

"Uniform Continuity and World Peace or
The Concept of a Justice Vector."

by

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Some function in quantum mechanics (I forget where, perhaps in Pauling & Wilson) looks like Fig. 1. This suggests a crude analogy in which the shaded squares represent different political interest groups. [For later developments see SEPR Nos. 19-A, 83 Sec. 10, 88-B, 91, & 92-B] If we expand these squares we are reminded of the proof of a theorem on uniform continuity in the theory of functions of a real variable in which the Heine-Borel-Lebesgue covering theorem is used. [See Lawrence M. Graves, The Theory of Functions of Real Variables, N.Y.: McGraw-Hill Book Co. (1946), pp. 51, 63-66]

Uniform continuity is defined as follows:

Given an $\epsilon > 0$, there exist a $\delta > 0$, such that

$$|f(x'') - f(x')| < \epsilon \text{ when } |x'' - x'| < \delta; \quad x', x'' \in [a, b],$$

where $f(x)$ is defined on the interval $[a, b]$ as shown in Fig. 2.

Uniform continuity enters into the picture by the theorems:

1. If $f(x)$ is continuous in a closed interval $[a, b]$ then $f(x)$ is uniformly continuous in the closed interval.
2. If $f(x)$ is continuous in the closed interval $[a, b]$ then $f(x)$ is integrable in the Riemann sense.

3. If $\lim_{\Delta \rightarrow 0} \sum_{j=0}^{n-1} f(x_j') (x_{j+1} - x_j)$ exist and is

equal to I , then $f(x)$ is (R) and $\int_a^b f(x) dx = I$.

[For a proposed generalization see Section IIA of SEP 65-C.]

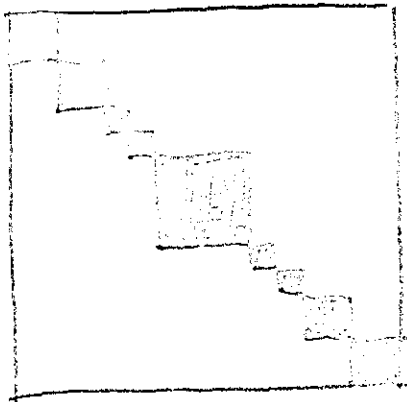


Fig. 1.

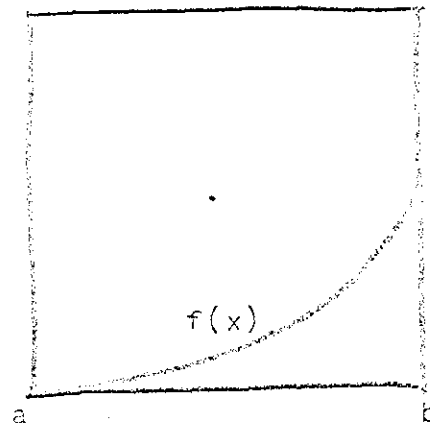


Fig. 2.

