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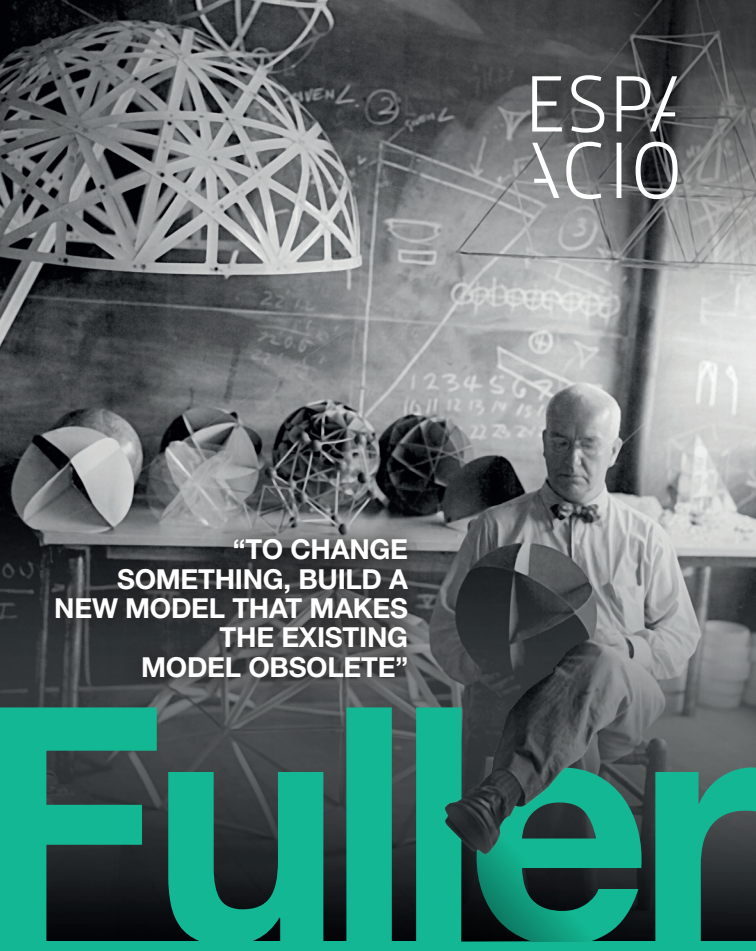

Radical Curiosity. In the Orbit of Buckminster Fuller

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RADICAL CURIOSITY. IN THE ORBIT OF BUCKMINSTER FULLER

COVER

Buckminster Fuller in his class at Black Mountain College, summer of 1948.
Courtesy The Estate of Hazel Larsen Archer / Black Mountain College Museum + Arts Center.
Hazel Larsen Archer.

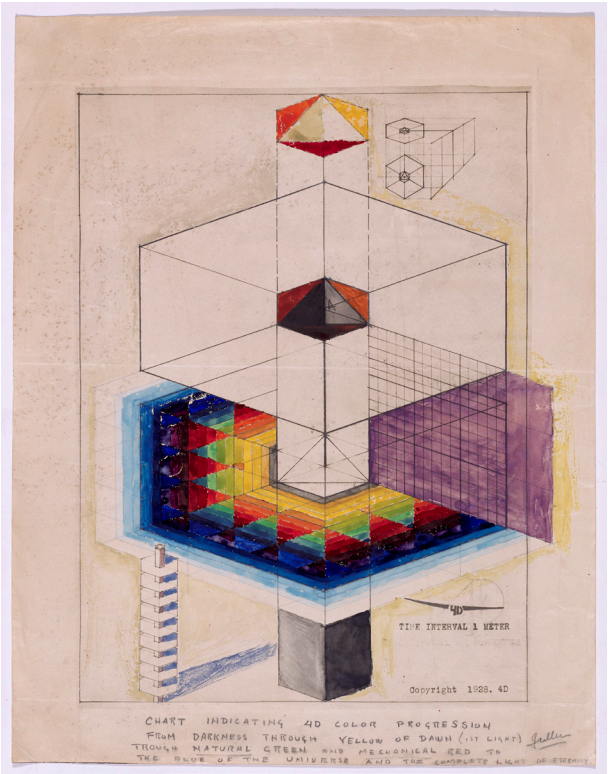
“Radical Curiosity. In the Orbit of Buckminster Fuller” is a journey through the universe of an unclassifiable investigator and visionary who, throughout the 20th century, foresaw the major crises of the 21st century. Creator of a fascinating body of work, which crossed fields such as architecture, engineering, metaphysics, mathematics and education, Richard Buckminster Fuller (Milton, 1895 - Los Angeles, 1983) plotted a new approach to combine design and science with the revolutionary potential to change the world.

