

The time of our lives

Tim Radford reports on an audacious plan to build a clock that will tick once a year for 10,000 years - and transform our perception of the future

The Guardian, Saturday 12 June 1999

A [larger](#) | [smaller](#)

Time contains every paradox. It heals all wounds, but it wounds all heels. It shrinks, it stretches, it flies, it drags. It varies relativistically according to the speed of the observer. It is measured in years, but even years have to be subdivided into tropical years, or anomalistic years, or Great Years.

Aeons are counted in the wheeling of the heavens - but it's the earth that moves. The planet goes round the sun at 30 kms a second, and the sun goes round the galaxy at 200 kms a second, and the galaxy, too, is moving: falling towards Andromeda at one speed, and racing with other galaxies towards some mysterious destination in the heavens at 600 kms a second.

Time is not infinitely divisible: the smallest unit cosmologists work with is called Planck time. It involves a decimal point followed by 43 zeroes before the first numeral. There are more of these Planck units in a period known as the Very Early Universe - the first thousandth of a second of creation - than there are seconds in the 15 billion year history of time thereafter. So for cosmic physicists, time stretches dizzily inside that first thousandth of a second.

Time is not infinite: St Augustine worked out 1,500 years ago that it came from nothing, simultaneously with space, out of nowhere. If time had a beginning, why not an end? Time may not mean the same for all creatures. A mouse barely lives three years; an elephant could survive for 60. But a mouse's heart beats 700 times a minute, and an elephant's 30 times a minute: they are both around for a billion heartbeats. So do both lifetimes feel like a lifetime?

Technology now sets an unimaginable pace: computer calculations are measured in nanoseconds - billionths of seconds - and computer power doubles every 18 months. Since 1959, the number of components on a chip has increased 137 billionfold, and new computers are obsolete in three years. "Now that we have progress so rapid that it can be observed from year to year," says Stewart Brand in a new book, "no one calls it progress. People call it change, and rather than yearn for it, they brace themselves against its force."

Brand, for decades an eco warrior and counter-culture campaigner, wants to stop the whirligig of time, or at least make people get off for a while. He wants people to understand the difference between the seize-the-day aspect of time, the Greek *kairos*, and the always-there backcloth of *chronos*.

Brand, author of *The Whole Earth Catalog*, which sold 10 million, wants to build a

whole history timepiece. He wants a clock that will remind people of their responsibility to the future, a clock that slows things down: it should tick once a year, bong once a century, and a cuckoo might pop out of it once every millennium. It would last for 10,000 years, and be central to a library devoted to the 10,000 years of human wisdom and experience accumulated so far. He calls it the "Clock of the Long Now".

The clock was proposed, and is being built, by Daniel Hillis, the Californian computer designer, and the name was dreamed up by Brian Eno the British artist and musician even before anyone mentioned a clock. Brand has always been in the business of making people think. And he had a crucial experience which made him think: his parachute failed while he was skydiving. He says he learned three visceral lessons in a very short sequence of events. First, technology is statistically unreliable: sooner or later, a parachute would fail. Second, a backup is always a good idea. Third, free fall was more fall than free: if his second parachute hadn't worked, then he would have had just eight seconds left. That was enough culture of immediacy: he wanted an outside frame of reference, and a backup.

The clock would remind him that humans were the sum of their past, which they dare not forget, lest they be condemned to repeat it in the future. The library would be the backup, a guide to risk assessment for future generations, the guide to the trails along which wrong turnings might have been made, the map of the way back. He is a founder member of the Long Now Foundation in San Francisco, which is building the clock, and wrestling with developing a form of information storage that will last.

Despite the promises of the digital revolution, computer discs last about five years. Even acid-free paper is good for only about 500 years. But a prototype of the clock is beginning to take shape, and the foundation is contemplating a permanent home for it. It won't yet say where, in case that pushes the price too high. But, says Brian Eno, the clock is in Daniel Hillis's laboratory at the Disney headquarters and the potential home is in the western US, somewhere very dry, in limestone hills hollowed out by abandoned mines.

Hillis developed the massive parallel architecture of today's supercomputers. His new clock is based on a binary digital mechanical system so accurate that the Long Now Foundation has applied for a patent. In theory, it will have an accuracy equal to one day in 20,000 years. The prototype is eight feet tall, built in alloy, tungsten carbide, metallic glass and synthetic sapphire.

It's also hotly debated, because time is a problem, and so is keeping it. In the medieval world, time used to be kept in days and years, with the hours a slightly arbitrary series of points, marking matins and compline and vespers. Punctuality was a late arrival (the monks divided the hour into four "puncts") and the minutes and seconds only began to matter with the arrival of precision navigation and train travel. But the kings of the supercomputer face the same calendar problems that Julius Caesar and Pope Gregory had to deal with: the days, and therefore the hours, do not fit neatly into the year. Old almanac-keepers settled the problem by inserting leap days. But now the second has been decoupled from the year - the modern second is so many vibrations of an isotope of caesium - and even the year won't keep still. The moon's drag on the earth is also drawing out day-length: leap seconds need to be inserted from time to time.