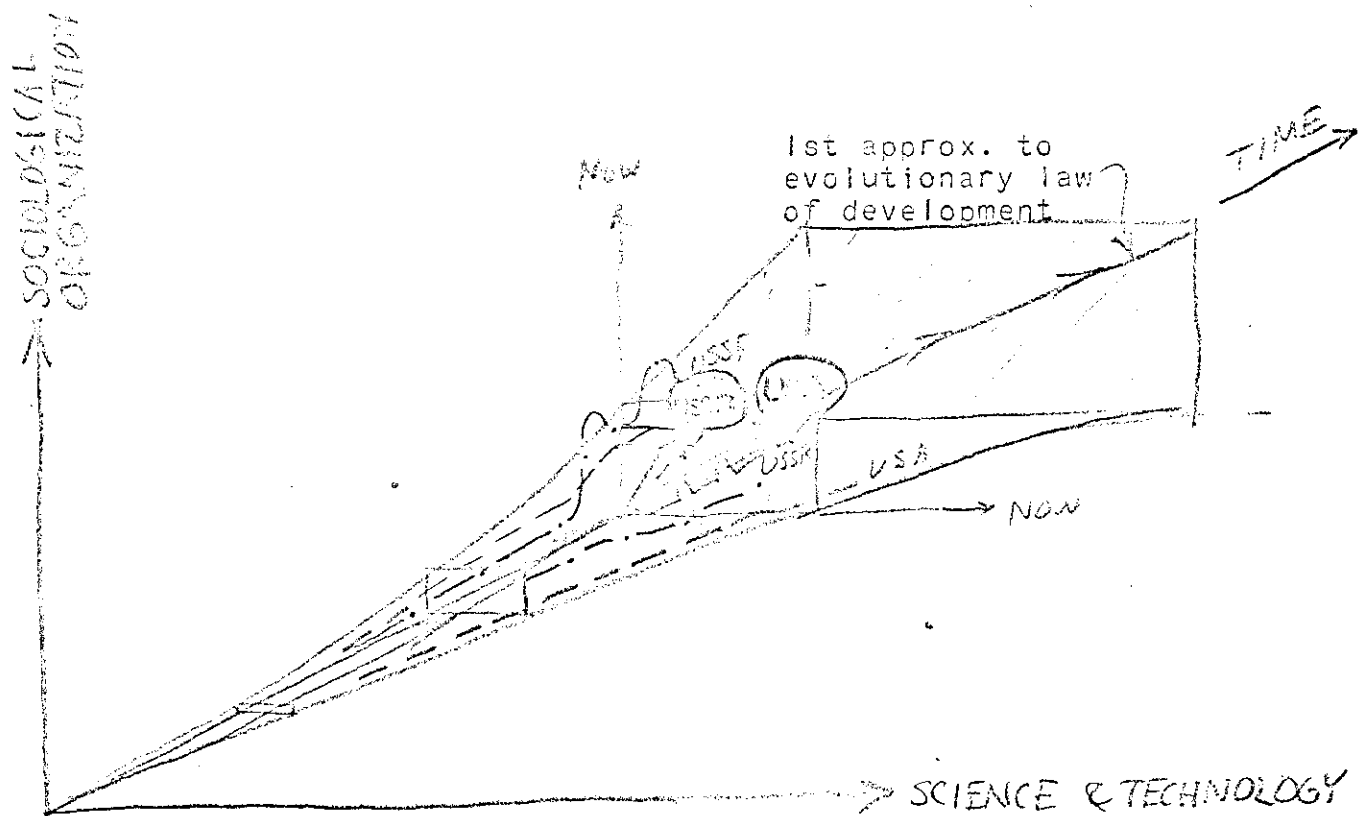


Fig. 3.

Fig. 3 illustrates an as yet undefined measure of the maturity of a group of people known as a sovereign nation. One axis is for the development of science and technology and the other is for the development of social organization; both plotted against time. An exponential curve is drawn in to represent a first approximation to an evolutionary law of development. Rough guesses for the USA and the USSR are drawn on the curve. The wiggles in the USSR curve are intended to indicate a development in which the degree of social organization shifts between too far ahead of the technical stage of development and vice versa, while the curve for USA shows a more optimum balance. The transients in the USSR curves may be largely due to disturbances going back further than the advent of Communism. It is a problem for social scientists to work out further details. [The concept of the continuous channel in Information Theory was not known to me at the time of writing the first draft of this memo. See SEPR Nos. 91 & 92-B for later developments in which the variance of a measure of social organization, "MCD," has a functional relationship to the state of technology through the electric power production per capita per year.]

Another concept not fully developed yet is the interaction between individual development and social (or institutional) development. Also each nation must be divided into sub-groups. Also a measure of democratic participation is worth investigation. # The diagram of Fig. 4 suggests the semi-Brownian motion type of development with the added constraints of individual, social, and geographical directions.