Buckminster Fuller with the Dymaxion Car and the Fly´s Eye Dome, at his 85th birthday in Aspen, 1980
© Roger White Stoller

The exhibition peeps into Fuller’s kaleidoscope from the global state of emergency of year 2020, a time of upheaval and uncertainty that sees us subject to multiple systemic crises – inequality, massive urbanisation, extreme geopolitical tension, ecological crisis – in which Fuller worked tirelessly. By presenting this exhibition in the midst of a pandemic, the collective perspective on the context is consequently sharpened and we can therefore approach Fuller’s ideas from the core of a collapsing system with the conviction that it must be transformed.

In order to break down the barriers between the different fields of knowledge and creation,

Buckminster Fuller defined himself as a "Comprehensive Anticipatory Design Scientist," a scientific designer (and vice versa) able to formulate solutions based on his comprehensive knowledge of universe. From that, he predicted contemporary, anti-disciplinary practices that operated with crosschecking, dissolution and experimental approaches of different areas of knowledge, such as science, art, architecture and design.



Buckminster Fuller. 4D Tower, 1928.
Courtesy The Estate of R. Buckminster Fuller.

Forerunner and inspiration for the tech community of Silicon Valley, as well as reference for the hippie generation, Fuller (also known as Bucky) is a controversial and key figure for understanding the foundations of contemporaneity in all its complexities. His footprint can be seen in current processes such as the building of light, standardised,

emergency housing; the circular economy; architecture based on energy efficiency; biometrics; data visualisation; inspirational conferences and innovation based on multi-disciplinary design. As one of the first "visionary gurus" who travelled the world offering very seductive utopian talks, Fuller's profound distrust of politics and his faith that technology could provide answers to almost all of the world's problems are still being felt today on the ideology and discussions over the topic of innovation.

Taking up the concerns and strategies of Fuller and some of his peers, modern researchers still follow the vectors of his ideas. The exhibition includes works by artists, architects and designers such as Olafur Eliasson, Norman Foster, Chuck Hoberman, Andrés Jaque, Gyula Kosice, Joris Laarman, Tomáš Libertíny, Isamu Noguchi, Neri Oxman, José Miguel de Prada Poole, Cedric Price, Abeer Seikaly, Studio Folder and WASP.

Expanding Fabric Dome, 1997.

Many of Fuller's maxims reiterate his belief that anyone can change the world if they put their mind to it and that we are all crew, not mere passengers, on this extraordinary spaceship called Earth. Taking this principle as a guide for his own life, the mission he set for himself and that he obsessively sought over five decades of work was to "make the world work, for 100% of humanity, in the shortest possible time, through spontaneous cooperation, without ecological offence or the disadvantage of anyone".

Bucky advocated and led what he called “Design Science Revolution,” a revolution based on research, experimentation and design for the transformation of the world, articulated into three axes: housing (which he called shelter), mobility and education. He would also introduce new concepts, such as Dymaxion (a portmanteau of “dynamic”, “maximum” and “tension”), Tensegrity (neologism, which blends “tension” and “integrity”) and Ephemeralization (the ability of technological advancement to do “more and more with less and less until eventually you can do everything with nothing”). The example that would combine them all was his most popular project: the geodesic dome.

Dome over Manhattan, 1960.
Courtesy The Estate of R. Buckminster Fuller.

To transform the housing system, Fuller developed a mass-produced house that would not depend on land ownership. They were standard, light, mobile and energy-efficient units. Based on tensegrity, a structural principle that consists of isolated components in compression inside a net of continuous tension, his housing model evolved from his Lightful Houses (1927), and the 4D House (1928), constructed around a mast and elevated from the ground, to the Dymaxion Dwelling Machine-Wichita House (1945), a circular aluminum house with 95 square metres of surface area and five metres high, weighing three tons (as opposed to the usual 150 of

a traditional house) and a price tag of 6,500 dollars per unit, the equivalent of the cost of a Cadillac at the time.

