How to Construct a Time Machine

Alfred Jarry

English edition
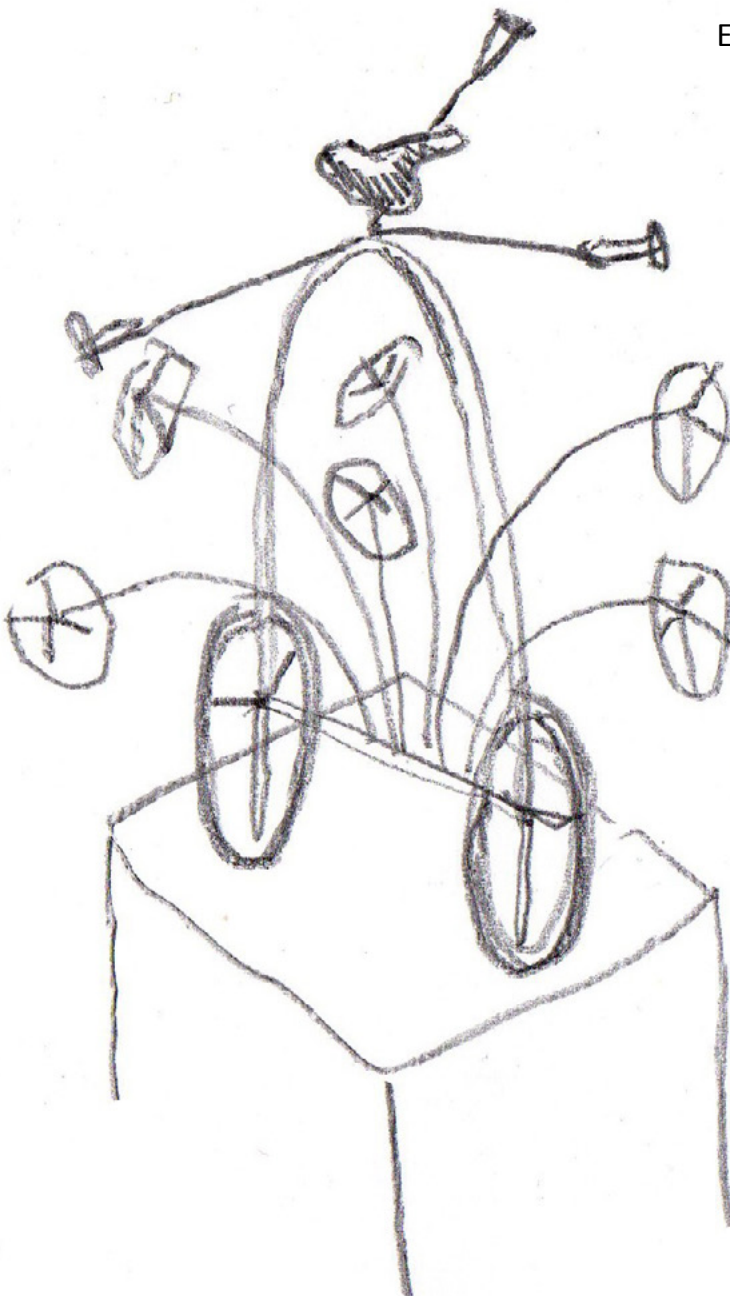
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PUBLIC DOMAIN

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Alfred Jarry

translated by Roger Shattuck

On the cover:
"La macchina del tempo" by Giovanni Ricciardi

I. THE NATURE OF THE MEDIUM

A Time Machine, that is, a device for explo-
ring Time, is no more difficult to conceive of
than a Space Machine, whether you consi-
der Time as the fourth dimension of Space
or as a locus essentially different because
of its contents.
Ordinarily, Time is defined as the locus of
events, just as Space is the locus of bo-
dies. Or it is defined simply as succes sion,
whereas Space -- (this will apply to all spa-
ces: Euclidean or three-dimensional spa-
ce; four-dimensional space implied by the
intersection of several three-dimensional
spaces; Riemannian spaces, which, being
spheres, are closed, since the circle is a ge-
odesic line on the sphere of the same ra-
dius; Lobatchevski's spaces, in which the
plane is open; or any non-Euclidean space
identifiable by the fact that it will not per-
mit the construction of two similar figures
as in Euclidean space) Space is defined by
simultaneity.
Every simultaneous segment of Time is
extended and can therefore be explored
by machines that travel in Space. The pre-
sent is extended in three dimensions. If one