See SEPR No. 88-B for the relationship between freedom and democracy as represented by the discrete channel in Information Theory.

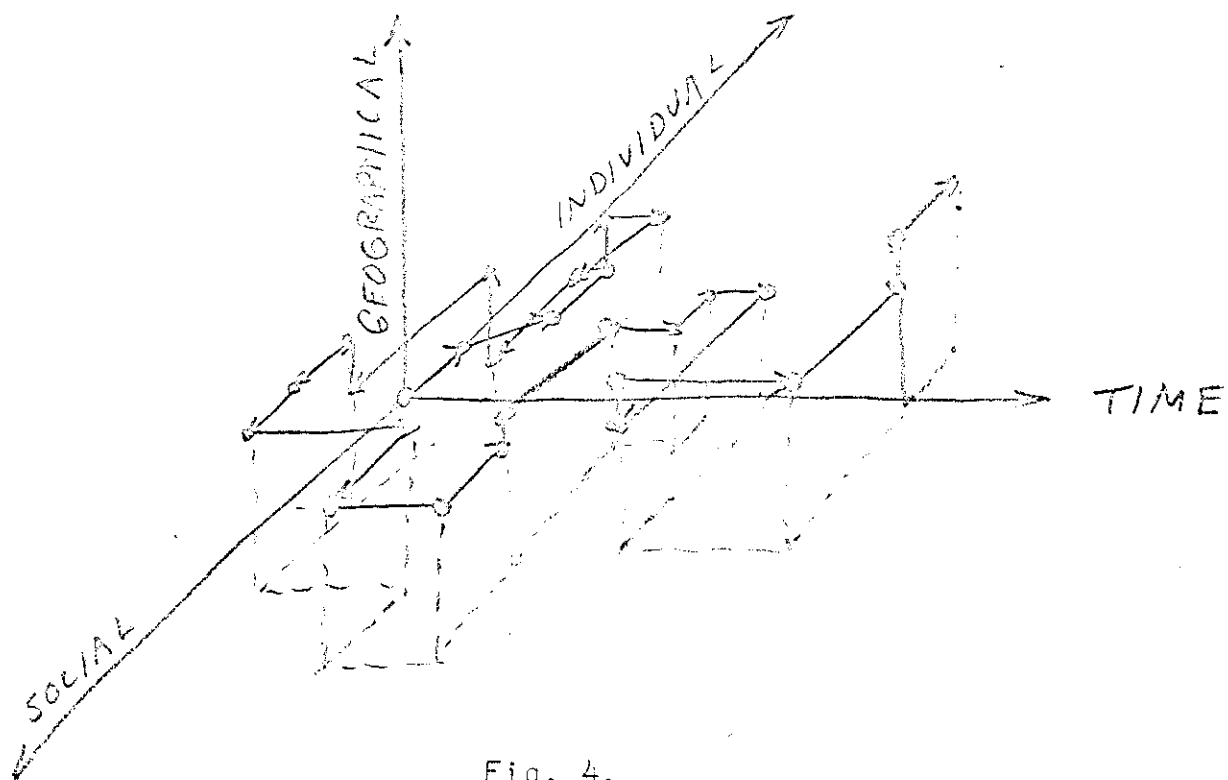


Fig. 4.