In mobility, Fuller offered the Dymaxion Car (1933-1935), a streamlined, three-wheeled vehicle with a length of six metres and capable of carrying up to eleven passengers. For its design, Fuller was assisted by Starling Burgess, a famous naval architect and aircraft builder, and the artist Isamu Noguchi, who crafted the first wood models. Learning based on the natural world was of great importance to Bucky. In this case, he took notice of fish and their navigation system, placing the direction control of the car on the rear flap. Fuller applied his maxim of "doing more with less," using a Ford V8 engine to reach speeds of over 140 kph and travelling 48 km on less than four litres of fuel.

With respect to education, Fuller believed that every child had an innate ability to understand the universe and how its systems work, essential to eradicating educational programmes that repress curiosity and the natural inclination to experimentation. Instead, he favoured an "educational metabolism" based on a transfer of elite knowledge to all children and young people through technologies that promoted concentration and communication, such as community television and two of Fuller's inventions: the Geoscope, a world globe that would show the evolution of data such as population, or resources such as copper or rice; and the Dymaxion Map, an essential artefact for understanding the world. with continents forming an almost continuous island in the middle of the ocean, dispensing with any notion of north-south, east-west.

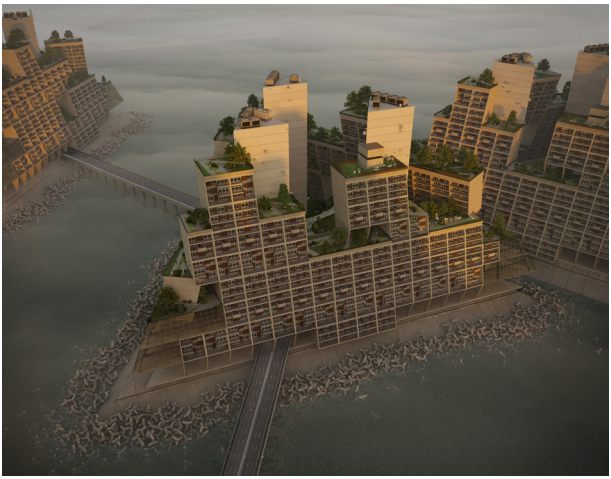
These two devices are linked to the large project that would absorb Bucky in the last 20 years of his life, the World Game. Preceded by ideas that he had already presented during the 1940s with the World Resources Inventory, the World Game is an ambitious project which set the challenge of compiling data on the world's resources, with the objective of preventing its future evolution and being able to approach

Reggio School, El Encinar de los Reyes, 2019.
© Andrés Jaque Office for Political Innovation.

a sustainable management of the planet. Bucky involved experts in economics, science, design, art and architecture as well as students from all over the world, in data visualisation and multi-disciplinary research more than four decades ahead of its time. The World Game also anticipated other firmly contemporary notions, such as digital democracy, and "gamification," the application of typical game playing logic in non-gaming contexts.

A constant in Fuller was working to understand the position of humanity in the world with respect to nature and the universe as an active part of the same, starting from the idea that one could not approach everything without taking into account each one of its parts and interactions. It is the notion of Synergy that Bucky researched his entire life to foresee the world's problems and establish priorities.

Thus, Fuller had already predicted problems that exist in today's list of pressing world issues, such as the depletion of the world's resources and the



Buckminster Fuller´s Triton City, 1968.
© Jon Stone. Project interpretation.

need to establish a sustainable relationship with them through a way of life that does not produce its collapse or the inequalities that have led us to the Anthropocene.

The importance of information and data to understand global and complex processes, and anticipate problems by proposing future actions, is something that Fuller had already seen in the 1940s and resulted in him working alongside experts such as CIA consultant E.J. Applewhite with whom he wrote the *Synergetics Dictionary*. He also worked simultaneously to open new communication channels for popular audiences, such as the manuals for building geodesic domes, pocket size Dymaxion cut-out globes, or the *Tetrascroll*, a book-object where he poured in all his ideas about time, physics, synergy and the cosmos; he made it with printmaker and publisher Tatyana Grosman starting with the drawings which he made in 1931 for his then convalescing daughter Allegra, to explain Einstein's Theory of Relativity to her, with a very personal version of the tale of *Goldilocks and the Three Bears*.

However, Everything I Know, the series of conferences he gave over two weeks in 1975 has to be Buckminster Fuller's greatest compendium of work.