transports oneself to any point in the past or the future, this point will be present and extended in three directions as long as one occupies it.

Reciprocally, Space, or the Present, has the three dimensions of Time: space traversed or the past, space to come or the fu ture, and the present proper.

Space and Time are commensurable. To explore the universe by seeking knowled- ge of points in Space can be accomplished only through Time; and in order to measu- re Time quantita tively, we refer to Space intervals on the dial of a chronometer.

Space and Time, being of the same nature, may be conceived of as different physical states of the same substance, or as differ ent modes of motion. Even if we accept them only as different forms of thought, we see Space as a solid, a rigid system of phe- nomena; whereas it has become a banal poetic figure to com pare Time to a flowing stream, a liquid in uniform rectilinear mo- tion. Any internal obstruction of the flow of the mobile molecules of the liquid, any increase in viscosity is nothing other than consciousness.

Since Space is fixed around us, in order to explore it we must move in the vehicle of Duration. In kinematics Duration plays the part of an independent variable, of which

the coordinates of the points considered are a function. Kinematics is a geometry in which events have neither past nor future. The fact that we create that distinction proves that we are carried along through them. We move in the direction of Time and at the same speed, being ourselves part of the Present. If we could remain immobile absolute Space while Time elapses, if we could lock our selves inside a Machine that isolates us from Time (except for the small and normal "speed of duration" that will stay with us because of inertia), all future and past instants could be ex plored successively, just as the stationary spectator of a panorama has the illusion of a swift voyage through a series of landscapes. (We shall demonstrate later that, as seen from the Machine, the Past lies beyond the Future.)

II. THEORY OF THE MACHINE

A Machine to isolate us from Duration, or from the action of Duration (from growing older or younger, the physical drag which a succession of motions exerts on an inert body) will have to make us "transparent" to these physical phenomena, allow them to pass through us without modifying or displacing us. This isolation will be sufficient (in fact it would be impos sible to design it any more efficiently) if Time, in overtaking us, gives us a minimal impulse just great enough to compensate for the deceleration of our habitual duration conserved by inertia. This slowing down would be due to an action compar able to the viscosity of a liquid or the friction of a machine.

To be stationary in Time means, therefore, to pass with im punity through all bodies, movements, or forces whose locus will be the point of space chosen by the Explorer for the point of departure of his Machine of Absolute Rest or Time Machine. Or one can think of oneself as being traversed by these events, as a projectile passes through an empty window frame without damaging it, or as ice re-forms after being cut by wire, or

as an organism shows no lesion after being punctured by a sterile needle.

The Time Explorer's Machine must therefore:

1) Be absolutely rigid, or in other words, absolutely elastic, in order to penetrate the densest solid as easily as an infinitely rarified gas.

2) Have weight in order to remain stationary in Space, yet remain sufficiently independent of the diurnal movement of the Earth to maintain an invariable orientation in absolute Space; and as a corollary, although it has weight, the Machine must be incapable of falling if the ground gives way beneath it in the course of the voyage.

3) It must be nonmagnetic so as not to be affected (we shall see why later on) by the rotation of the plane of polarization of light. An ideal body exists which fulfills the first of these conditions: the Luminiferous Ether. It constitutes a perfect elastic solid, for wave motion is propagated by it at the well-known speed; it is penetrable by any body or penetrates any body with out measurable effect, since the Earth gravitates within it as in empty space.

