FRONTIERS IN GROUP DYNAMICS

Concept, Method and Reality in Social Science; Social Equilibria and Social Change

by KURT LEWIN

ONE of the byproducts of World War II of which society is hardly aware is the new stage of development which the social sciences have reached. This development indeed may prove to be as revolutionary at the atom bomb. Applying cultural anthropology to modern rather than "primitive" cultures, experimentation with groups inside and outside the laboratory, the measurement of socio-psychological aspects of large social bodies, the combination of economic, cultural, and psychological fact-finding, all of these developments started before the war. But, by providing unprecedented facilities and by demanding realistic and workable solutions to scientific problems, the war has accelerated greatly the change of social sciences to a new development level.

The scientific aspects of this development center around three objectives:

(1) Integrating social sciences.

(2) Moving from the description of social bodies to dynamic problems of changing group life.

(3) Developing new instruments and techniques of social research.

Theoretical progress has hardly kept pace with the development of techniques. It is, however, as true for the social as for the physical and biological sciences that without adequate conceptual development, science cannot proceed beyond a certain stage. It is an important step forward that the hostility to theorizing which dominated a number of social sciences ten years ago has all but vanished. It has been replaced by a relatively wide-spread recognition of the necessity for developing better concepts and higher levels of theory. The theoretical development will have to proceed rather rapidly if social science is to reach that level of practical usefulness which society needs for winning the race against the destructive capacities set free by man's use of the natural sciences.

I should like to survey certain concepts and theories which have emerged mainly from experimental research. They concern:

(*a*) Quasi-stationary social equilibria and social changes.

(*b*) Locomotion through social channels.

(*c*) Social feedback processes and social management.

The last two of these will be dealt with in a later article. A cursory introductory discussion of certain aspects of the present state of affairs in social science is included here for those readers who are interested in the general background of these concepts and in the problems from which they have sprung.

A. CONCEPT, METHOD, AND REALITY IN SOCIAL SCIENCE.

1. Developmental Stages of Sciences

For planning and executing research a clear insight into the present stage of scientific development is needed. Research means taking the next step from the known into the jungle of the unknown. To choose scientifically significant objectives and procedures it does not suffice to be acquainted with the factual knowledge available at a given stage. It is also necessary to free oneself from the scientific prejudices typical of a given developmental stage.

To gain sufficient distance from scientific details and to gain proper perspective for determining next steps the scientist may avail himself of the findings of "comparative theory of science." This discipline deals with the developmental stages of sciences, with their differences and equalities, and can sometimes provide useful yardsticks or way-posts to the empirical scientist.

The types of obstacles which have to be overcome when proceeding to a next scientific step are frequently quite different from what one may expect. Looking backwards it is often hard to understand how anyone could have been influenced by those arguments which have delayed scientific progress for considerable time.

Ernst Cassirer, who has analyzed the developmental stages of the natural sciences, and who had a great gift of viewing logical problems as they appear to the person doing research, points out that scientific progress has frequently the form of a change in what is considered to be "real" or "existing" (7).

2. The Problem of Existence in an Empirical Science

Arguments about "existence" may seem metaphysical in nature and may therefore not be expected to be brought up in empirical sciences. Actually, opinions about existence or non-existence are quite common in the empirical sciences and have greatly influenced scientific development in a positive and a negative way. Labeling something as "non-existing" is equivalent to declaring it "out of bounds" for the scientist. Attributing "existence" to an item automatically makes it a duty of the scientist to consider this item as an object of research; it includes the necessity of considering

its properties as " facts " which cannot be neglected in the total system of theories; finally, it implies that the terms with which one refers to the item are accepted as scientific " concepts " (rather than as " mere words ").

Beliefs regarding " existence " in social science have changed in regard to the degree to which " full reality " is attributed to psychological and social phenomena, and in regard to the reality of their " deeper," dynamic properties.

In the beginning of this century, for instance, the experimental psychology of " will and emotion " had to fight for recognition against a prevalent attitude which placed volition, emotion, and sentiments in the " poetic realm " of beautiful words, a realm to which nothing corresponds which could be regarded as " existing " in the sense of the scientist. Although every psychologist had to deal with these facts realistically in his private life, they were banned from the realm of " facts " in the scientific sense. Emotions were declared to be something too " fluid " and " intangible " to be pinned down by scientific analysis or by experimental procedures. Such a methodological argument does not deny existence to the phenomenon but it has the same effect of keeping the topic outside the realm of empirical science.

Like social taboos, a scientific taboo is kept up not so much by a rational argument as by a common attitude among scientists: any member of the scientific guild who does not strictly adhere to the taboo is looked upon as queer; he is suspected of not adhering to the scientific standards of critical thinking.

3. The Reality of Social Phenomena

Before the invention of the atom bomb the average physical scientist was hardly ready to concede to social phenomena the same degree of "reality" as to a physical object. Hiroshima and Nagasaki seem to have made many physical scientists ready to consider social facts as being perhaps of equal reality. This change of mind was hardly based on philosophical considerations. The bomb has driven home with dramatic intensity the degree to which social happenings are both the result of, and the conditions for the occurrence of, physical events. Gradually, the period is coming to an end when the natural scientist thinks of the social scientist as someone interested in dreams and words, rather than as an investigator of facts, which are not less real than physical facts, and which can be studied no less objectively.

The social scientists themselves, of course, have had a stronger belief in the " reality " of the entities they were studying. Still, this belief was frequently limited to the specific narrow section with which they happened to be familiar. The economist, for instance, finds it a bit difficult to concede to psychological, to anthropological, or to legal data that degree of reality which he gives to prices and other economic data. Some psychologists still view with suspicion the reality of those cultural facts with which the anthropologist is concerned. They tend to regard only individuals as real and they are not inclined to consider a " group atmosphere " as something which is as real and measurable as, let us say, a physical field of gravity. Concepts like that of " leadership " retained a halo of mysticism even after it had been demonstrated that it is quite possible to measure, and not only to " judge," leadership performance.

The denial of existence of a group, or of certain aspects of group life, is based on arguments which grant existence only to units of certain size, or which concern methodologic-technical problems, or conceptual problems.

4. Reality and Dynamic Wholes

Cassirer (7) discusses how, periodically throughout the history of physics, vivid discussions have occurred about the reality of the atom, the electron, or whatever else was considered at that time to be the smallest part of physical material. In the social sciences it has usually been not the part but the whole, whose existence has been doubted.

Logically, there is no reason to distinguish between the reality of a molecule, an atom, or an ion, or more generally between the reality of a whole or its parts. There is no more magic behind the fact that groups have properties of their own, which are different from the properties of their subgroups or their individual members, than behind the fact that molecules have properties, which are different from the properties of the atoms or ions of which they are composed.

In the social as in the physical field the structural properties of a dynamic whole are different from the structural properties of subparts. Both sets of properties have to be investigated. When one, and when the other, is important, depends upon the question to be answered. But there is no difference of reality between them.

If this basic statement is accepted, the problem of existence of a group loses its metaphysical flavor. Instead we face a series of empirical problems. They are equivalent to the chemical question whether a given aggregate is a mixture of different types of atoms, or whether these atoms have formed molecules of a certain type. The answer to such a question has to be given in chemistry, as in the social sciences, on the basis of an empirical probing into certain testable properties of the case in hand.

For instance, it may be wrong to state that the blond women living in a town " exist as a group," in the sense of being a dynamic whole which is characterized by a close interdependence of their members. They are merely a number of individuals who are " classified under one concept " according to the similarity of one of their properties. If, however, the blond members of a workshop are made an " artificial minority " and are discriminated against by their colleagues they may well become a group with specific structural properties.

Structural properties are characterized by *relations* between parts rather than by the parts or elements themselves. Cassirer emphasizes that throughout the history of mathematics and physics problems of constancy of relations rather than of constancy of elements have gained importance and have gradually changed the picture of what is essential. The social sciences seem to show a very similar development.