It is an extraordinary 42 hour- conference in which he recounts his own personal story in the context of the history of science and industrialisation. There, he draws on the infinite journeys of his most ambitious and comprehensive device: the Dymaxion Chronofile, his personal archive comprising over 140,000 documents detailing events from 1928 until his death in 1983. Thus, in the exhibition, both projects mark the beginning and end of a spherical itinerary in which, according to Fuller's way of thinking, everything is interconnected.

Fuller witnesses Marine Corps helilift of his geodesic dome at Orphan's Hill, North Carolina, 1954.
Courtesy The Estate of R. Buckminster Fuller

Rosa Pera and José Luis de Vicente

Curators

ESPACIO

RADICAL CURIOSITY.
IN THE ORBIT OF BUCKMINSTER FULLER

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10 Introduction

"Radical Curiosity. In the Orbit of Buckminster Fuller" is a journey through the universe of an unclassifiable investigator and visionary who, throughout the 20th century, foresaw all the major systemic crises of the 21st century. Creator of a fascinating body of work, which crossed fields such as architecture, engineering, metaphysics, mathematics and education, Richard Buckminster Fuller (Milton, 1895 – Los Angeles, 1983) plotted a new way to combine design and science with the revolutionary potential to change the world.

Reconnecting to Fuller's all-embracing knowledge is an exercise as vibrant as his experiments, a journey replete with leaps between wisdom and questions regarding how to better understand and guide this extraordinary spaceship called Earth, of which we are all passengers. Bucky shows us new ways of exploration and renewal through a whole range of different operations. At the closest and most material level, he sought to transform models of housing and transport, whilst at a general level he pursued collective and networked research into our planet's resources and their management.

His great mission was to find a way to ensure that the world worked at 100% of its capability for 100% of the population, without any distinctions or prejudices. "Radical Curiosity. In the Orbit of Buckminster Fuller" peeps into Fuller's kaleidoscope from the global state of emergency of 2020, a time of upheaval and uncertainty in which we are subject to multiple systemic crises – inequality, massive urbanisation, extreme geopolitical tension, ecological crisis – in which Fuller worked tirelessly. Returning to his concerns and strategies, contemporary researchers follow the vectors of his ideas as applied to architecture, art and design.

20 MAKE YOUR LIFE AN EXPERIMENT

Of all of Richard Buckminster Fuller's projects, the most ambitious one was building his own myth. Like the story of a comic superhero, the legend of Bucky (his familiar name for those that knew him) began at a crucial time in which his life changed and he was reborn as a new person.

In 1927, devastated by the loss of his daughter, penniless and without prospects for the future, Fuller decided to take his own life on the banks of Lake Michigan so that his family could cash out his life insurance. An inner voice told him he could not take his life as he was not its owner, it belonged to the universe. He understood that he had to dedicate all his lifetime to an experiment: he had to discover what he, an ordinary individual without any special attributes, could do to improve the lives of all humankind.

Fuller embarked on a period of profound introspection during which he did not speak for two years, frenetically writing five thousand pages that would become the first ideas of his career. This is just one of the many colourful stories that embellished his interviews and conferences over decades; in others, he claimed that he only needed two hours of sleep per day. A complex and controversial man, Fuller imbibed ideas and processes over his life, which he then developed into theories and experiments that had a massive reach. As a result, the names of other would-be pioneers of new ideas comparable to Fuller's "tensegrity" and geodesic domes have slipped into the background.

We know that these stories were often exaggerated and yet the Bucky myth was an instrument through which he constructed his image of a visionary entrepreneur in order to transmit a powerful idea: without the need to be anything special, we can all do exceptional things.

21 Dymaxion Chronofile

In 1917, at the age of twenty-two, Fuller decides to start an experiment that would last until his death in 1983, in which he offers himself as the guinea pig. It consists of creating the most detailed archive possible of the life of a person who, born at the end of the 19th century, contemplates the transformation of the world throughout the new century.

Every day, Fuller preserves every document that has passed through his hands: letters sent and received, handwritten notes, drawings and plans, newspaper cuttings and brochures, even aeroplane and train tickets, medical prescriptions and correspondence from his lawyer. Preserved at Stanford University since 1999, the 140,000 personal documents contained in the Dymaxion Chronofile make Richard Buckminster Fuller's life one of the best documented in history.