The aim of the clock is to make people think "long" - if they do, the foundation will have succeeded. Its keepers will have to think long just to keep it working at all. But that, too, is part of the aim. The idea is to have something ticking in the public gaze by January 2001, maybe in its permanent home. Brian Eno sees people entering from a

gallery somewhere up the side of the mountain. He sees the whole experience as a brief history of time: "The thing itself will be designed with the clock at its centre, but in such a way as to make it obvious that you don't just walk in, take a look at the thing and leave. There is a fair amount of thinking going on about what happens when you get there, what you see, how quickly it should reveal itself."

What the library will contain isn't so important, right now, as how it will contain it. Throwaway culture is already here to stay. Stewart Brand keeps pointing out that word processor files and computerised financial records from 10 years ago are now inaccessible: either the operating system has vanished, or the computer has perished, or the floppy disk has deteriorated. The computer, meant to be the great creator, has become the great eraser. Clay, stone, papyrus and parchment have survived, but haphazardly: most of the literature of ancient Greece perished in the deliberate destruction of the great library at Alexandria.

The invention of printing turned the book into a kind of multiple independently-targeted warhead: burn as many books as you like, one will always get through. The French Revolution tried to start with a clean slate - and a new calendar - and failed. The Nazis burned Einstein and Gide, Proust and Zola, HG Wells and Jack London, but someone somewhere kept the flame alight. Other cultures were almost obliterated by history's bigots. The Mayans had a written language and a better calendar system than Europe: Franciscan friars destroyed most of it.

All the destruction was wrong, says Brand. The accumulated past is life's best resource for innovation. Reinventing beats inventing every time. But libraries only house, they don't really keep. People are and should be the keepers. The works of the past that have stayed the distance were those that people used, every day: the great religious works. So there may have to be robot librarians "exercising" knowledge to keep it from perishing of disuse. There may need to be an indelible, fireproof form of storage. And the computer's binary code may not be ultimate form of information storage: you could go back to a real language, and etch the words. They could be etched very small. As a sample, the Biblical book of Genesis has been etched for the foundation on a scale that would fit 1,000 pages on a two-inch metal disc. This is big enough to be read with an optical microscope, or with recognition software.

There is a story about Eno in Brand's book: that in 1979, in New York, Eno, the genius of Roxy Music became depressed by the way that a generation of here and now New Yorkers thought only in terms of "this loft" and "this week". "You're history" became an insult. He wrote in his diary: "More and more, I want to be living in a Big Here and a Long Now." Eno says that is still his motive. But he sees time in musical intervals, too. "I have been working for a long time on self-generating pieces of music which are effectively endless, they don't repeat, they keep making themselves, so I have been interested in making things that last for a very long time. You behave quite differently if you think you are acting in terms of one year or two years, as opposed to 10 years or 100 years, so I'm trying to get into my mind that sense of the scale of time - and then get it into everyone else's. The point of this project is not primarily the clock. It is to make people think that our species will possibly be around for another 10,000 years, and we ought to be behaving as if that were the case."

Humans started changing the environment with the invention of agriculture about 10,000 years ago. They accelerated this change with the Industrial Revolution 200 years ago. Yet the changes are still slow enough to seem imperceptible. Brand and his colleagues see the clock/library project as the guardian of slow research and

measurement.

Somebody has to take on the long-term projects. Nuclear power operators are proposing not to dismantle nuclear power stations as they become inoperable, but to "park" them for a minimum of 125 years while they cool. Humans now have to think 125 years ahead. Try thinking 125 years back, to the world of Our Mutual Friend and the Paris Commune, and look at the gap. Try looking ahead 125 years, and imagine the gap to come.

There are even longer term projects: Britain's National Radiological Protection Board, when contemplating where to store long-lived nuclear waste, had to imagine radiation hazards to communities of hunter-gatherers wandering over what had been Sellafield, 100,000 years from now, after the next Ice Age. Who will take responsibility for remembering where these things were buried, and what language will be recognisable 100,000 years from now? Brand imagines the Long Now Library issuing a warning every 300 years to the government "of the region formerly known as New Mexico" about an extremely large quantity of radioactive waste buried in salt in "what used to be called the Carlsbad caverns". He also imagines the librarians planting messages in bottles for the future: burying global warming statistics inside glaciers, or seeding minefields with data about who planted the mines.

The library could itself turn into a museum of technologies still to come, technologies which have now begun to be fashioned and discarded at bewildering speed. The world has lost most of its languages, and many of its books, and most of its memory. Does it matter now what the world will keep in the future? "The ultimate reason for initiating something ambitious," says Brand, "is not to fulfil certain notions, but to find out what surprises might emerge." He quotes the writer Ken Kesey, who calls the idea "boiling rocks. If you don't boil rocks and drink the water, how do you know it won't make you drunk?"

The Long Now Foundation is a charity, and its existence depends on it being taken seriously for a very long time, which raises other problems. Brian Eno is not daunted. "The most important part is the conversation," he says. "You say to someone 'If you were going to save things for 10,000 years, what would you save?' When you start thinking about that question, you are already starting to do what we hope this project will achieve. You are thinking: what are we doing now that is valuable, that is worth holding on to, that is worth communicating? "And, by implication, you are also saying: what are we doing that isn't worth communicating to the future?"

The Clock Of The Long Now: Time And Responsibility, by Stewart Brand, is published by Weidenfeld at £12.99