5. Reality and Methods. Recording and Experimentation

If recognition of the existence of an entity depends upon this entity's showing properties or constancies of its own, the judgment about what is real or unreal should be affected by changes in the possibility of demonstrating social properties.

The social sciences have considerably improved techniques for reliably recording the structure of small or large groups and of registering the various aspects of group life. Sociometric techniques, group observation, interview techniques, and others are enabling us more and more to gather reliable data on the structural properties of groups, on the relations between groups or subgroups, and on the relation between a group and the life of its individual members.

The taboo against believing in the existence of a social entity is probably most effectively broken by handling this entity experimentally. As long as the scientist merely describes a leadership form he is open to the criticism that the categories used reflect merely his " subjective views " and do not correspond to the " real " properties of the phenomena under consideration. If the scientist experiments with leadership and varies its form, he relies on an " operational definition " which links the concept of a leadership form to concrete procedures of creating such a leadership form or to the procedures for testing its existence. The " reality " of that to which the concept refers is established by " doing something with " rather than " looking at," and this reality is independent of certain " subjective " elements of classification. The progress of physics from Archimedes to Einstein shows consecutive steps by which this " practical " aspect of the experimental procedure has modified and sometimes revolutionized the scientific concepts regarding the physical world by changing the beliefs of the scientists about what is and is not real (7).

To vary a social phenomenon experimentally the experimenter has to take hold of all essential factors even if he is not yet able to analyze them satisfactorily. A major omission or misjudgment on this point makes the experiment fail. In social research the experimenter has to take into consideration such factors as the personality of individual members, the group structure, ideology and cultural values, and economic factors. Group experimentation is a form of social management. To be successful it, like social management, has to take into account all of the various factors that happen to be important for the case in hand. Experimentation with groups will therefore lead to a natural integration of the social sciences, and it will force the social scientist to recognize as reality the totality of factors which determine group life.

6. Social Reality and Concepts

It seems that the social scientist has a better chance of accomplishing such a realistic integration than the social practitioner. For thousands of years kings, priests, politicians, educators, producers, fathers and mothers—in fact, all individuals, have been trying day by day to influence smaller or larger groups. One might assume that this would have led to accumulated wisdom of a well integrated nature. Unfortunately nothing is farther from the truth. We know that our average diplomat thinks in very one-sided terms, perhaps those of law, or economics, or military strategy. We know that the average manufacturer holds highly distorted views about what makes a work-team "tick." We know that no one can answer today even such relatively simple questions as what determines the productivity of a committee meeting.

Several factors have come together to prevent practical experience from leading to clear insight (17). Certainly, the man of affairs is convinced of the reality of group life, but he is usually opposed to a conceptual analysis. He prefers to think in terms of " intuition " and " intangibles." The able practitioner frequently insists that it is impossible to formulate simple, clear rules about how to reach a social objective. He insists that different actions have to be taken according to the various situations, that plans have to be highly flexible and sensitive to the changing scene.

If one tries to transform these sentiments into scientific language, they amount to the following statements: (a) Social events depend on the social

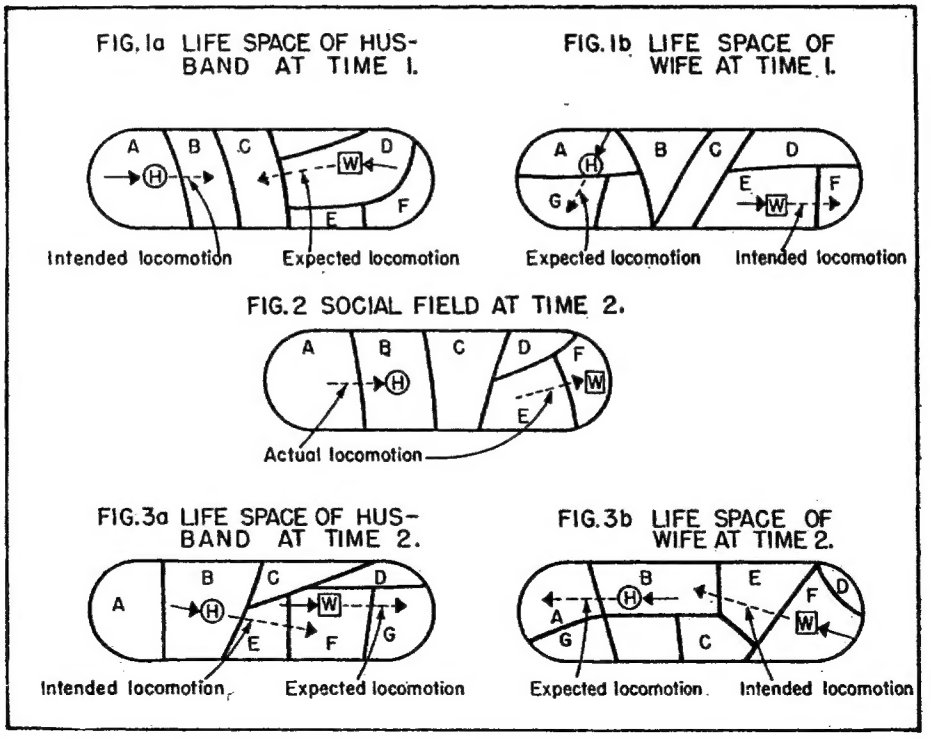
field as a whole, rather than on a few selected items. This is the basic insight behind the field theoretical method which has been successful in physics, which has steadily grown in psychology and, in my opinion, is bound to be equally fundamental for the study of social fields, simply because it expresses certain basis general characteristics of interdependence. (b) The denial of " simple rules " is partly identical with the following important principle of scientific analysis. Science tries to link certain observable (phenotypical) data with other observable data. It is crucial for all problems of interdependence, however, that—for reasons which we do not need to discuss here—it is, as a rule, impracticable to link one set of phenotypical data *directly* to other phenotypical data. Instead it is necessary to insert " intervening variables " (29). To use a more common language: the practitioner as well as the scientist views the observable data as mere " symptoms." They are " surface " indications of some " deeper-lying " facts. He has learned to " read " the symptoms, like a physicist reads his instruments. The equations which express physical laws refer to such deeper-lying dynamic entities as pressure, energy, or temperature rather than to the directly observable symptoms such as the movements of the pointer of an instrument (7).

The dynamics of social events provides no exception to this general characteristic of dynamics. If it were possible to link a directly observable group behavior, B, with another behavior, B^1,—$B=F(B^1)$ where F means a simple function—then simple rules of procedure for the social practioner would be possible. When the practitioner denies that such rules can be more than poor approximations he seems to imply that the function, F, is complicated. I am inclined to interpret his statement actually to mean that in group life, too, " appearance " should be distinguished from the " underlying facts," that similarity of appearance may go together with dissimilarity of the essential properties, and *vice-versa*, and that laws can be formulated only in regard to these underlying dynamic entities: $k = F(n, m)$ where k, n, m refer not to behavioral symptoms but to intervening variables (13).

For the social scientist this means that he should give up thinking about such items as group structure, group tension, or social forces as nothing more than a popular metaphor or analogy which should be eliminated from science as much as possible. While there is no need for social science to copy the specific concepts of the sciences, the social scientist should be clear that he, too, needs intervening variables, and that these dynamic facts rather than the symptoms and appearances, are the important points of reference alike for him and for the social practitioner.

7. " Subjective " and " Objective " Elements in the Social Field. The Three Step Procedure

One last point concerning conceptualization and general methodology may be mentioned. To predict the course of a marriage, for instance, a psychologist might proceed in the following way. He might start by analyzing the life space of the husband H. This analysis would involve the relevant physical and social facts in the husband's surroundings, including the expectations and character of his wife W, all represented in the way the husband, H, perceives them. Let us assume that this analysis is sufficiently complete to permit the derivation of the resultant forces on the husband (Fig. 1a). This would be equivalent to a prediction of what the husband



actually will do as his next step. The data about the life space of the husband might be sufficiently elaborate to determine the resultant force on the wife W, as he sees her (Fig. 1a). This resultant force, however, would not indicate what the wife will actually do but merely what the husband expects his wife to do.