30 DESIGN REVOLUTION. Making the world work for 100% of humanity

Buckminster Fuller defined himself as a "Comprehensive Anticipatory Design Scientist", a scientific designer (and vice versa) who was able to foresee solutions based on his comprehensive knowledge of the universe. He sought to change the world through a "design revolution" that would result in the radical and systemic transformation of our understanding of the planet and how it worked. His mission: "To make the world work for 100% of humanity, in the shortest possible time, through spontaneous cooperation without ecological offense or the disadvantage of anyone."

Lightness, adaptability, ephemeralization and mobility are the main characteristics of Bucky's projects. His early concerns focused on rethinking the way we remain under cover and move from one place to another. The results were Dymaxion House and Dymaxion Car, which would be the models for housing and automobiles for the society of the future. The Dymaxion brand name, a portmanteau of "*dynamic maximum tension*", summarised his way of thinking and acting. Always experimental, his work expanded to take in innovative strategies, ideas and methods concerning knowledge and education, physics and metaphysics, resource management and information.

Bucky's ideas and procedures today serve as points of reference for researchers working in the fields of art, architecture and design, aware of the wisdom of nature and the search for other ways to integrate it into their lives, often using contemporary approaches such as biomimetic design, in which design is based on the observation of nature's processes.

31 Visions of the Universe

Fuller understood the world as an interactive part of the universe, "a scenario in which every action has a reaction and a result that are neither coincidental nor simultaneous", while "energy is always transforming systems that affect each other". Tension and compression co-exist in nature and its systems, as well as between the Earth and the universe. He was fully aware that Einstein's Theory of Relativity had a direct application in daily life, expressing the idea in *Nine Chains to the Moon* (1938), which warned of the finitude of the planet's resources and its relationship with population growth. *Better News* magazine ran an unpublished extract that sought to combine the spiritual and scientific approach in an original way to explain "the game of life". Bucky felt that it was essential to have an individual awareness in the world to better understand how it works and be able to identify and resolve problems: "You do not belong to you; you belong to the Universe". He was also keen to correct terms such as "sunrise" and "sunset", as it is the spherical Earth that is in motion rather than the Sun.

32 Dymaxion Car

The Dymaxion Car (1933-1935) was a three-wheeled streamlined automobile that was twenty feet long, capable of carrying up to eleven people. For its design, Fuller had the help of Starling Burgess, a famous naval architect and aircraft builder, and the artist Isamu Noguchi, who crafted the first wood models. Learning based on the natural world was of great importance to Bucky. In this case, he took notice of fish and their navigation system, placing the direction control of the Dymaxion Car on the rear flap, emulating the hind flippers of fish. Fuller applied his maxim of "doing more with less", using a Ford V8 engine to reach speeds of over 87 mph and travelling thirty miles on less than eleven gallons of fuel. This was a perfectly tangible example of a trim tab in action, a small part that was used to stabilise enormous ships and aeroplanes, which Bucky saw as a vital metaphor to express the power that an individual has to change the course of the world. This was his guiding principle in life, which in fact is inscribed on his gravestone: "Call me trim tab".

33 Inventions: Twelve Around One

Inventions: Twelve Around One brought together a series of Fuller's most important inventions through a device that he came up with, which in each case presented a design and a patent through an illustration and superimposition of the technical data, printed on transparent acetate. A selection of projects is shown here: 4D House, Dymaxion Car, Dymaxion Deployment Unit, Dymaxion Dwelling Machine, Tensegrity, Submarisle, Monohex Geodesic Dome and Tensile-Integrity Structures projects.

40 SHELTER. Home, the pending transformation

From the outset of his career, Buckminster Fuller was convinced that the swiftest way to change society was through the reinvention of housing. By the early 20th century, industrialisation had transformed every aspect of daily life. Nevertheless, the form and function of houses and the way we live in them essentially had not changed.

The possibilities offered by assembly-line production and the development of new manufacturing technologies that Bucky discovered during his time at the Navy made it possible to construct lighter and cheaper buildings, which optimised the use of materials. The house of the future would be self-sufficient in terms of energy in order to free themselves of supply networks and their inhabitants from the slavery of domestic drudgery thanks to new automation technologies.

The most radical of his reinventions was based on his belief that houses should be mobile, meaning that their location could be changed as quickly as did people's circumstances. In a world in which houses were to lose their non-negotiable ties to the ground they were built on, ownership of land would become "something as devoid of meaning as the idea of the ownership of the sea is to a boat".

