NATURE'S TIME SCALE

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One of the conundrums of modern science is the apparent disregard that our laws of thermodynamics have for the direction of time. These laws do not distinguish between past and future, as they are symmetrical in time. As has been stated, "Does the notion of an arrow of time have to be given up, or do we need to change the fundamental dynamical laws" (1). Others have commented about this indifference of thermodynamic principles to the direction of time (2). The present communication revives an approach offered 40 years ago (3). It seems appropriate as we enter the 21st century, in view of the renewed interest in the study of Chaos theory, Non-linearity, and Entropy, to present this approach once again. The observations on the Nature of Time by Peter Lynds (4) seem particularly pertinent to the content of the present work.

A plot of a typical so-called survival curve is shown in Fig. (a). The kinetic behavior of a reaction such as this has classically been analyzed by plotting the log of survivors (S) vs. time (actually S is equal to that fraction of the process under study which did not undergo any change). Many examples exist in the literature going back to the 19th century, in which the kinetics were determined by examining the disappearance of starting material (survivors) rather than the appearance of new products. Investigators who utilize this analytical procedure complain that linearity is not universally achieved and that the semilog curve obtained often demonstrates a plateau during the early measurements before descending as a straight logarithmic function, but which then usually begins to deviate from a logarithmic decrease in the latter portions of the curve.

I question why we work with data describing what remains of a process rather than with what new products have been created. When attempts were made to graph the portion that had undergone change, Y = (1 – S) (Fig. (b)), a successful result was obtained by plotting the log log 1/Y vs log t!!! A straight line relationship was achieved from the earliest experimental point to the last. Opponents stated that the kinetics derived from S should be the same as those derived from 1 – S. This would be true if, and only if, the time parameter were a linear function. From the linearly plotted data the constants k and c can be determined, and then the distribution function can be plotted (Fig. (c).

The analyses of over 100 different processes have been studied (and are available upon request), and in no case was a bell-shaped curve obtained symmetrically distributed about a mean, but only skewed distribution functions.

There are those who will exclaim that one can render any data into a straight line if sufficient numbers of logs are taken. This argument is patently untrue and the result is obtained by taking only two logs of one parameter and one log of time. This is the critical finding, and leads to the other comments I will make. With this method of analyzing the data, the parameters for the entire process can be calculated from a minimum of three data points taken at a geometric ratio, such as at 2, 4 & 8 minutes, or 1, 5 and 25 hours. The integral of the curve represented by Fig. (a) is Fig. (d), which continues to increase without limit during the course of the process.

I hereby list the main postulates arising from this work.

a. Each process in Nature proceeds according to its own unique exponential function of time, therefore, no such entity as negative time exists in Nature. Time can only flow from zero to infinity. Those who study thermodynamics will need to finally come to grips with this fact. Once a process (hypothetically a closed system) is triggered and brought into existence, the ultimate course of that process is preordained.

b. Time is the measure of the duration of a specific process. In a closed system all of the variables determining the outcome of a given process are in place at the starting gate, so to speak, just waiting for the button to be pressed at $t = 0$. If the system is perturbed, then the course of that process can no longer be measured with reference to the original time scale. Process A then ceases to exist as such and the components of the former Process A now become incorporated into the components of a new process, Process B, with a new time scale.

c. The integral of the curve shown in Fig. b is shown in Fig. d. This curve represents the entropy evolved by the process, and which continues to increase until the process is terminated.