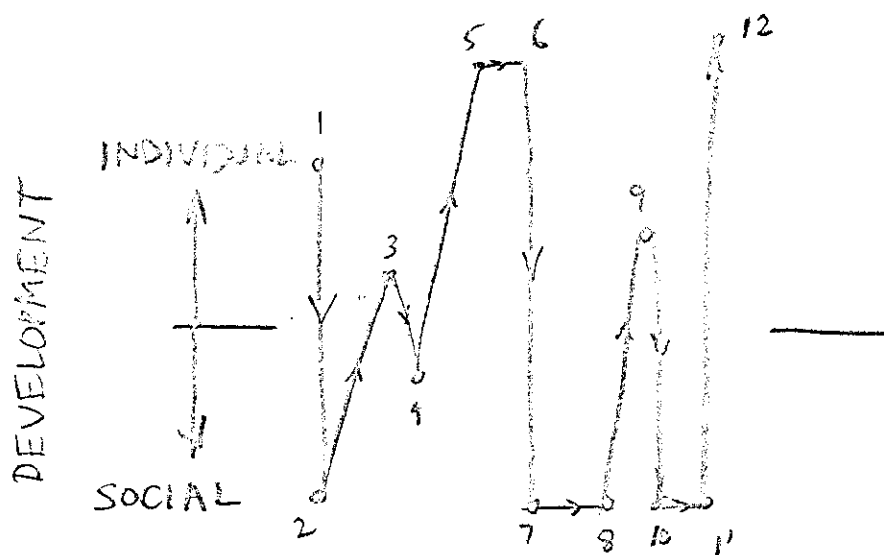


Fig. 5.

Fig. 5 is a similar case shown in two dimensions. When this development stops, movements develop to establish new social institutions to guide individuals, or to abolish social institutions which retard the individual development. If the established institutions will take the trouble to learn what is happening and to figure out how close they are to the optimum development curve, they can plan a course of adaptation to the new conditions.

A revolutionary form of action develops when the social maturity of a group and its individuals lags way behind the level of development needed for its state of physical development. A slower time scale is suitable for an agricultural community, but not for an industrial society.

A number of conditions can be explored for their relevance to establishment of world peace. Some requirements on the derivatives of $f(x)$ in Fig. 2 may be necessary. [See partial derivatives of history in earlier SEP's.] The test as to whether a country is approaching its optimum political idea distribution has been suggested as a test for use in determining when disarmament talks could be fruitful. [See SEPR No. 91]

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"The Development of Society"

by

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The development of our planet can be represented as a combination of continuous change and discrete transitions from one stage to another. Early man could not understand many phenomena of nature, so he tried to imagine how and why things happened. Gradually man gained greater and greater insights into nature. Even though the concepts developed at certain stages were based on incorrect physics or chemistry, they explained important truths relating to human relations. Perhaps early man did not differentiate between physical science, social science, and religion.

We can consider a hypothesis (which must be verified or discarded later) as an approximation to the truth. Let us examine the trends of world power production, electric power production, mineral production to see what laws certain items which are capable of quantitative measurement conform to. We cannot transfer these laws to strictly social phenomena for which there are as yet no scales for precise checking. However, we may try analogies from physical science in the social sciences, if we set up a method of testing or a method of insuring the concepts remain tentative (not turned into an orthodoxy) until testing procedures are developed.

Let us examine world mineral production. Take t_0 as a reference point in history, then let P_1 = annual production of mineral 1 in year t .

The curves⁽¹⁾ for capitalist regions of the world fit reasonably close to

$$P_1(t) = e^{K_0 + d_1(t-t_0)} \text{------(A)}$$

with the exception that wars and depressions delay the development so that for the periods between wars and depressions a t_0 must be used to replace t_0 .

A similar curve applies to total world power production and to electric power. For electric power production eg(A) has been checked for the Soviet Union and found to be a reasonably close fit, excepting for revolution and war. For curves see Hogbom⁽²⁾ and also F.B. Wood.⁽³⁾

To examine the development of society lets consider the application of equation (B) as a first approximation in Fig. 1.

$$K_m(t) = A_m + e^{K_0 + d_m(t-t_0)} \text{------(B),}$$

where $K_1(t)$ represents an approximation to the quantity of social knowledge, and

$K_2(t)$ represents an approximation to the quantity of physical knowledge

We may note that the constant d_1 may be changed by a jump from one economic system to another, but that d_1 cannot be changed outside narrow limits without greater sacrifice and energy on the part of the people. For study at present we can examine the record of the U.S.S.R. in its change to socialism, but keeping in mind the backwardness of the position from which the revolution started.