To derive the next conduct of the wife, her life space would have to be analyzed (Fig. 1b). Usually the wife will see the situation, including herself (W), and her husband, (H), somewhat differently than her husband. Let us assume she sees her husband located in an area corresponding to his own perception of himself; that she perceives her own position, however, as being in region e rather than d; and that the cognitive structure of the intermediate regions b and c are for her too, somewhat different from what they are for her husband. Corresponding to this difference between the life spaces of the husband and wife, the resultant force on the wife (W) may point to the region f rather than to c. This means that the wife will actually move forward f rather than toward c as her husband expected.

The considerations thus far give the basis for predicting the next moves of husband and wife to the region b and f respectively (Fig. 2): analyzing the two psychological (" subjective ") fields gives the basis for predicting the actual (" objective ") next step of behavior.

But how do we proceed from here if we are to answer the social problem of the fate of the marriage? Neither husband nor wife had expected their partner to behave as he or she actually did. Obviously, the next step will depend largely on how each will react to this surprise, how each will interpret the conduct of the other, or, more generally speaking, how each will " perceive " the new situation.

The husband who has expected his wife to move from d to c and now sees her moving in the opposite direction, to f, may interpret this to mean that his wife has " changed her mind." In this case he may expect her next move to proceed in the same direction, namely toward g (Fig. 3a). Furthermore, the behavior of his wife is likely to change for him the " meaning " of c, that is, the cognitive structure of the situation. The wife who sees her husband move to b rather than g may perceive this to be an excursion to an activity which would be completed in a certain time after which he would return to a (Fig. 3b). She therefore decides to join her husband in b (Fig. 3b), whereas her husband, having a different perception of the situation (Fig. 3a), intends to move on to f, which he perceives as being closer to his wife.

Obviously, husband and wife will soon be in trouble if they do not " talk things over," that is, if they do not communicate to each other the structure of their life spaces with the object of equalizing them.

This analysis of the history of a marriage has proceeded in a series of three steps: first, a separate analysis of the psychological situation of the husband and that of the wife, at time 1 with the purpose of deriving the next behavior of each. Second, representing the resultant sociological (" objective ") situation at time 2. Third, deriving with the help of the laws of perception the resultant psychological situation for husband and wife at time 2. This would give the basis for the next sequence of three steps, starting with the analysis of the psychological situation of the persons involved predict their actual next step.

Such a procedure looks involved, particularly if we consider groups composed of many members. Is it possible to eliminate the " objective," or the " subjective," aspect of this analysis? Actually, social science faces here two types of question; one concerning the size of units, the other concerning the role of perception in group life. It would be prohibitive if the analysis of group life always had to include analysis of the life space of each individual member.

Analysis of group life, can proceed rather far on the basis of relatively larger units. In the end, of course, the theory of small and large units has to be viewed in social science as well as in physical science, as one theoretical system. But this stage can be reached only after an attack on both the larger and the smaller units.

Unfortunately, treating groups as units does not eliminate the dilemma between " subjective " and " objective " aspects of social fields. It seems to be impossible to predict group behavior without taking into account group goals, group standards, group values, and the way a group " sees " its own situation and that of other groups. Group conflicts would have quite different solutions if the various groups concerned did not perceive differently the situation existing at a given time. To predict or to understand the steps leading to war between two nations A and B it seems to be essential to refer to the group life space of A and to the different group life space of B. This means that the analysis of group interaction has again to follow a three-step procedure, moving from the separate analysis of the life space of each group to the group conduct in the total social field and from there back again to the effect on the group life space.

This procedure of analysis which swings from an analysis of " perception " to that of " action," from the " subjective " to the " objective," and

back again is not an arbitrary demand of scientific methodology, nor is it limited to the interaction between groups or between individuals. The procedure mirrors one of the basic properties of group life. Any kind of group action or individual action, even including that of the insane, is regulated by circular causal processes of the following type: individual perception or " fact-finding "—for instance, an act of accounting—is linked with individual action or group action in such a way that the content of the perception or fact-finding depends upon the way in which the situation is changed by action. The result of the fact-finding in turn influences or steers action.

Certain schools in psychology, sociology, and economics have had the tendency to eliminate the problems of perception. The analysis of all social sciences, however, will have to take into account both sections of this circular process. The following discussion of the mathematical representation of social problems should not be misunderstood as trying to minimize the importance of cognitive processes in group life. It is rather based on the conviction that topological and vector psychology has demonstrated the possibility of including them in such a treatment.

B. QUASI-STATIONARY EQUILIBRIA IN GROUP LIFE AND THE PROBLEM OF SOCIAL CHANGE.

Periods of social change may differ quite markedly from periods of relative social stability. Still, the conditions of these two states of affairs should be analyzed together for two reasons: (a) Change and constancy are relative concepts; group life is never without change, merely differences in the amount and type of change exist; (b) Any formula which states the conditions for change implies the conditions for no-change as limit, and the conditions of constancy can be analyzed only against a background of " potential " change.

1. Constancy and Resistance to Change

It is important to distinguish two questions which are generally not sufficiently separated; the one concerns actual change or lack of change, the other concerns resistance to change. A given group may show little change during a period of, let us say, two weeks. The group may be composed of friends on an island in the middle of their vacation, or a work-team in a factory. Let us assume that the conditions under which this group lives happen to stay constant during this period: no individual leaves or joins the group, no major friction occurs, the facilities for activities or work remain the same, etc. Under these circumstances the constancy of group life, for instance, the unchanged level of production does not require any other " explanation " than the reference to the principle: the same conditions lead to the same effect. This principle is identical with the general idea of lawfulness of group life.

The case would be different if the production level of the work-team were maintained in spite of the fact that a member of the work-team took sick or that inferior or superior material was provided. If, in spite of such changes in the group life setting, production is kept at the same level, then can one speak of " resistance " to change of the rate of production. The mere constancy of group conduct does not prove stability in the sense of resistance to change, nor does much

change prove little resistance. Only by relating the actual degree of constancy to the strength of forces toward or away from the present state of affairs can one speak of degrees of resistance or " stability " of group life in a given respect.

The practical task of social management, as well as the scientific task of understanding the dynamics of group life, require insight into the desire for and resistance to, specific change. To solve or even to formulate these questions adequately we need a system of analysis which permits the representation of social forces in a group setting. The following considerations are directed more toward the improvement of these analytical tools than toward the analysis of a particular case.

2. Social Fields and Phase Spaces

A basic tool for the analysis of group life is the representation of the group and its setting as a " social field." This means that the social happening is viewed as occurring in, and being the result of, a totality of coexisting social entities, such as groups, subgroups, members, barriers, channels of communication, etc. One of the fundamental characteristics of this field is the relative position of the entities, which are parts of the field. This relative position represents the structure of the group and its ecological setting. It expresses also the basic possibilities of locomotion within the field.

What happens within such a field depends upon the distribution of forces throughout the field. A prediction presupposes the ability to determine for the various points of the field the strength and directions of the resultant forces.

According to general field theory the solution of a problem of group life has always to be finally based on an analytical procedure of this type. Only by considering the groups in question in their actual setting, can we be sure that none of the essential possible conduct has been overlooked.

Certain aspects of social problems, however, can be answered through a different analytical device called " *phase space*." The phase space is a system of coordinates, each corresponding to different amounts of intensities of one " property." The phase space does not intend to represent the layout of a field composed of groups, individuals and their ecological setting, but concentrates on one or a few factors. It represents by way of graphs or equations, the quantitative relation between these few properties, variables or aspects of the field, or of an event in it.