d. The basic equation is $Y = e^{-kt^{-c}}$

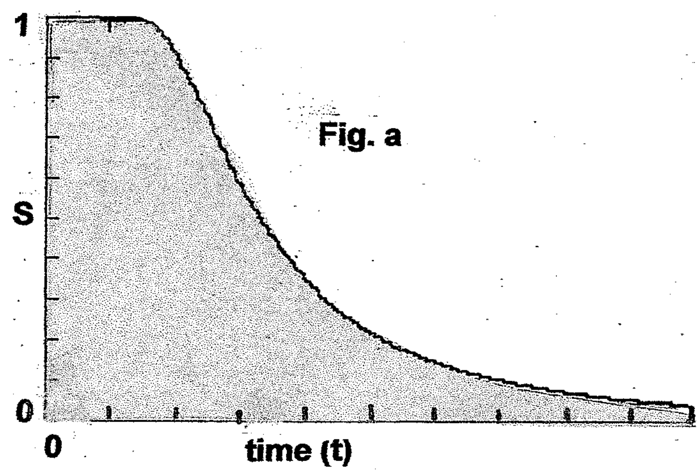

Fig. a

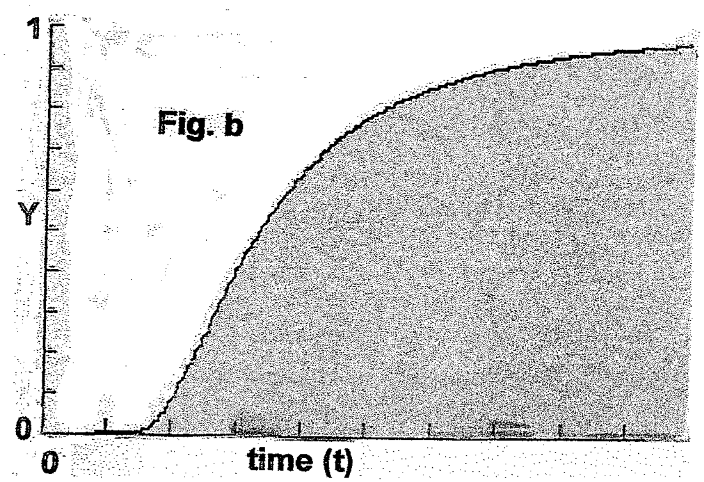

Fig. b

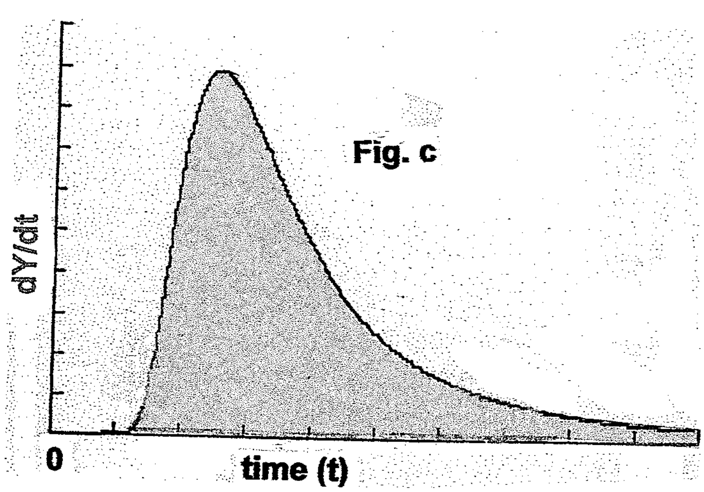

Fig. c

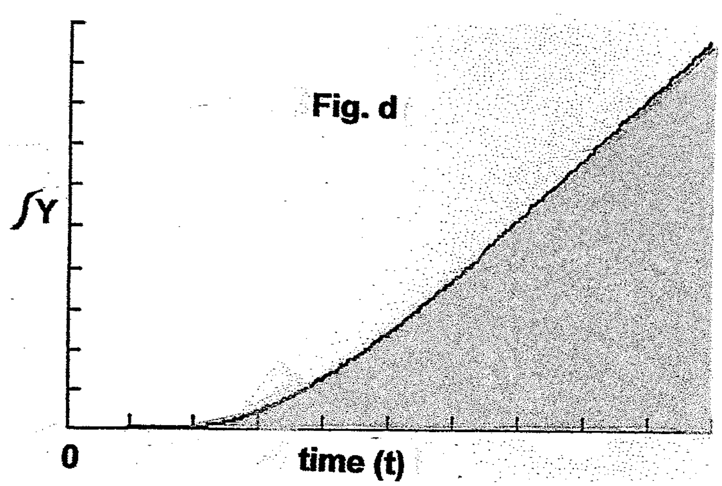

Fig. d

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(4) P. Lynds. Indeterminancy vs. Discontinuity, Foundation of Physics Letters, 2001.