

PHYSICS

Physics Turns Time Backwards; Mind Again Eludes Analysis

Minus as Well as Plus Time is Logical to Physical Science, Eddington Points Out, But Ridiculous to Consciousness

SCIENCE has difficulty in determining whether the physical sign-posts in our universe point to the future or to the past.

Sir Arthur Eddington in the Messenger Lectures at Cornell University asked:

"Do you get up in the morning and shave off the night's whiskers or do the whiskers that you think you have shaved off hop back onto your face and grow back into the roots from which you think they were cut while you sleep from morning back until evening?"

Both descriptions of the events may be true and scientifically sound, Sir Arthur emphasized. It is not that science has no way of telling the difference between the two descriptions, but that it has no way of attaching more significance to one than to the other. It uses both directions in time, just as mathematics uses plus or minus quantities, without considering that from a common sense point of view, such a quantity as minus time is nonsensical. While we are used to imaginary numbers in mathematics, expressed as the square root of minus one, which have no place in the ordinary scheme of digits, the use of minus time in physics, which is analogous, is shocking for man has depended for centuries upon physics to give him an account of the world about him.

The explanation is due to the position modern physicists have taken that matter, or the external world viewed by the mind, is somehow of the same stuff or quality as the mind itself, that it is an extension of the mind or of an entity similar to the mind.

The one thing known about the mind is that it goes forward not backward, that is, that it is evolving not devolving. Thus it is difficult for both the scientist and the common man to grasp that the external world of modern science shows no evidence of the state of evolution as opposed to devolution.

The evidence upon which science bases its distinction between "going forward" and "going backward" rests upon what is known as the second law

of thermodynamics concerning entropy or the increase of the random element in the universe. The law states that entropy always acts in "plus time," that is, in time going in the only direction in which common sense says it goes.

Thus in two isolated events the one which has the greater amount of the random element is the later in time. We must imagine that the action of the universe is somewhat like a pack of cards being constantly shuffled. As the shuffling goes on the cards become more and more mixed, less and less organized in suits and sequences. Thus it is with atoms. In other words "the random element" is continually increasing, never decreasing.

Thus, in "plus time" we come to one end of the world. For a time comes at last when no matter how much longer the cards are shuffled "the random element" can increase no more, as everything is completely random. This entropy, or the increase of the random element, results in increasing radiation of energy or heat in the universe, so that scientists sometimes speak of this end of the world as the (Turn Page)

GEOLOGY

Layers Found in Asphalt May Describe Prehistoric Weather

SEARCHING for the bones of extinct animals that ages ago had become bogged down in asphalt deposits at McKittrick, Calif., V. L. VanderHoof came upon something that may be useful in forming an estimate of the kind of weather that was "unusual" on the Coast in those remote times. He found a succession of layers in the asphalt, which are comparable in a way to the annual growth-rings in trees, and may have been due to the same causes.

The yearly bands, he told members of the Geological Society of America, represent a yearly recurrence of physi-



BOULDER DAM AT NIGHT

The world's greatest dam is now rising during every hour of the twenty-four, as this striking night view of construction attests. The photograph was taken by Dr. Morton Mott-Smith of Hollywood, Calif. According to latest reports, more than 1,543,000 cubic yards of concrete had been placed in the dam by March 31 bringing the structure to a height of about 330 feet. A new record for concrete pouring was set on March 20 when 10,462 cubic yards went into the dam and auxiliary structures. The hardening concrete is being cooled by pre-cooled and refrigerated water. More men are working on the project than ever before, nearly 5,000 being employed. According to present progress, the pouring of mass concrete for the main dam will be finished by May 1935, and the \$49,000,000 contract of the Six Companies will be completed in May 1937.

cal conditions which are influenced by climate. Winter cold increases the viscosity of the tar so that it solidifies, while high summer temperatures render it fluid and able to flow down slope. Winter rains cause enough sheet wash to blanket with dirt the previous summer flow, thus sharply marking off one year's layer from another.

Mr. VanderHoof has measured and plotted a series of 180 of these bands, and efforts are now being made to correlate the resulting curves with similar curves resulting from studies of tree rings and of varves.

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"heat death." The other end of the world, however, commonly called the beginning, is just as important scientifically, but is a great deal more difficult to construct. As we go back in "minus time" toward the "beginning," things become less and less random until, theoretically, they have become completely organized. The problem then arises of how they got that way.