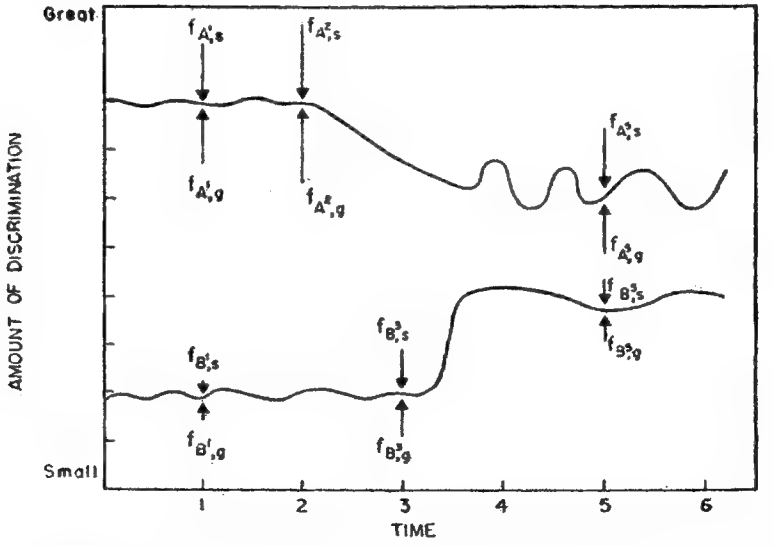
For the discussion of the conditions of change we make use of such a phase space, realizing that one has finally to refer back to the actual social field.

3. Social States as Quasi-Stationary Processes

It is possible to represent the change in discrimination against Negroes in towns A and B by means of a curve in a diagram where the ordinate represents degrees of discrimination and the abscissa time (Fig. 4). In this way the level of discrimination in the two towns can be represented (A is more discriminatory than B), the direction and rapidity of change (gradual decrease in A between the time 2 and 3, sudden increase in B at time 3), the amount of fluctuation (in the period 4—6, A shows relatively much, B relatively little fluctuation).

By " degree of discrimination " we are obviously not referring to the quality of a static object but to the quality of a process, namely the interaction between two populations. Discrimination refers to a number of refusals and permissions, orderings and yieldings, which indicate open and

FIG. 4 LEVEL OF EQUILIBRIUM AND STRENGTH OF OPPOSING FORCES



closed possibilities for various individuals in their daily living.

Similarly when speaking of the production level of a work-team one refers to the " flow " of products. In both cases we are dealing with a process which, like a river, continuously changes its elements even if its velocity and direction remain the same. In other words, we refer to the characteristic of quasi-stationary processes. The importance of quasi-stationary equilibria for the psychological problems of individual life has been emphasized by Köehler (10).

In regard to quasi-stationary processes one has to distinguish two questions: (1) Why does the process under the present circumstances proceed on this particular level (for instance, why does the water in this river move with this particular velocity)? and (2) What are the conditions for changing the present circumstances?

4. A General Analytic Treatment of Quasi-Stationary Social Equilibria

Concerning the relation between the character of the process and the present conditions certain analytic statements of a rather general nature can be made.

Frequently, analytic conceptual tools (intervening variables) must be developed to a relatively elaborate stage before they are ready to be linked to observable facts. In the beginning it seems to be easier to make empirical use of secondary derivations; only gradually is one able to design experiments to test the fundamentals more directly. The concept of " force," for instance, is more fundamental than the concept " resultant of forces." It is, however, easier in psychology and sociology to coordinate an observable fact to a resultant of forces than to the components: certain aspects of behavior can be directly related to the resultant force (14), whereas we are able at present to determine psychological component forces only under special conditions (6). We have thought it advisable, therefore, to develop in some detail the conceptual analysis before discussing examples and specific testable theories.

(a) The Level of a Quasi-Stationary Process as a Quasi-Stationary Equilibrium

In the case of discrimination, for instance, certain social forces drive toward more discrimination. The interest of certain sections of the white population to keep certain jobs for themselves is such a force; other forces correspond to ideals of the white and colored population about what is "proper" or "not proper" work, etc. Other forces act against greater discrimination: the colored population may show signs of rebellion against higher degrees of discrimination, the white may consider "too much" discrimination unfair, etc. If we indicate the forces toward greater discrimination in the community A by $f_{A,g}$ and the forces toward less discrimination by $f_{A,s}$ we may state that $f_{A,g}$ and $f_{A,s}$ are equal in strength and opposite in direction*

(1) $f_{A,g} + f_{A,s} = 0$

This equation does not determine the absolute strength of the forces. The strength of the opposing forces at the time 1 in town A may be smaller or greater than in town B $|f_{A,g}| > |f_{B,g},|$ (Fig. 4). The strength of the opposing forces may increase without a change of the level. For instance, before the level of discrimination decreased in A the opposing forces may have increased:

$|f_{A,s}|^2 = |f_{A,g}|^2 > |f_{A,s}|^1 = |f_{A,g}|^1$.

This would imply that *group tension* has increased. A similar increase of the opposing forces may have occurred in town B at the time 3 prior to the increase in discrimination:

$|f_{B,s}|^3 = |f_{B,g}|^3 > |f_{B,s}|^1 = |f_{B,g}|^1$.

Social changes may or may not be preceded by an increase in the opposing forces. Under some conditions, however, social changes can be achieved much easier if the tension is previously decreased. This is important for social management and for the theory of the after effect of changes.

After the discrimination in the town A has decreased the tension may gradually decrease so that

$|f_{A,s}|^5 < |f_{A,s}|^3$.

In some cases, however, tension may increase: the decrease of discrimination may lead to a still stronger pressure of the suppressed toward further advances and to an increased counter-pressure. After a change to a higher level of discrimination the opposing forces may decrease again or may remain permanently stronger.

On the whole, then, we can say that a quasi-stationary social state corresponds to equally strong opposing forces but that no general statement concerning their absolute strength is possible.

(b) Force Fields

Quasi-stationary processes are not perfectly constant but show fluctuations around an average level L. If we assume the fluctuation to be due to the variation in the strength of an additional force and the amount n of the change

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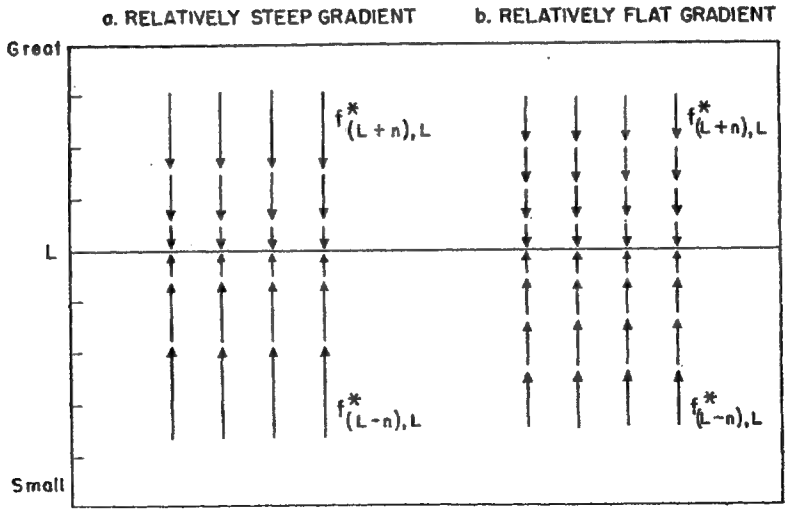
* The notation of forces follows on the whole the notation I have used for psychological problems (14). $f_{P,g}$ means a force acting on the person P in the direction toward g. $f_{P,-g}$ indicates a force on P in the direction away from g. $rf_{\overline{P,g}}$ is a restraining force against P's moving toward g. $f^*_{P,g}$ means a resultant force which has the direction toward g. The strength of the force $f_{P,g}$ is indicated by $|f_{P,g}|$.