1. "Report of the committee for the study of the problem of raw materials, Appendix I: Development of world production of raw materials," League of Nations Official Journal, 1937 II B 7, Off. No. A.27.1937 II B, annex 1682, pp. 1249-1267, Dec. 1937.

2. "Mineral production, a study in trend and geographical displacement," Ingenjors Vetenskaps Akademiens, Handlignar, (The Royal Swedish Institute for Engineering) No. 117, 1932. Dr. Hogbom

3. F.B. Wood. "Example of Use of Checking Chart, Part I: Checking Chart Historical Perspective, and World Power Production" manuscript 5/21/47. Reprinted as SEPR No. 14-A, 6/3/61.

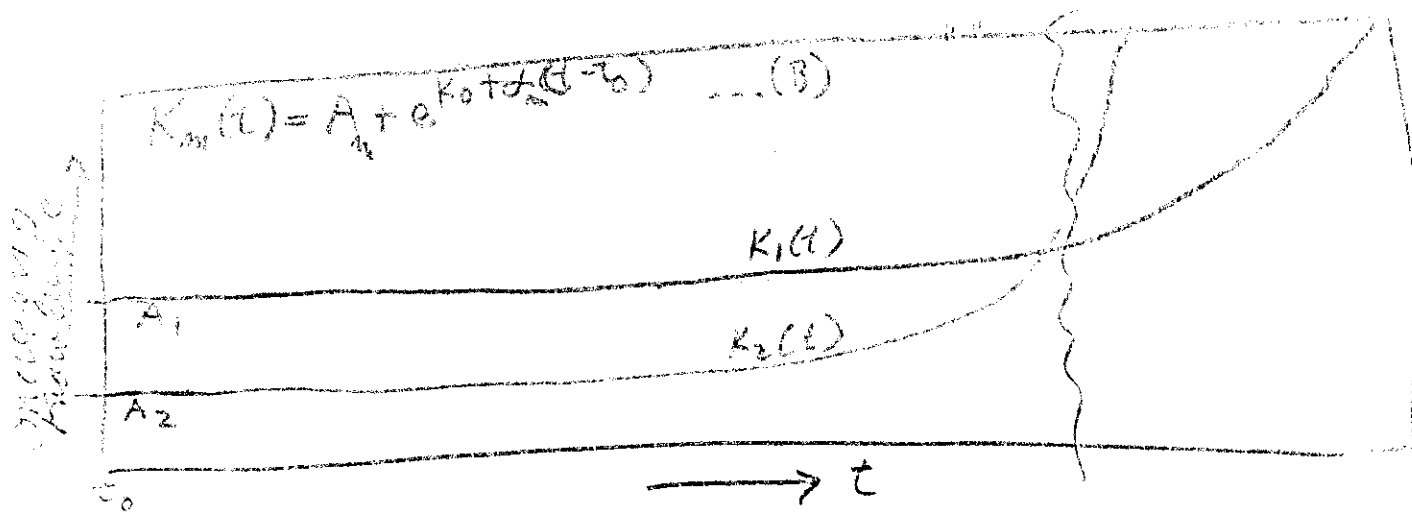


Fig. 1.