One hundred years after Bucky expressed his ideas regarding the reinvention of the home, all of the world's major cities are suffering a crisis of access to housing. Reimagining "shelter technologies" in order to make housing accessible, affordable and sustainable is one the greatest challenges we face today.

41 4D Lightful Tower

The first of Fuller's visions for the future maximises mobility and lightness above any other criterion. Bucky imagined a tower block of apartments that could be transported by zeppelin to stand anywhere in the world, including in remote locations such as Antarctica or the Amazon. These towers, up to ten storeys high, were designed to hang from a central mast which would also provide the energy supply, making foundations unnecessary and allowing them to be erected in a single day.

42 4D House

In 1928, Bucky presented his proposal to the American Institute of Architects for a new kind of single-family home that could be mass-produced and easily transported. Like the Lightful Tower, the house hung from a central mast which held up the structure with taut steel cables. It was to be made from aluminium, a strong yet light material that requires minimal maintenance.

The construction featured several systems that guaranteed self-sufficiency, including wind turbines on the roof to ensure that air circulated and cisterns which collected rainwater and recycled it. The bathroom was designed to reduce resource use to a minimum, including a toilet that did not require the use of water. The 4D House exemplifies Fuller's vision of what the main function of a house should be: not a property that one possesses but rather an efficient and functional mechanical configuration.

43 Dymaxion Deployment Unit, Dymaxion Dwelling Machine - Wichita House

In 1942, the US army commissioned Fuller to design two hundred prefabricated units that would be used to accommodate American soldiers around the world. The circular aluminium design was a foretaste of what was to be his most ambitious and sophisticated plan, even though he only built two prototypes.

The Dymaxion Dwelling Machine was again made from aluminium, a material that allowed for industrial assembly-line production and which was available in large quantities after the Second World War. The aim was to design a model whose elements could be rolled onto tubes, transported and assembled in one day. It would weigh thirty times less than a traditional home and have a sale price of 6,500 dollars. Although more than thirty thousand possible buyers expressed an interest in purchasing a unit, Fuller could not reach agreement with his investors and the project never bore fruit.

44 Climatroffice

In his final years, Buckminster Fuller became close friends with Norman Foster, at that time a promising architect. The two embarked on a fluid intellectual dialogue. Both men worked together on a number of projects, such as the unrealised plans for the Willis Faber & Dumas Building (1971-1975), one of Foster's first major undertakings. The idea consisted of enclosing this office block and its gardens in a glass structure in order to create a microclimate with a controlled temperature. In recent projects, Foster has continued to develop systems designed to control buildings´ climatic conditions.

45 Tetrahedron City, Tokyo and San Francisco

In his constant search for strategies to make housing more accessible, affordable and sustainable, Fuller sought alternatives to one of the main costs associated with construction: the ownership of the land on which it is built. On a planet with three-quarters of its surface covered by oceans, the most obvious solution would seem to build on water. As Fuller said: “Floating cities pay no rent to landlords.”

These metropolises designed for the bays of Tokyo and San Francisco would have housed up to a million people in three hundred thousand apartments. The buildings were designed in the form of a pyramid, as tetrahedrons have the greatest surface area with respect to their volume.

46 Metro-engineering

In the twilight of his life, Fuller's projects dedicated to shelter technologies became even more speculative, but also changed scale and vaulted from a personal to a city level. In 1959 he produced one of his most widely reproduced images for an exhibition at MoMA, in which he covered Manhattan with a huge dome that could regulate the whole city's climatic conditions instead of each building in an individual way, saving vast amounts of energy. He also imagined macro housing structures which could accommodate up to a million people and cities that floated on the sea to escape land constraints. The major challenges posed by the climate crisis and mass migrations are making today's architects once again consider designing cities that until very recently would have been unthinkable, and yet these ideas were all foreshadowed by Bucky.

47 Iceberg City

José Miguel de Prada Poole is the most important Spanish exponent of the new, highly speculative and radical architecture, which in the 1960s revolutionised thinking on how we imagine the future of building technologies. Iceberg City was a visionary idea for the design and construction of a mobile research base inside an iceberg, which was breaking off from the polar ice mass. The base, which would include a living space, would be sculpted using a flamethrower and would wander around the world flowing through ocean currents without any energy consumption at all.