If not the individual P but a group Gr is viewed as the point of application of the force, a force toward g is indicated as $f_{Gr,g}$ away from g as $f_{Gr,-g}$. To refer to forces acting on different groups A or group B, or on the same group in different positions A and B, we will use the notation $f_{Gr,A,g}$ and $f_{Gr,B,g}$, or the shorter notation $f_{A,g}$ and $f_{B,g}$. The reader should keep in mind, however, that if we say that a force $f_{A,g}$ exists at a position (or a level) A we mean that a force is acting on a group in the position A or that it would act on the group if the group were in that position. The concept of force field refers to such potential positions.

A force toward g existing at a given time, n, at a place, A, may be notated as $(f_{A,g})$.

FIG. 5 GRADIENTS OF RESULTANT FORCES (f^*)



of the level L to be a function of the strength of this force, we can state that a force field in the area of fluctuation around L exists which has the following characteristics: the opposing forces on all levels between L and (L+n) and between L and (L—n) are unequal with the stronger force pointing toward the level L.

(2) $|f_{(L+n),L}| > |f_{(L+n),-L}|$;
$|f_{(L-n),L}| > |f_{(L-n),-L}|$

The meaning of this statement becomes clearer if we consider the resultant force $f^*_{L,x}$ where $f^*_{L,x} = f_{L,s} + f_{L,g}$. In case of a quasi-stationary process the resultant force on the level L equals zero (Fig. 5).

(3) $f^*_{L,x} = 0$

The direction of the resultant forces at the " neighboring levels " ($L \pm n$) is *toward* level L, their strength increasing with the distance from L. In other words, the resultant forces in the neighborhood of L have the character of a " positive central force field " (14).[1]

(4) $f^*_{(L \pm n),L=F(n)}$

The character of the function F determines how far, *ceteris paribus*, the social process fluctuates in a specific case.

Changes of the level of quasi-stationary processes will occur if and only if the numerical value of L changes for which the opposing forces are equal. If the resultant force field loses the structure of a central field, the social process loses its quasi-stationary character.

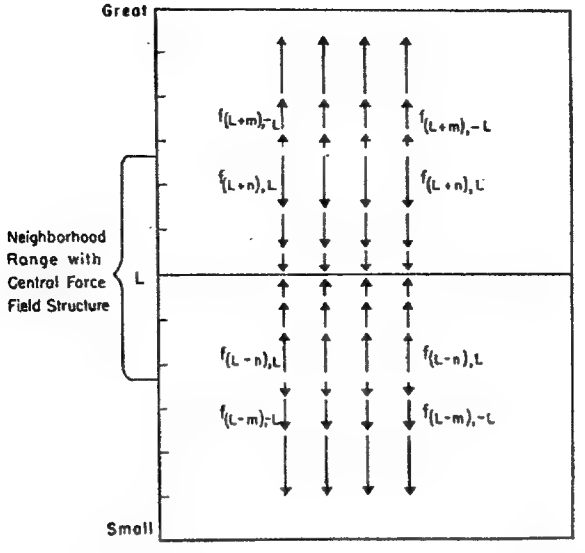
(c) Force Field Within and Beyond the Neighborhood Range

It is important to realize that a quasi-stationary process presupposes a central structure of the force field only within a certain neighborhood area of L. The statement (4) does not need to hold for n above or below a certain

1. A positive central force field is defined as a constellation of forces directed toward one region. In a phase space where one dimension is time, one may use this term for a constellation where all forces are directed toward one level.

value. In other words, within a certain range stronger forces are necessary to change the level to a larger extent and a weakening of these forces will lead to a return of the process toward the previous level. If, however, the change has once gone beyond this range n to a level (L±m), the process might show the tendency to move on and not to return to the previous level. This seems to be typical for revolutions after they have once overcome the initial resistance. In regard to the force field, this means that beyond the " neighborhood range " of L the resultant forces are directed away rather than toward L (Fig. 6).

FIG. 6 LIMITS OF NEIGHBORHOOD RANGE, SHOWING OPPOSITE GRADIENTS OUTSIDE NEIGHBORHOOD RANGE



It is obvious that for most problems of management the width of the range in which the process has the character of a stationary equilibrium is of prime importance. This is equally fundamental for the prevention of major managerial catastrophes and for bringing about a desired permanent change.

(d) The Effect of Various Gradients

Before referring to empirical examples let us mention certain additional analytic conclusions. Statement (4) characterizes the structure of the neighboring force field but its gradient is not yet characterized. It might be more or less steep (Fig. 5a and b). The gradient can be different above and below L.

(5) Given the same amount of change of the strength of the resultant force ($f^*_{L,x}$), the amount of change of the level of social process will be the smaller, the steeper the gradient.

This holds for permanent changes of L as well as for periodical fluctuations

We have thus far referred to the conduct of the group as a whole. If we consider individual differences within a group we may state:

(6) *Ceteris peribus*, individual differences of conduct in a group will be smaller the steeper the gradient of the resultant force field in the neighborhood of the group level.

Situations of different degrees of permissiveness can be viewed as examples of different steepnesses of the gradient affecting the individuals within a group. The greater range of activities permitted by the democratic leader in the experiment of Lippitt and White (22) was paralleled by greater differences of conduct among the individuals in regard to such items as suggestions to leader, out-of-club-field conversation, and attention demands to companions.

It would be important to relate quantitatively the ease of change of the

group level as a whole to the individual differences within the group, although we do not expect to find this relation to be simple.

C. EXAMPLES OF QUASI-STATIONARY EQUILIBRIUM IN DIFFERENT AREAS OF GROUP LIFE.

The following examples are not intended to prove the correctness of a theory for the given case. They are intended mainly to illustrate principles and to prepare the way for the quantitative measurement of social forces. In regard to the specific case they represent hypotheses which have to be tested experimentally.

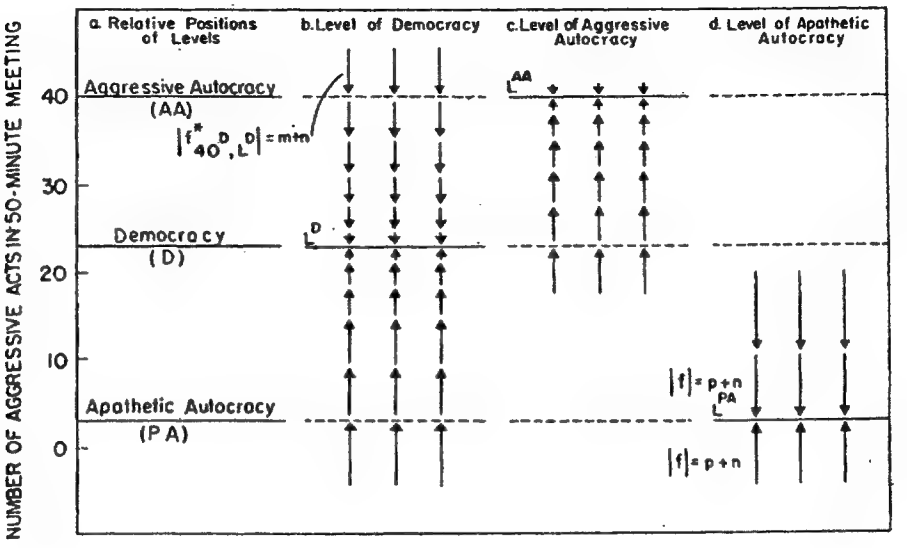
In the absence of sufficient data on group experiments to illustrate the various analytical principles which should be discussed we have taken the liberty of using somewhat indiscriminately data concerning groups, populations that do not happen to be groups, and individuals.

1. Level of Aggressiveness in Democratic and Autocratic Atmospheres

Lippitt (21) and Lippitt and White (23) have compared the amount of intermember aggression of the same groups of boys in democratic and autocratic atmospheres. Since the personalities and types of activities were kept constant, the change can be attributed to the different social climate or form of leadership. They found that the group average of intermember aggressiveness in autocracy is either very high or very low; in democracy it is on a more medium level (Fig. 7).

