The paper is a second step toward a biomathematical theory of the rates of spread of new nonconformist ideas or behaviors in a society. It is intended as a preliminary and purely theoretical study of a very oversimplified case. An equation which determines the distribution function of the tendencies toward conformist and nonconformist behaviors is set up under a number of oversimplified assumptions, and a solution by successive approximations is indicated. The expression for the first approximation is given, and an estimate of the order of magnitude of the rates of changes is made. In conclusion an outline is given for further improvement of the theory.

In a previous paper (Rashevsky, 1953) we discussed a biosocial mechanism which may account for the gradual spread of new ideas or forms of behavior through human society. In particular we discussed the gradual change of society from "arational" behavior (Rashevsky, 1951), which is based principally on an acceptance of a set of beliefs or prejudices, to a "rational" behavior, based on a critical and logical examination of any action or opinion. The gross features of development of humanity from the stage at which it was some 8,000 to 10,000 years B.C. to our days do show just such a slow shift from arational to rational behavior.

The mechanism discussed is based on a general assumption, which hardly will be doubted by any biologist; namely, we consider that the behavior of every individual is determined both by his innate tendencies, and by the educational effects of his social environment. The natural spread of the innate tendencies results in itself in a non-uniformity of behavior of a social group. A certain fraction of individuals will "naturally" behave appreciably differently from the average majority even in the absence of any social environment. This fraction of "nonconformists," however, affects the social milieu in which new-born individuals are raised, and therefore an individual of a new generation, who has the same innate tendencies as another individual of the old generation, will in general behave differently from that other individual. This results in a change of the
fraction of the nonconformists, and this in its turn results in a further change of the behavior distribution of the next generation.

We have derived (1953, p. 222) an approximate expression for the rate of change of the fraction of nonconformists for the case of two mutually exclusive behaviors (such an arational and rational). Implicit in that derivation is the assumption that the distribution function for the total tendency toward one or other of the behaviors, that is, the tendency determined by both innate and environmental factors, merely shifts toward one of the behaviors, without changing its shape. This assumption is most certainly unrealistic, and should be discarded in the next step of our investigation. Setting up the equations which govern the time course of the distribution function under most general assumptions does not present too great difficulties. The nonlinear functional equations thus attained are, however, of a kind which hardly lends itself to treatment by known mathematical methods. The study of some rather oversimplified and unrealistic cases, which are amenable to analytical treatment, is therefore indicated at this stage. The study of such purely theoretical cases will give a general orientation in this field and may lead to expressions which may be used as zero order approximations to the more realistic but also much more difficult situations. All that could be expected from such a preliminary theoretical study by way of practical application are correct orders of magnitude when plausible values of the parameters are assumed.

Let $r$ denote the difference between the central excitations $e_1$ and $e_2$, which determine the drives toward the two mutually exclusive behaviors $R_1$ and $R_2$. When an individual has the value $r = 0$, he is indifferent in the choice of $R_1$ and $R_2$. A large positive $r$ means a strong preference to $R_1$, a large negative $r$ a strong preference to $R_2$ (Rashevsky, 1951, Chaps. ii, xii; 1953).

Let the innate distribution function of $r$ among newborn individuals not yet influenced by the social environment be

$$ N_0(r) \, dr $$

with

$$ \int_{-\infty}^{+\infty} N_0(r) \, dr = 1. $$

In the total population of individuals of different ages the value of $r$ of each individual is in general determined both by innate factors and by the effect of education. Let

$$ N(r, t) $$

(3)