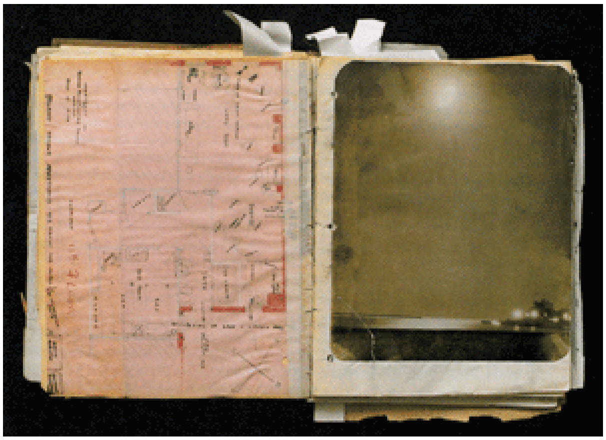

FIG 1 : *Dymaxion Chronofile*

Buckminster Fuller also had to invent his own tools both to develop his ideas and carry out his projects. He could not envisage his research work without practical applications. Pure theory did not interest him. What interested him was to influence the world. At a lecture at East Saint Louis in 1962[8], Buckminster Fuller said: *"I have set myself the task of never speaking except after having translated my philosophy and thoughts into actions and artefacts, of only expressing my ideas after conceiving a*

[6] Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario., op. cit. p. 52.
[7] Sources of information that he supplied from 1920 to 1983, the date of his death. The Dymaxion Chronofile archives are at Stanford University in the United States.
[8] Buckminster Fuller gave this lecture on 22 April 1962 to the planning commission, whose mission was to establish the new campus for Southern Illinois University.

concrete object – and not a social reform." [9] It was also in his work *Nine Chains to the Moon*[10] that he suggested the possible applications of the works of Albert Einstein. In a chapter called *"E=mc² = Mrs Murphy's horsepower"*, he described what Mrs Murphy's life would be like if Albert Einstein's equation were true. Because at the time, this equation had not yet been shown to be true. Buckminster Fuller told how in 1936 he met Albert Einstein, the latter allegedly saying to him: *"But, young man, in your chapter on Mrs Murphy, you impressed me. I am personally quite incapable of thinking through the practical application of any of my discoveries."* [11] There you have it, the strength of Buckminster Fuller, his ability to innovate by associating at the same time the thought and then doing it by experimentation. Experimentation being for him the opportunities for producing the project. The ability of Fuller to transcend theory and pass to experimentation marks his work as an architect.

It is in this way that Buckminster Fuller established what he called ***Global Design.*** He considered *design* to be a fully-fledged science, capable of synthesising all the disciplines. It was for him, by the project, and more precisely by its architecture[12], that the synthesis operates to take shape in the material, in the concrete world. Thus his relationship to design is that of someone having the ability to plan long-term. Of projecting whilst taking account of the data and problematics in a global way, as a whole.

Once these reference points have been put in place, and having indicated that it is only by considering all elements that it is possible to plan the future, Buckminster Fuller moved on in this understanding to the question of resources. Very quickly aware that natural resources are not inexhaustible, it became essential for him to mark out his position on the exact situation, before establishing an action strategy for the survival of the planet. *"To do this, we will start by recognising that the abundance of resources immediately consumable, truly essential and manifestly desirable, has been sufficient to allow us to survive in spite of our ignorance. But the resources are exhaustible and will be exhausted one day; they will only have been sufficient and will only have lasted up to the critical moment that we are living in*

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[9] R. Buckminster Fuller, 2009. Education Automation: Comprehensive Learning for Emergent Humanity.Translated from the American by Claude Yelnick, collection Idée Doctrine, Éd. Hachette Littérature, France 1973, p. 29.

[10] published in 1935.

[11] Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario., op. cit. p. 82.

[12] Term used in the widest sense and not specifically referring just to building.

today ". [13]Fuller was already, at that time, well aware of the environmental problematics existing on the earth.