48 The Hydrospatial City

As well as Fuller, other mid-to-late 20th century visionary artists and utopian architects from all over the world began to look at how population growth would drive people to leave solid ground and build cities on the sea, up in the clouds or even in space. Between 1946 and 1972, Argentinian artist and poet Gyula Kosice produced numerous sculptures and models that gave form to his vision of a habitat that defied the laws of gravity. In his Hydrospatial City, people would live by using electrolysis to separate out the hydrogen and oxygen to produce water and energy.

50 TENSEGRITY. The forces that rule the universe

The notion of "synergy", connecting his vision of the universe to the methodologies to be applied to ensure the sustainability of the world, was of central importance to Fuller. Synergy is the behaviour of complete systems, which cannot be predicted from the behaviour of any of their separate parts on their own. For Fuller, synergy is vision and methodology:

"Universe is a synergy of synergies. It is a corollary of synergy that the known behaviour of wholes plus the known behaviour of a few of their parts enables discovery of other parts and their behavioural characteristics. In order to really understand what is going on, we have to abandon starting with parts, and we must work instead from the whole to the particulars" (...) "There is nothing that one does that does not affect all others in varying degrees. This, of course, includes all life." Buckminster Fuller.

In order to visualise this in functional forms, Fuller applied geometry, creating another of his key concepts, "tensegrity", a portmanteau of "tension" and "integrity". It consists of the suspension of rigid elements in space solely through continuous tension and discontinuous compression. He designed building elements such as the Octet Truss and Tensegrity Mast, synergetic systems that materialised the fourth dimension, this is, time and space.

51 Fuller and Noguchi

Among the constellation of intellectuals and researchers whose paths crossed with Bucky, artists were always very important to the evolution of his thinking, including Annie and Josef Albers, Ruth Asawa, John Cage, Merce Cunningham, Elaine and Willem de Kooning and Martha Graham. One of the most notorious was Isamu Noguchi, with whom he exchanged ideas throughout his life, influencing one another. An example of this can be seen in the wooden models that Noguchi made of the Dymaxion Car or his titling of one of his sculptures, *Miss Expanding Universe*, in tribute to Fuller. There is also the telegram that Fuller sent Noguchi explaining Einstein's Theory of Relativity in response to a question that the artist had asked him while he was in Mexico working on the mural *History of Mexico*. In this work, we see an indigenous boy looking at Einstein's formula, an evocation of the power of nature and man through mathematics, light and energy.

52 Synergetics

The synergy study occupied Buckminster Fuller all his life. A large part of his findings is reflected in "Synergetics Folio", the collection of ten posters he made between 1976 and 1977. On the other hand, Edgar Jarratt Applewhite Jr. is, along with Fuller, the person who worked the hardest to clarify the meaning and importance of synergy. Applewhite worked with Bucky on the books *Synergetics 1* and *Synergetics 2*, and in 1986, he published *The Synergetics Dictionary*, an extraordinary four-volume photocopied collection of 22,000 index cards. In these records, he summarized Buckminster Fuller´s ideas found in letters, books, tapes, and both published and unpublished articles, becoming an invaluable body of work for the study of Bucky.

"The essence of Fuller´s synergetic geometry is to advance a single model to describe the shape of the physical universe, the shape of energy´s behaviour, as well as the shape of metaphysical universe, which is the shape of our thinking. He has proposed all this life to write a book attempting to describe all physical and metaphysical experience in terms of the tetrahedron. What I proposed was to help him complete this task and to discover whether I would become a convert in the process". E.J. Applewhite.

60 EXPERIMENTATION. Learning by doing

For Fuller, experimentation is the route to knowledge that we use from birth and that should guide all the advances made by both individual and by society as a whole. This innate and non-transferable capacity needs to be practiced throughout life, combining intuition, imagination and experience.

“Almost anybody can learn to think or believe or know, but not a single human being can be taught to feel (experience). Why? Because whenever you think or you believe or you know, you´re a lot of other people: but the moment you feel (experience), you´re nobody-but-yourself. To be nobody-but-yourself –in a world which is doing its best, night and day, to make you everybody else- means to fight the hardest battle which any human being can fight; and never stop fighting. Information is experience. Experience is information”. Buckminster Fuller.