Let us assume that each of these levels of aggressiveness is a quasi-stationary equilibrium, and ask which forces tend to raise and which to lower the level. One factor is the type of activity: a wild game gives more chance for clashes than quiet work; a certain amount of fighting might be fun for

FIG. 7 FORCE FIELDS AT THE AGGRESSIVENESS LEVELS FOR AGGRESSIVE AUTOCRACY, DEMOCRACY, AND APATHETIC AUTOCRACY



boys. Forces against intergroup aggression might be: friendship between members; the presence of an adult leader; the dignified character of the setting.

The actual conduct indicates that in the democratic atmosphere these conflicting forces lead to an equilibrium ($f^*_{L^D,x}=0$) for $L^D=23$. This implies a resultant force field of the chracter indicated in Fig. 7b.

If we use the force field in the democratic atmosphere as our base for comparison, the higher level of aggressiveness in aggressive autocratic (AAGr) ($L^{AA}=40$) could be explained by an increase in the strength of forces toward more aggression or by a diminishing of the forces toward less aggression. Actually both forces seem to have been altered in autocracy: the style of leadership and the irritation due to the restriction of the space of free movement increases the force toward aggressiveness

($|f_{AAGr,g}| > |f_{DGr,g}|$);

Lippitt found that the we-feeling which tends to decrease intermember aggression is diminished in autocracy

($|f_{AAGr,s}| < |f_{DGr,s}|$).

This would suffice to explain why the level of aggression increases in autocracy ($L^D<L^{AA}$). If there were no other changes involved, we could even derive a statement concerning the gradient of the force field in the democratic situation: if the increase of the force $f_{Gr,g}$ equals m and the decrease of the force $f_{Gr,s}$ equals n, the strength of the resultant force at level 40 would be $|f^*_{40^D,L^D}| = m+n$.

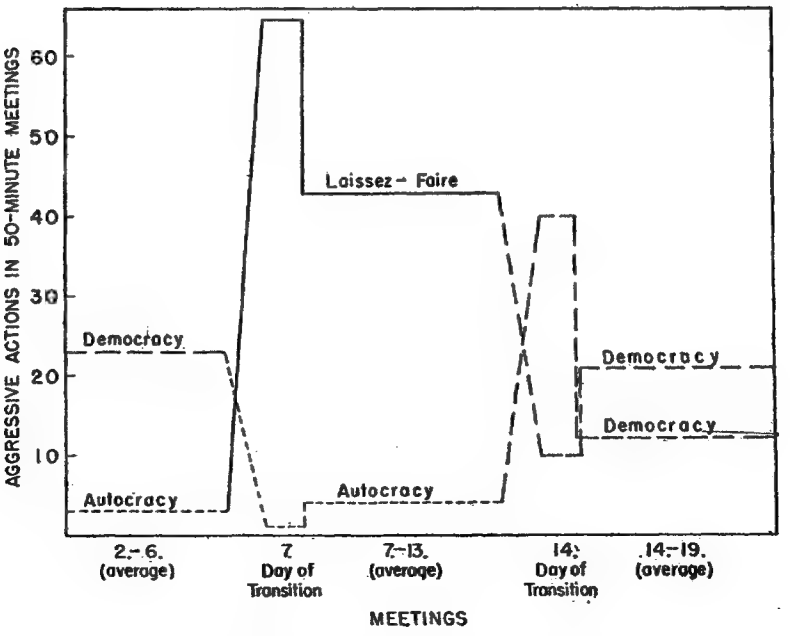
How then can aggressiveness in apathetic autocracy (PA) be low ($L^{PA}=3$)? Lippitt and White (23) found the we-feeling to be low in both types of autocracy; it is unlikely that the irritating effect of the frustrating autocratic leadership should not exist. We are inclined rather to assume that the autocratic leadership form implies an additional force ($f_{Gr,c}$) which corresponds to the higher degree of authoritarian control and which in these situations has the direction against open aggression.

As a rule we can assume that this force is rather strong and is considerably greater than m+n ($f_{PAGr,c}= p > (m+n)$). This autocratic control would keep open aggression very low in spite of the greater force toward aggressions. Only if this control were, out of one reason or other, sufficiently weakened so that $|f_{Gr,c}| < (m+n)$ would the increased tendency toward aggression come into the open.

From this theory one could conclude: Although the resultant force on the level L^{PA} of apathetic autocracy is of course again zero ($f^*_{L^{PA},x}=O$) the opposing components which make up the resultant forces are greater than in the case of democracy. The strength of this additional component is—compared with that in the democratic situation—*ceteris paribus* equal to the pressure of the autocratic control plus the force due to the difference in we-feeling ($|f|=p+n$). In other words we would expect a *high degree of inner tension existing in apathetic autocracy in spite of its appearance of quietness and order.* This additional tension would correspond to opposing forces of the strength $|f|=p+n$ (Fig. 7d).

Since an autocratic atmosphere is less permissive than the democratic atmosphere one may wonder how a high level of in-group aggression can occur in autocracy. The answer lies in the fact that the restrictive character of autocracy has two contradictory effects: (a) it leads to frustration of the group members and therefore to an increase of $f_{P,g}$ in the direction of more aggression. (b) The control aspect of restriction is equivalent to a restraining force $rf_{\overline{P,g}}$ against in-group aggression. This

FIG. 8 AGGRESSION IN TWO GROUPS OF BOYS



inner contradiction is inherent in every autocratic situation and is the basis of the higher tension level (Fig. 7d.).

From the point of view of management autocratic leadership is confronted with the task of establishing a restraining force field ($rf_{\overline{P,g}}$) of such strength and gradient that the intensity of open in-group aggression does not rise above a certain level. As a first step toward this end, usually, the autocrat tries to strengthen his operational means of control. Strengthening the police or other means of power corresponds to an increase in the "capacity" to control. If this is actually used for stronger suppression, a higher degree of conflict results. This means that a spiral has been set in motion which leads to increasingly more tension, stronger forces toward aggression and suppression.

There are two ways by which autocratic leaders try to avoid this spiral: (1) Restrictive control creates less frustration or at least less open aggression if the individual accepts "blind obedience to the leader" as a value. Germany and Japan are examples of cultures where this attitude is relatively strong. Hitler systematically tried to decrease $f_{P,g}$ through an "education for discipline" in this sense. (2) The second method of reducing $f_{P,g}$ is based on the fact that the tension resulting from a conflict is dynamically equivalent to a "need." Need satisfaction, in this case open aggression, decreases $f_{P,g}$ at least for a certain time. To permit open aggression, but to channel it in a way which is not dangerous for the autocrat is an old technique of social management for autocratic leaders. Another conclusion from the general theory would be that, if the autocratic control in a case of apathetic autocracy were abandoned, a high degree of open aggression should occur as the result of

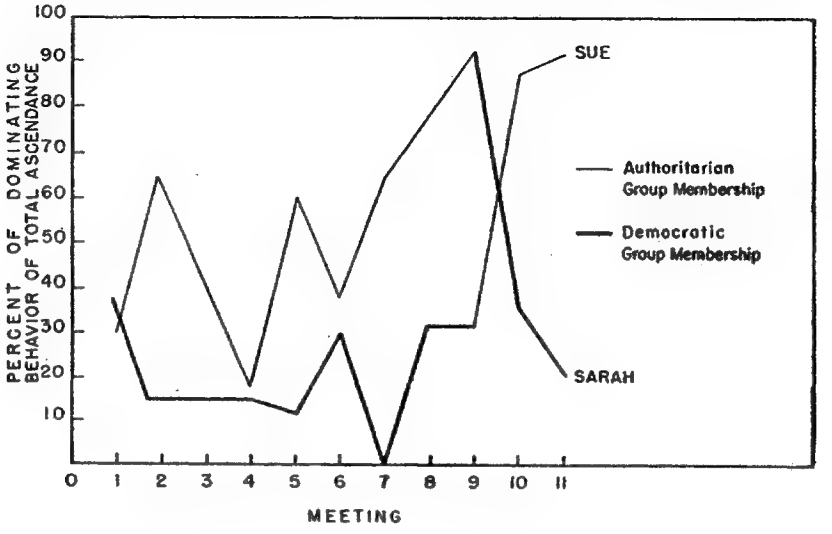
removal of $f_{Gr,c}$. Replacing the autocratic atmosphere with a democratic or laissez-faire atmosphere is equivalent to such a removal. Indeed Lippitt and White (20) observed marked " boiling over " in the first meeting of transition from apathetic autocracy to laissez-faire or democracy (Fig. 8). It is in line with the theory that this boiling over went to a higher level in the case of transition to laissez-faire than to democracy since the general degree of control or self-control which counteracts intermember aggression is stronger in democracy than in laissez-faire.