Remaining in the perspective of action on the planet, he turned the focus of his work towards the question of economy in the sense of efficiency. This economy is of course considered in regard to the world as a whole, but above all it is an economy seen as the improved management of materials, energy and wealth. So the optimum distribution and use of resources would be at the heart of his work: *"Doing the most with less and less is always the point. "* [14]

Starting from this concept, Buckminster Fuller carried out numerous experiments and projects. The most well-known representative of "doing more with less" would be symbolised by his work on geodesic domes. This structure enables the covering of a very large surface on the ground with very little material, allowing a true economy of means. Its rigidity arises from its form, from the assembling of the material and not from the quantity of material used. Thus, its stability increases exponentially with the size of the dome.

It was in 1947, when he was teaching at Black Mountain Collège[15], a famous multi-disciplinary school where notable teachers were Walter Gropius, Josph Albers and Marcel Breuer (as regards architects and artists) but also the choreographer Merce Cunningham and the composer John Cage, that Buckminster Fuller experimented and developed with his students the first geodesic structures.

During a lecture at Southern Illinois University[16] Buckminster Fuller demonstrated that the construction of domes is a true response to the question of economy of resources because *"The amount of resources on the exterior area that they use is about one per cent of that used by classic objects of comparable volumes you are familiar with. They have stood the test of hurricanes, banks of snow and similar. My objects have also withstood earthquakes, in contrast to their classic equivalents. I have succeeded in doing more with less."* [17]

[13] R. Buckminster Fuller, 2008. Operating Manual for Spaceship Earth. 1 Edition. Lars Müller Publishers.op. cit. p. 67

[14] Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario., op. cit. p. 142.

[15] Black Mountain College is the name of an experimental university founded in 1933 near Asheville in North Carolina, in the United States and which functioned until 1957.

[16] Lecture delivered on 22 April 1961.

[17] R. Buckminster Fuller, 2009. Education Automation: Comprehensive Learning for Emergent Humanity. Op/cit. p. 33.

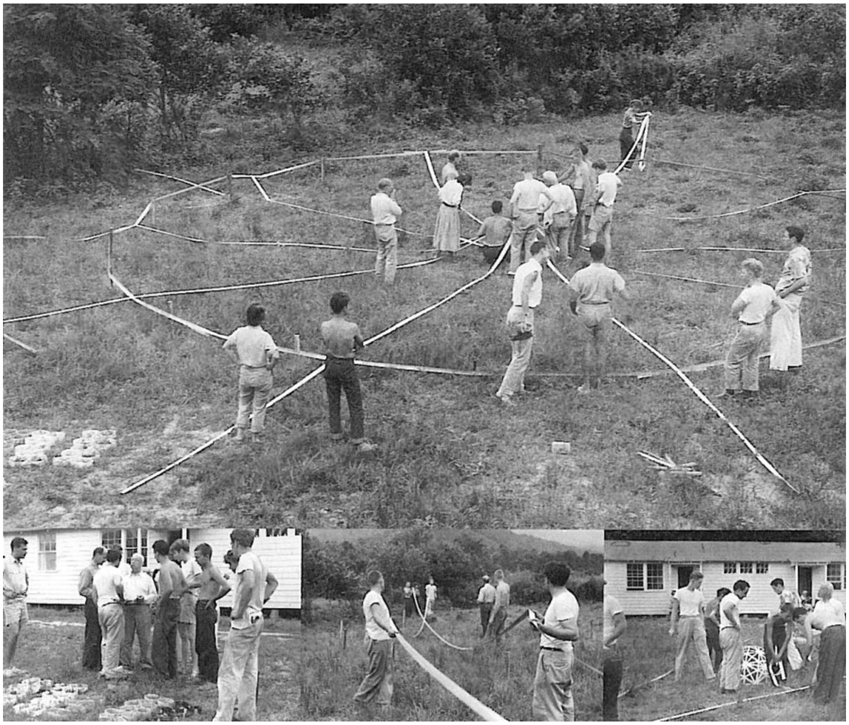

FIG. 2 : Experimenting on the geodesic dome with Black Mountain College students. Construction workshop on a geodesic dome at Black Mountain College. The bands being used are venetian blind slats[18].