One explanation depends upon the nature of the "second law" of thermodynamics which, like all so-called natural laws, is statistical. That is, it states what will happen in terms of innumerable observations of what has happened. It does not pretend to be absolute, but merely a statement on the basis of experience of an overwhelming probability, a probability of ten, raised to the twentieth power, to one. In the words of Sir Arthur: "If all my statements had as good a chance of being right, I would be afraid I was either a genius or a fool stating the obvious."

In these terms time may be imagined as extending indefinitely in both directions but having the character, not of a level plain, but of a series of mountains, the peaks of which represent states of complete organization and the valleys of which represent complete randomness. Logically, according to science, we progress over these peaks one after the other in turn, each journey up and down being an exact repetition of the one before so that "history" constantly repeats itself exactly.

Going "up the peak" from randomness to organization represents actually travelling reverse in time and going down the peak represents going in the direction which is ordinarily thought of as time. While science does not distinguish between the significance of the two directions, consciousness refuses to accept any but the downward direction from past to future, from the peak of organization to the valley of randomness or "heat death" where all is reduced to radiant energy.

Whereas for science it is perfectly reasonable thus to consider the direction of time's arrow in terms of plus and minus, for consciousness any reversal at all, any concept of minus time, is simply ridiculous. Thus matters stand at the moment. The dynamic quality of time which we instinctively sense and which the philosophers call "becoming" as opposed to "being" and the significance which we attach to it mentally is not explainable or describable by modern science. Once more the mind eludes analysis.

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ARCHAEOLOGY

Explorations at Ur Finished; Cemetery Found in Pit Bottom

Abraham's Town Had Great History and a "Personality" Scientists Declare Summarizing Discoveries of 12 Seasons

See Front Cover

EXPLORATION at Ur of the Chaldees, one of the most remarkable archaeological projects ever undertaken, is finished, according to announcement made at the University of Pennsylvania Museum.

A report just received from C. Leonard Woolley, British archaeologist, who has directed the long campaign of digging, tells of the last discovery at Ur. This discovery is a cemetery of 200 graves found in the depths of a huge pit 50 feet deep, which is pictured on the front cover of this week's SCIENCE NEWS LETTER.

Skeletons and Vases

Crumbling remains of skeletons, with tightly flexed knees and thighbones bent to right angles with the spine, were surrounded by vases and bowls. At the necks and waists of the bodies were found innumerable beads of crystals, lapis lazuli, carnelian, marble, shell, chalcedony, and one of gold. The age of these people of Ur is set at the fourth millenium before Christ, in a period which the archaeologists have named the Jemdet Nasr period.

In the latter days of this period, fashions of Ur evidently called for stone vases and bowls instead of the native clay, and the stone had to be imported from northern Mesopotamia, or from the Persian Gulf far away to the south. In the 200 graves, the archaeologists found 770 stone vessels of alabaster, gypsum, limestone, and diorite.

The British Museum and the University of Pennsylvania Museum have worked jointly at Ur for twelve seasons, finding the home town of Abraham to be a place with a great history and a "personality."

Important Discoveries

Reviewing discoveries of paramount interest at Ur, Horace H. F. Jayne, director of the University Museum, included these:

1. Pre-Dynastic royal tombs of about 3500 B.C. were opened, revealing mute evidence of human sacrifice on a lav-

ish scale. Bodies of kings, queens, and their servitors, buried with an unbelievable array of jewelry and household goods, attest to the artistry, culture and luxury of Ur's royal court 5,000 years ago.

2. Royal tombs of the great Third Dynasty were found, and, while these burials at Ur had been plundered, the massive and elaborate construction of the tombs is of great historic interest.

3. Residential districts of Ur, particularly about 2000 B.C., which was Abraham's time, revealed a surprising elaborateness in middle class dwellings. Many middle class homes had private chapels, and below the houses were family burial vaults.

4. The great public buildings of Ur were found grouped mainly in the Sacred Area. The Ziggurat, largest existing example of the great staged towers of Mesopotamian cities, dominated this center. Near it were the Treasure House and the Temple to the Moon-God. Several palaces were also found.

5. A bed of water-laid clay eight feet thick was discovered and pronounced evidence of a flood which marked a break in the history of Ur. The layers of remains above and below the barren clay level were of very different civilizations.

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ORNITHOLOGY

Ravens Know Trick Of Military Aviators

STUNTING in the air is not a new thing under the sun. One of the favorite tricks of the military aviator—a quick side roll to an upside down position, followed by a half-loop downward restoring the right side up position and reversing the direction of flight—is known to ravens.

Several observations of this turn have been observed by a German naturalist, J. O. Fulz, and have been reported by him to the weekly journal, *Die Umschau*.

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