Experimentation was also his basis for network production and transmission of knowledge. His approach was to continue investigating alongside colleagues and students working in fields such as architecture, physics, art, mathematics and engineering at workshops all over the word, which often ran simultaneously. The best known and most fruitful of these were held at Black Mountain College (1948) and the Southern Illinois University Department of Design in Carbondale, with Fuller as visiting lecturer (1956) and research professor (1959-1971) on the subject titled “Generalized Design Science Exploration”.

61 Black Mountain College

Buckminster Fuller used experimentation as both work methodology and norm of life, undertaking all his activities as a designer, architect, inventor and, of course, as a transmitter of knowledge through workshops, seminars and work sessions that he led around the world. Two contexts are worthy of mention: summer 1948 at Black Mountain College and his time as professor at Southern Illinois University in Carbondale in the 1960s. Ruth Asawa was one of the artists who passed through Black Mountain College, a ground-breaking academic environment in which teachers and students worked alongside each other in a horizontal structure that favoured cooperation and experimentation. Under the directorship of Josef Albers, Bucky was joined by such key figures as the visual artist Anni Albers, the composer John Cage, the dancer and choreographer Merce Cunningham, the architect Walter Gropius and the painters Willem and Elaine de Kooning, and Robert Motherwell.

Both in Carbondale and at the countless workshops around the world, Fuller formed trans-disciplinary teams composed of colleagues and students from a wide range of fields, such as art, architecture, engineering and design. With it, he was over seventy years ahead of his time in terms of his approaches to the work and research undertaken today in the most advanced centres (such as the Massachusetts Institute of Technology - MIT), where science, art and design are naturally combined, in tension with conventional academic structures, founded in stagnant notions of disciplinary specialisation.

70 GEODESICS. An icon for the future

In the early 1950s, the various lines that Bucky had been working on converged in his most successful project, which captured America's collective imagination and became the iconic idea that has symbolised the future for decades now: the geodesic dome.

This was a product of his experiments with tensegrity and his obsessive study of the rules of geometry. Geodesic lines mark the shortest possible path between two points on a sphere. Fuller theorized that this principle of efficiency could be used to design a stable structure. Effectively, the strength of a dome based on geodesic lines is greater than that of its separate elements. A geodesic structure is also the greatest area that can be covered with the least amount of material and which can support itself without the need for foundations. It represents the culmination of the idea of ephemeralization: more cannot be achieved with less.

In summer 1948, Fuller and his students at Black Mountain College tried unsuccessfully to erect the first dome, which measured 45 feet in diameter and 20 feet high. By the time of his death, thirty-five years later, between 100,000 and 200,000 geodesic domes had been built around the world.

80 INFORMATION. Design, science and data to understand the world

Fuller felt that the source of many of our problems lies in our inability to detect patterns of activity in society, the economy and the way that global systems work. If we knew enough to understand how the world's resources are distributed, it would be much easier to find out a solution reasonable for everybody.

In his constant search to find ways that the world might work through a design-science duality, in the 1930s Bucky sought to create large databases which we could analyse thanks to the new possibilities offered by computers to process large amounts of information that would allow us to make better decisions. We need to create new visual codes to represent the world's complexity, including a new cartography that allows us to depict the planet without pre-conceived – and often wrong – ideas of north and south, east and west.

Various decades before technology made it possible, Fuller foresaw the contemporary discourse offered by Big Data and the visualisation of information, and by the logic of gamification, which uses the mechanics of games to tackle complex problems.

90 EDUCATION. One can never know less, only more

Fuller felt that we are all passengers of spaceship Earth, with an innate ability to understand the universe and the behaviour of its systems. He saw it essential to eradicate educational programmes that repress curiosity and natural inclination to experimentation. Instead, he advocated an "educational metabolism" based on the transfer of elite knowledge to all children and young people through technologies that promoted concentration and communication. He planned to build individual cubicles from where students could have access to audiovisual materials prepared by specialists based on research by renowned scientists, architects and philosophers. These cubicles would have community television systems (which he called "Two-Way TV") and a permanent telephone link to the tutor. In order to ensure a correct perception of the world, they would include two *Fullerian* inventions: the Geoscope and the Dymaxion Map.

Bucky was one of the most prolific and charismatic conference speakers of all time (it is estimated that he travelled around the world fifty-seven times). His style as a speaker made him one of the first "influencers" by talking about the social, political and economic impact of innovation. The peak of his conference career, with sessions that usually lasted for hours and took place before huge audiences, was a series titled *Everything I Know in 1975*.

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#CuriosidadRadical
#RetoEducativoFuller