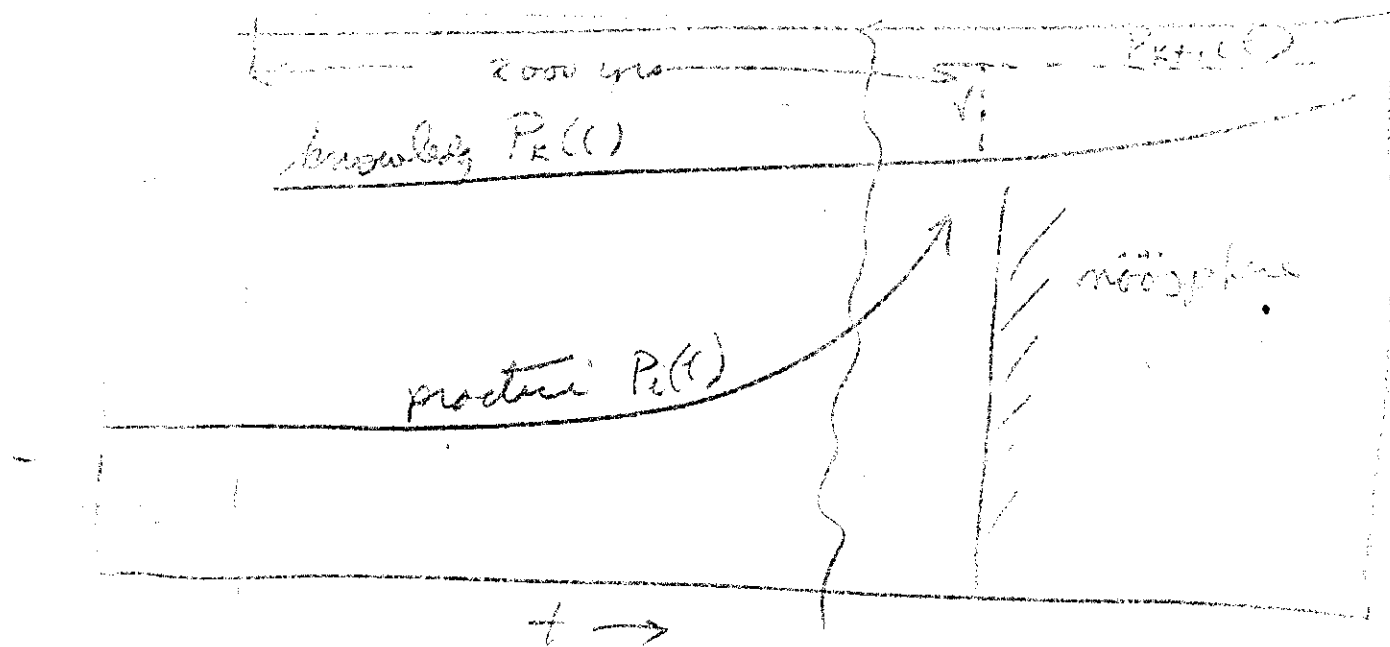
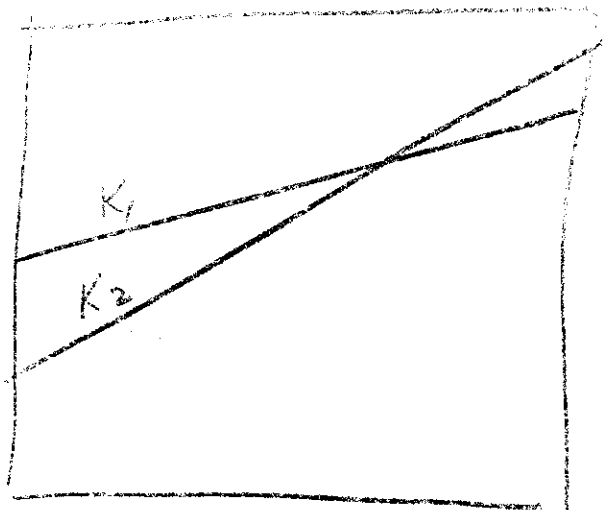
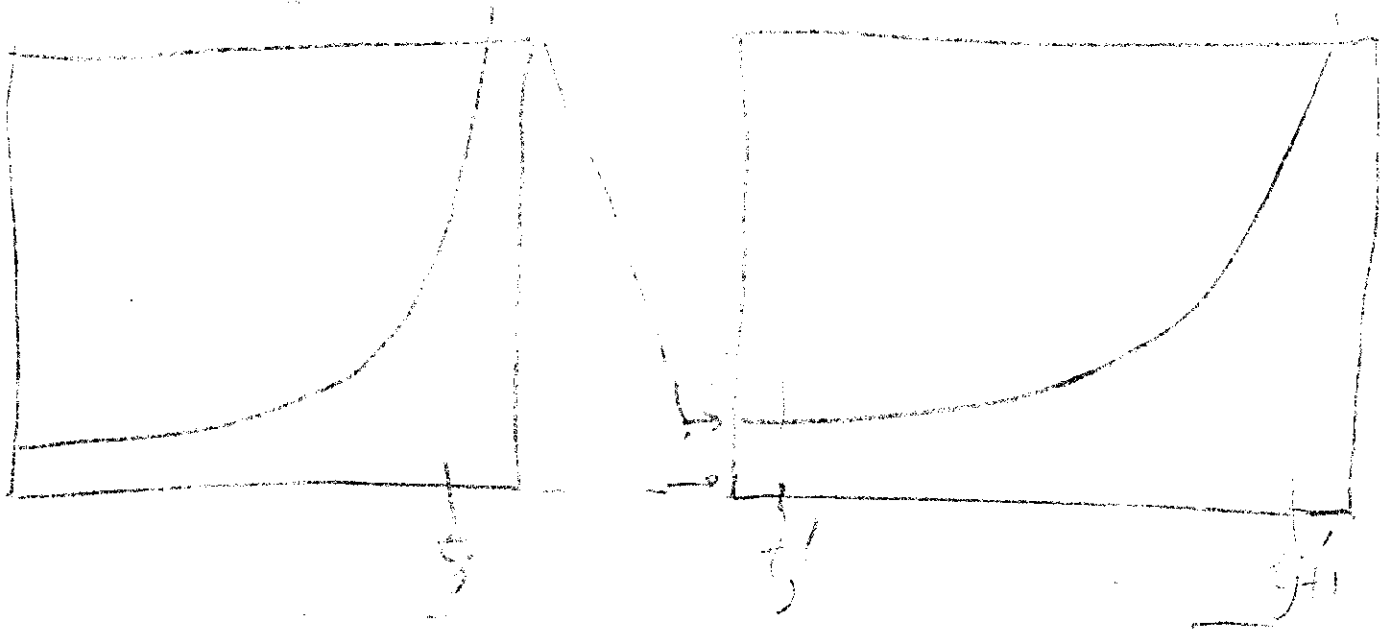