This representation by way of a phase space takes into account only certain aspects of the actual processes in the social field. For instance, if authoritarian control weakens to the point of permitting open intermember aggression, this aggression is likely to weaken still further the level of control (unless the leader is " reacting " to the situation by a heightening of control). These circular causal processes have to be taken into account for prediction.

2. An Atmosphere Affecting Individual Levels of Conduct

Figure 9 represents the amount of dominating behavior of a member of an aggressive autocratic group and a member of a democratic group. After an equality at the first meeting, the conduct of the individuals changed in line with the social atmosphere. The two members were changed from one group to the other after the ninth meeting. The fact that after transfer each member rapidly displayed the level of conduct shown by the other member before change, indicates that the strength and the gradient of the resultant force field corresponding to the two atmospheres was approximately the same for both individuals.

FIG. 9 EFFECT OF TRANSFER TO A DIFFERENT GROUP



3. Scapegoating and the Interdependence of Levels of Conduct

Data regarding the amount of dominance given and received by individual members of an aggressive autocratic group (Fig. 10 a and b) can serve as an illustration for several general points concerning quasi-stationary processes.

(a) Levels of Received Hostility as Equilibria

It is appropriate to consider such a *passive* property as "being attacked" as a quasi-stationary equilibrium. The amount of aggression received depends partly on the degree to which the individual provokes or invites aggression and the way he fights or does not fight back. Other factors are the aggressiveness of the other members, the social atmosphere, etc. On the whole then, the constellation is the same as in the forces in other cases of equilibrium: the forces always depend on the characteristics of the group or the individual in question and on his relation to the surroundings.

(b) Quitting and the Range of the Central Force Field

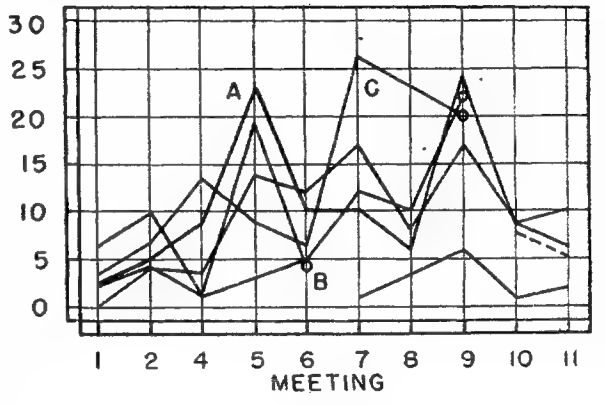
Scapegoat B (Fig. 10b) quits membership in the club on the sixth day, scapegoat C on the ninth day. These happenings are examples of the general fact that a sufficiently large change of the level of equilibrium leads to a basic change in the character of the total situation: too much received dominance makes the member leave.

One may be tempted to represent the tendency of the individual to leave the club after too much received hostility by means of a central force field with a definite range (see Fig. 6) beyond which the resultant forces are directed away from the level of equilibrium. Such a representation could not indicate, however, that the individual leaves the club since the coordinates of the phase space refer only to time and to the amount of received dominance. To represent this fact one has either to refer to the force constellation in the actual social field or to introduce the degree of "eagerness to belong to the club" as a third dimension of the phase space.

(c) Interaction and Circular Causal Processes

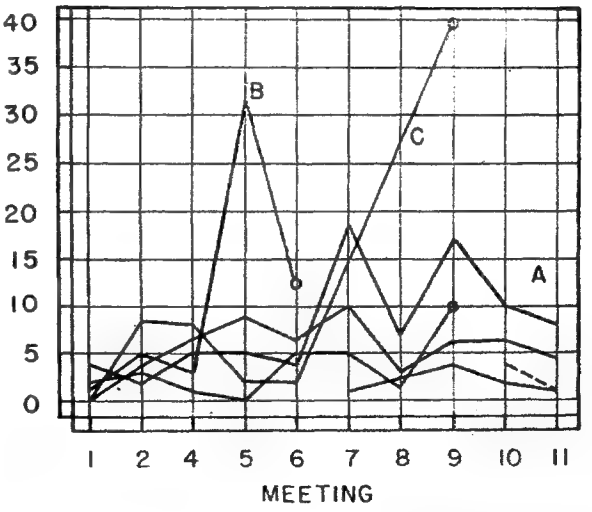
The scapegoats A and B who received much dominating behavior (Fig. 10b) themselves showed much dominating behavior (Fig. 10a). This indicates a close relation between being attacked and attacking. This relation has the character of a circular causal process: the attack of A against B increases B's readiness to attack; the resultant attacks of B raise A's readiness, etc. This would lead to a continuous heightening of the level of equilibrium for A, for B, and for the group as a whole. This holds, however, only

FIG. 10a DOMINATION DEALT OUT



within certain limits: if the attack of A is successful B might give in (3). This is another example of the fact that the change of a social process which results from the change of the force field determining the level of equilibrium may in itself effect the total situation in the direction of a further change of the force field. This example can, of course, be regarded as a case of non-equilibrium which corresponds to a constellation of forces away from the present level.

FIG. 10b DOMINATION RECEIVED

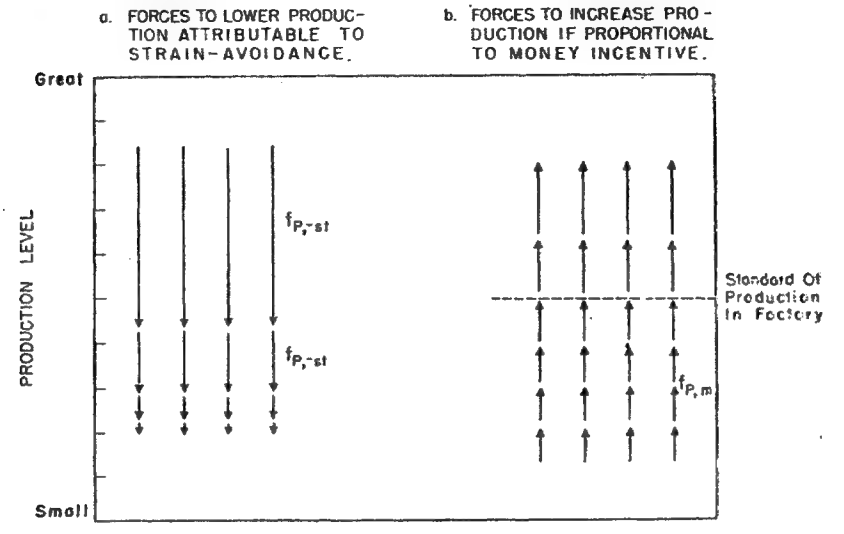


4. Production in a Factory

The output of a factory as a whole or of a work-team frequently shows a relatively constant level of output through an extended period of time. It can be viewed as a quasi-stationary equilibrium. An analysis of the relevant forces is of prime importance for understanding and planning changes.