But - and here lies its only similarity to the

circular body or Aristotelian ether - it is not by nature heavy; and, as it turns as a whole, it determines the magnetic rotation discovered by Faraday.

Now one common machine known to us all provides a per fect model for the luminiferous ether and satisfies the three postulates.

Let us briefly recall the constitution of the luminiferous ether. It is an ideal system of material particles acting on one another by means of springs without mass. Each molecule is mechanic ally the envelope of a coil spring whose ends are attached to those of neighboring molecules. A push or a pull on the last molecule will produce a vibration through the entire system, exactly as does the advancing front of a luminous wave.

The structure of this system of springs is analogous to the circulation without rotation of infinitely extensive liquids througll infinitely small openings, or to a system consisting of rigid rods and rapidly rotating flywheels mounted on all or some of those rods.

The system of springs differs from the luminiferous ether only because it has weight and does not turn as a whole, any more than would the ether in a field without magnetic force.

If one keeps increasing the angular velocity

of the flywheels, or if one keeps tightening the springs, the periods of elemen tary vibrations will become shorter and shorter and the ampli tacte weaker and weaker. The movements will increasingly re semble those of a perfectly rigid system formed of material points mobile in Space and turning according to the well known law of rotation of a rigid body having equal moments of in ertia around its three principal axes.

In sum, the element of perfect rigidity is the gyrostat or gyroscope.

Everyone is familiar with those square or round copper frames containing a flywheel spinning rapidly around an in terior axis. By virtue of its rotation, the gyrostat maintains its equilibrium in any position. If we displace the center of gravity a little out of the vertical of the point of support, it will turn in azimuth without falling. The azimuth is the angle subtended between the meridian and a plane determined by the vertical and a given fixed point-- a star for example.

When a body rotates around an axis one of whose points is carried along with the diurnal motion of the earth, the direc tion of its axis remains fixed in absolute Space; so that for an observer carried along without his awareness in this diurnal motion, that axis appears to turn uniformly around the axis

of the earth, exactly as would a parallactic telescope constantly pointed at a particular star low down on the horizon.

Three rapidly rotating gyrostats with shafts parallel to the three dimensions of space would produce a condition of cubic rigidity. The Explorer seated in the machine would be me chanically sealed in a cube of absolute rigidity, capable of pene trating any body without modification just like the luminifer ous ether.

We have just seen that the Machine maintains an invariable orientation in absolute Space, but related to the diurnal move ment of the Earth so as to have a reference point to determine time traveled.

Finally, the Machine has no magnetized parts as its description will show.

III. DESCRIPTION OF THE MACHINE

The Machine consists of an ebony frame, similar to the steel frame of a bicycle. The ebony members are assembled with soldered copper mountings.

The gyrostats' three tori (or flywheels), in the three perpen dicular planes of Euclidean space, are made of ebony cased in cop per, mounted on rods of tightly rolled quartz ribbons (quartz ribbons are made in the same way as quartz wire), and set in quartz sockets.

The circular frames or the semicircular forks of the gyro stats are made of nickel. Under the seat and a little forward are located the batteries for the electric motor. There is no iron in the Machine other than the soft iron of the electromagnets.

Motion is transmitted to the three flywheels by ratchet-boxes and chain-drives of quartz wire, engaged in three cogwheels, each of which lies on the same plane as its corresponding fly wheel. The chain-drives are connected to the motor and to each other through bevel gears and driveshafts. A triple brake controls all three shafts simultaneously.

Each turn of the front wheel triggers a lever

attached to a pulley system, and four ivory dials, either separate or concen tric, register the days in units, thousands, millions, and hundreds of millions. A separate dial remains in contact with the diurnal movement of the Earth through the lower extremity of the axis of the horizontal gyrostat.

