christmas books

Michael Berry

Uncompromising vision

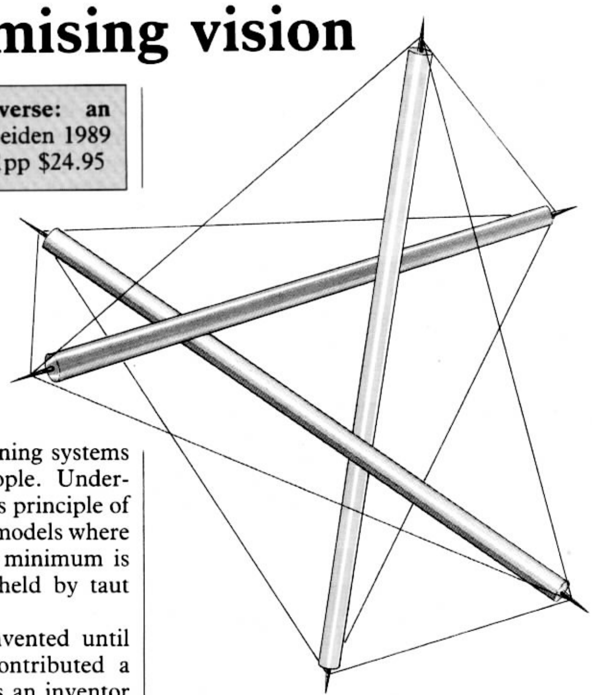
Buckminster Fuller's Universe: an Appreciation Lloyd Steven Seiden 1989 Plenum Press, New York 511pp $24.95

To most physicists, Buckminster Fuller, who died recently in his late eighties, was the engineer who invented geodesic domes. These are triangulated lattices of tensioned struts, with a metal or plastic skin, used to cover sports grounds and exhibitions, to house polar early warning systems (radomes) and sometimes people. Underlying these structures is Fuller's principle of tensegrity, often illustrated by models where a small number of struts (the minimum is three) that do not touch are held by taut strings.

But the domes were not invented until Fuller was nearly 50, and contributed a small part of his long career as an inventor and a philosopher of technology. One of his inventions was a 'fog gun' using 'atomised water under pressure to clean human skin far more efficiently than anything previously known. With the fog gun, a person could take a complete shower using less than one pint of water . . .'. Other inventions were the Dymaxion car and the Dymaxion map (the silly word 'Dymaxion' was invented in collaboration with a publicity consultant).

The car (invented in the early 1930s) was astonishingly manoeuvrable and could carry '11 people comfortably and average nearly 30 miles per gallon of gasoline while attaining speeds in excess of 120 miles per hour'. This performance was achieved by a combination of several unusual features, such as front-wheel drive and rear-wheel steering. The map was based on Fuller's original idea of radially projecting geographical features onto an icosohedron inscribed in the Earth sphere, and then cutting and flattening the icosohedron. The result is a map consisting of triangles. These can be rearranged in many ways (corresponding to different cuttings of the icosohedron), giving interesting perspectives on, for example, the distribution of land versus ocean, and world resources.

Fuller's inventions often reached the prototype stage but usually failed to get the widespread acceptance that their combination of originality of conception and robust practicality deserved. The reason, well described here by Seiden, was his refusal to compromise his visions to accommodate the wishes of the large corporations who would pay for them to be implemented. The fact that he achieved a great deal in spite of this destructive obstinacy later became a tenet of his personal philosophy: individuals have powers of creative thought and rapid response that are shared by neither committees nor corporations.



The simplest example of tensegrity: three rigid struts, which do not touch, supported by tensioned strings

His view of the world was ecological: in 1951 he coined the now-popular term 'spaceship Earth'. Nevertheless, he held the opinion, unfashionable among today's anti-scientific anti-intellectuals, that the problems of supplying food and energy to an expanding world population could be solved by technology. For example: 'pollution [is] resources not positioned at their maximally effective location'.

The author of this attempt to give a comprehensive account of Fuller's ideas and inventions is described as 'a lecturer, consultant and educator whose primary focus is on the ideas of Buckminster Fuller'. Although the prose is wooden, the description of Fuller's personality and his dealing with the business world is useful. Unfortunately, physicists seeking to penetrate Fuller's brilliant and odd insights will be disappointed that Seiden appears ignorant of science. This makes his accounts of technical matters either ludicrously ill balanced (as when he credits Fuller – rather than, say, Maxwell or Hertz – with the conception of ultrashort radio waves) or nonsensical (as in his account of Fuller's troubles learning trigonometry) or badly focused (as in his picture of the simplest tensegrity which fails to illustrate the essential point, that the struts do not touch). We would do better to read Fuller in the original, in spite of the flatulence and opacity of *his* prose. Anyone with the vision to make detailed and workable plans for cities beneath domes, or floating in the sea or sky, deserves continued study by those of us who are held back by more down-to-earth perspectives.

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Frank Tipler

Is it all in the mind?

The Emperor's New Mind: Concerning Computers, Minds and the Laws of Physics Roger Penrose 1989 Oxford University Press 466pp £20.00hb

DURING a conversation over lunch at a 1984 astrophysics conference in Jerusalem, Roger Penrose mentioned to me that he had grave doubts about the strong AI (artificial intelligence) hypothesis, which holds that human consciousness and intelligence is in essence a program being run on a computer called the brain. I was taken aback, for I believed that the whole trend of physical and biological science supported the hypothesis, and indeed I have based most of my recent work in cosmology on it. But doubts by a mathematical physicist of Roger's ability and insight have to be taken seriously. I asked Roger the reason for his doubts, and he replied, 'Oh, a lot of reasons. To do justice to them I'd have to write a book'. This is the book.

After reading it twice, I remain unconvinced by Roger's arguments: I still believe in strong AI. In fact, I think Roger's central arguments were countered by the great computer scientist Alan Turing in his classic defence of strong AI, *Computing Machinery and Intelligence*, first published in 1950. In essence, Turing claimed that thinking and consciousness are fundamental algorithmic processes. Thus they can be done by a computer, since it is a theorem that any algorithmic procedure can be simulated by a computer. Roger gives two general arguments for believing thinking and consciousness to be non-algorithmic.

The first argument is entirely physical, and arises from two of the most glaring defects of contemporary physics: there is no acceptable quantum theory of gravity and no generally accepted interpretation of quantum theory. Most workers in quantum gravity ignore interpretation problems, and gravitation is almost never mentioned in quantum measurement papers. In contrast, Roger suggests these problems are deeply