In his work on domes, two essential ideas came together. The first started from a somewhat abstract concept concerning structures themselves. He was able to construct domes following his structural study on tensegrity poles, seeking a maximum of space covered with a minimum of material used. This was possible thanks to his mathematical work but was also directly linked to structural problems.
A second idea, present in Buckminster Fuller's work for many years, is a somewhat idealistic desire to offer a home to all. The first experiments saw the light of day at the time of his unfortunate attempts at architecture with the creation of the

[18] Picture taken from Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario., op. cit. p. 100.

Dymaxion[19] houses from 1928. This house, about which Fuller said that it didn't cost more than buying a new car, already showed his premisses on self-sufficiency in energy (notably by a system of water recycling). So in the domes there is also an underlying desire for cheap accommodation. In so far as little material is necessary to implement them and that they are the result of an industrial principle, their cost is reduced.

Following up on his work and in order to give shape to the idea of "doing more with less", Buckminster Fuller established an experimental procedure contained in Global Design which he called *"ephemeralisation".* Relying on the constant renewal of the general cycle of life and also on the renewal of CO2, he proposed a new way of managing and organising the relationships established between production and resources.

The principle of ephemeralisation is based on the recycling of industrial processes and its materials. Technology and industrialisation are new natural sources in abundance and have to be diverted to humanitarian ends. *"We are now able to recycle materials, the newest and the rarest alone being the exception to the rule. There is already easily enough iron, brass and aluminium in circulation."* [20] He based his opinion on recalling how, during the Second World War, Japan succeeded in doing without its own resources, without depending on other States or Nations. It simply bought scrap from the United States, and recycled it.

Buckminster Fuller firmly believed that it would be thanks to technology that ephemeralisation would be possible. For him, technology had to evolve in order to be able to contribute to the management of well-used resources. In the idea of ephemeralisation there is certainly the idea of recycling, of reuse, but there is also another idea which is much more linked to lifestyle. This goes through a sort of renunciation of the permanent possession of material goods. Because if man does not put roots down in a place, he would potentially leave it viable and appropriable thanks to recycling, for future generations.

These experiments and projects were certainly expressed in geodesic domes but above all by a series of experimental houses that he developed in the 1940s. These

[19] In 1928 Buckminster Fuller founded the "4D Company" within which he developed the 4D house project, which he subsequently called Dymaxion House. The term comes from the association of the words "dynamic", "maximum" and "ion", the latter a term used very often by Fuller to qualify his inventions.

[20] Robert Snyder, 1980. Buckminster Fuller: An Auto-Biographical Monologue/Scenario., op. cit. p. 165.

houses can potentially be placed – and not anchored with heavy foundations – anywhere on the planet. At the time of a change of location it is possible to leave a plot totally suitable for a future habitation. But they are also the result of a recycling process, not exclusively of material but also of an industry, thus proposing to relaunch an economy. In the case of houses in the style of Wichita House, it would be a question of the aeronautical industry. Because it is on the production lines of this industry in decline that Buckminster Fuller proposed to build prefabricated houses. He did the same with the Butler DDUs, suggesting recycling the Butler grain silos. With ephemeralisation, Buckminster Fuller built the bases of a global and contemporary ecology.

Thus Fuller's work was able to demonstrate that thanks to the association of knowing how to think with knowing how to act by experimentation, the project constitues the place of the production of knowledge. These pieces of knowledge are not even exclusively constituent parts of their own discipline, namely architecture, but serve as bases for pieces of knowledge for other disciplines. Fuller's work has certainly led to developments in engineering, but also in physics and biology, in the field of energy, and in the putting in place of a strand of contemporary global ecological thought. It thus links up with the interdisciplinary foundations of architecture in a process of reversibility.