A lever, controlled by an ivory handle and moving in a longitudinal or parallel direction to the Machine, governs the motor speed. A second handle slows the advance of the Ma chine by means of an articulated rod. It will be seen that a re turn from future to present is accomplished by slowing down the Machine, and that travel into the past is obtained by a speed even greater than that used for movement into the future (so as to produce a more perfect immobility of duration). In order to stop at any determined point in Time, there is a lever to lock the triple brake.

When the Machine is at rest, two of the circular frames of the gyrostats are tangential to the ground. In operation, since the gyrostatic cube cannot be drawn into rotation or at least is held to the angular motion determined by a constant couple, the Machine swings freely in azimuth on the extremity of the horizontal gyrostatic axis.

IV. FUNCTIONING OF THE MACHINE

By gyrostatic action, the Machine is transparent to successive intervals of time. It does not endure or "continue to be," but rather conserves its contents outside of Time, sheltered from all phenomena. If the Machine oscillates in Space, or even if the Explorer is upside down, he still sees distant objects normally and constantly in the same position, for since everything nearby is transparent, he has no point of reference.

Since he experiences no duration, no time elapses during a voyage no matter how long it is, even if he has made a stop outside the Machine. We have said that he does not undergo the passage of time except in the sense of friction or viscosity, an interval practically equivalent to that he would have passed through without ever entering the Machine.

Once set in motion, the Machine always moves toward the future. The Future is the normal succession of events; an apple is on the tree; it will fall. The Past is the inverse order: the apple falls from the tree. The Present is non-existent, a tiny fraction of a

phenomenon, smaller than an atom.

The physical size of an atom is known to be 1.5×10^{-8} centimeters in diameter. No one has yet measured the fraction of a solar second that is equal to the Present.

Just as in Space a moving body must be smaller than its con taining medium, the Machine, in order to move in duration, must be shorter in duration than Time, its containing medium -- that is, it must be more immobile in the succession of events.

Now the Machine's immobility in Time is directly propor tional to the rate of rotation of its gyrostats in Space.

If t stands for the future, the speed in space or the slowness of duration necessary to explore the future will have to be a temporal quantity, V, such that

$$V < t.$$

Whenever V approaches 0, the Machine veers back to the Present.

Movement into the Past consists in the perception of the reversibility of phenomena. One sees the apple bounce back up onto the tree, the dead man come to life, and the shot re-enter the cannon. This visual aspect of succession is well known to be theoretically obtainable by outdistancing light waves and then continuing to travel

at a constant speed equal to that of light. The Machine, by contrast, transports the explorer through actual duration and not in search of images preserved in Space. He has only to accelerate to a point where the speed indicator (recall that the speed of the gyrostats and the slowness in duration of the Machine, that is the speed of events in the opposite direction, are synonymous) shows

$$V <- t.$$

And he will continue with a rate of uniform acceleration that can be controlled almost according to Newton's formula for gravitation. For a past anterior to- t may be indicated by- t, and to reach it he must obtain on the dial a reading equivalent to

$$V < (<- t).$$

V. TIME AS SEEN FROM THE MACHINE

It is worth noting that the Machine has two Pasts: the past anterior to our own present, what we might call the real past; and the past created by the Machine when it returns to our Present and which is in effect the reversibility of the Future.

Likewise, since the Machine can reach the real Past only after having passed through the Future, it must go through a point symmetrical to our Present, a dead center between future and past, and which can be designated precisely as the Imaginary Present.

Thus the Explorer in his Machine beholds Time as a curve, or better as a closed curved surface analogous to Aristotle's Ether. For much these same reasons in another text (Exploits and Opinions of Doctor Faustroll, Book VIII) we make use of the term Ethernity. Without the Machine an observer sees less than half of the true extent of Time, much as men used to regard the Earth as flat.

From the operation of the Machine there can easily be de duced a definition of Dura-

tion. Since it consists in the reduction of t to 0 and of 0 to- t, we shall say:

Duration is the transformation of a succession into a reversion.

In other words:

THE BECOMING OF A MEMORY.