Fig. 2.



If we can study the situation and plot approximating curves as Fig. 1 we can better understand the steps needed to correct the contradictions in our own society (U.S.A.) and to give constructive criticism to other societies (such as the U.S.S.R.).

Let us consider the relationship between knowledge and practice in social phenomena, as is illustrated by the two curves in Fig. 2.

Note on changes of scale in Figs 1 and 2 could be shown more clearly by separate curves as in Fig. 3. For example the jump in Fig. 2 between $P_k(t)$ and $P_{k+1}(t)$ just before the start of the noosphere represents a discrete jump in the development of our knowledge of social phenomena. This jump is somewhat like the superposition of the old quantum theory upon classical atomic physics theory.

Examination of Högbooms curves of mineral production indicates an unbelievably steep rate of change after t_1 . A change of scale as illustrated in Fig. 3 brings the data into the range of human comprehension. Plotting on log paper gives a better basis for comparison as is shown in Fig. 4.

Here nothing is outside of science (a disputed point). If something cannot yet be tested, we set up a hypothesis that is as consistent as possible with all that is known and mark the hypothesis with a rating as to its possible reliability with a note that it is to be modified as soon as we find a way of testing or a valid process of reasoning which sheds more light on the subject.

SOCIO-ENGINEERING PROBLEMS REPORT No. 32-C

A series of manuscripts on the social relations of engineering and related philosophical questions dealing with the interaction of science and society. Distribution is limited to reviewers and discussion groups for criticism prior to consideration for possible publication.

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