One of the forces keeping production down is the strain of hard or fast work. There is an upper ceiling for human activity. For many types of work the force away from the strain $f_{P,-st}$ increases faster the closer one comes to the upper limit. The force field has probably a gradient similar to an exponential curve (Fig. 11a).

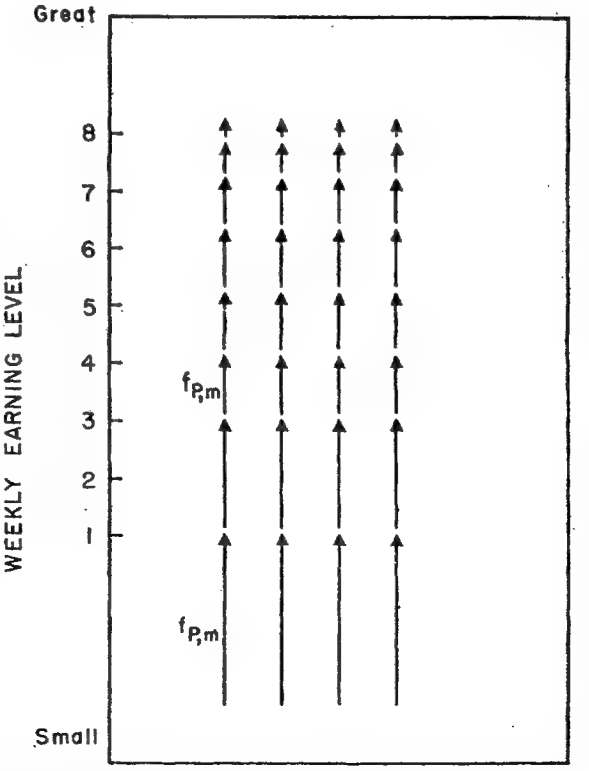
FIG. 11 GRADIENTS OF CERTAIN FORCES INFLUENCING LEVEL OF PRODUCTION



The common belief views the desire to make more money ($f_{P,m}$) as the most important force toward higher production levels. To counter the gradient of the forces $f_{P,-st}$, away from fast work, various incentive systems are used which offer higher rates of pay above a certain standard (Fig. 11b).

Several reasons make it unlikely that the force toward greater output is actually proportional to the unit pay rate in the way indicated in Figure 11b. An increase in earning a certain amount means quite different things to different people. Some factories which moved from a northern state to the South ten years ago found it impossible for years to reach a level of production which was at all comparable to that of northern workers. One of the reasons was the fact that for the rural southern girls the weekly pay was so much above previous living standards that they did not care to make more money even for a relatively small additional effort.

FIG. 11c GRADIENT OF FORCES TOWARD EARNING MORE MONEY

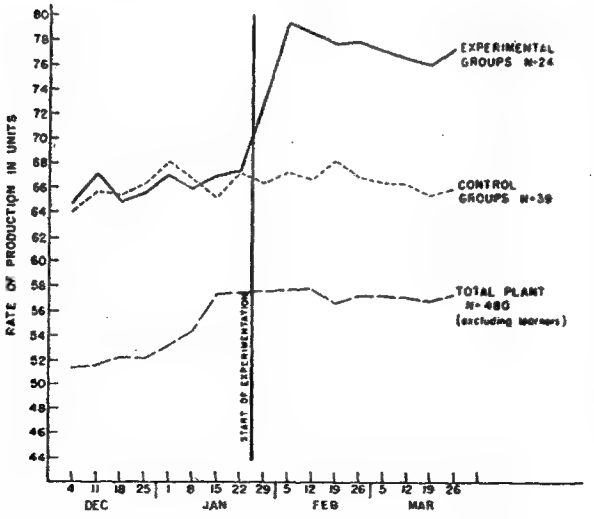


The relation between the total amount of earnings and the strength and gradient of the force field differs with the sub-culture of the group. One fairly common pattern corresponds to Fig. 11c. A sufficiently low level will lead to a very strong force $f_{P,m}$ toward more income; a sufficiently high level, to a small force toward still higher earnings. In some social groups the units on the scale correspond to ten dollars, in others to a hundred or a thousand dollars. The strength of a force $f_{P,m}$ corresponding to an incentive will depend therefore upon the general " living standards " of the group.

In team work one of the strongest forces is the desire to remain not too far above or below the rest of the group. This holds particularly between " parallel workers " or " friends " in an assembly line (27). An important force against increase of speed may be the fear that a temporary increase of speed would bring about pressure from the supervisor or foreman permanently to keep up the higher speed.

Figure 12 presents data from experiments carried out by Bavelas. The output of the sewing factory as a whole, of the experimental population, and of a control population has a typical quasi-stationary character. After the intro-

FIG. 12 EFFECT OF GROUP DECISION AND PACING CARDS IN A SEWING FACTORY



duction of pacing cards or group decision the experimental groups show a marked increase to a new level of equilibrium. We will not discuss here the details of the methods used. They seem to be based at least in part on procedures which reduce the forces which tend to keep production down rather than on procedures which add new forces toward higher levels.

5. Two Basic Methods of Changing Levels of Conduct

It is of great practical importance for any type of social management that production levels are quasi-stationary equilibria which can be changed either by adding forces in the desired direction or by diminishing opposing forces.

(7) If a change from the level L^1 (Fig. 13a) to L^2 is brought about by increasing the forces toward L^2 (Fig. 13b) the secondary effects should be different from the case where the same change of level is brought about by diminishing the opposing forces (Fig. 13c). In the first case, the process on the new level L^2 would be accompanied by a state of relatively high tension, in the second case by a state of relatively low tension.

Since increase of tension above a certain degree goes parallel with greater fatigue, higher aggressiveness, higher emotionality, and lower constructiveness it is clear that as a rule the second method will be preferable to the high pressure method. (For details about the relation between productivity and tension see Barker, Dembo and Lewin (2).)

Figure 14 offers a striking example of the production of a "nervous" worker which is in line with these considerations. Her average level was above the average of the group; she showed, however, extreme variations in speed and frequent absenteeism. The use of pacing cards led to an increase in production to an exceptionally high level. At the same time, the fluctuation diminished markedly.

Since restlessness is a common symptom of tension we may assume the greater constancy and the lack of absenteeism to be an expression of the fact that the change of the level of production was accomplished through a change in the force field corresponding to the pattern 13c rather than 13b.

6. Capacity, Learning Curves and Equilibria

(a) Ability, Difficulty and Change of Difficulty

One factor which affects the level of many social events is "ability." Ability

FIG. 13 QUASI-STATIONARY EQUILIBRIA BEFORE AND AFTER CHANGING LEVELS OF PRODUCTION, SHOWING TWO POSSIBLE STATES OF TENSION AT THE NEW LEVEL

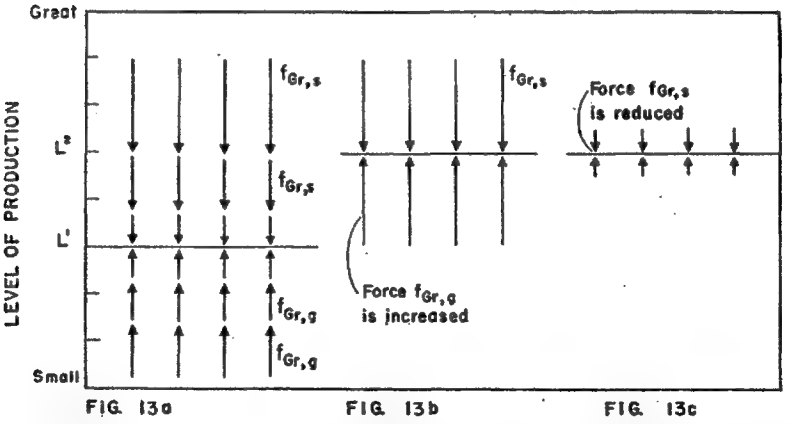
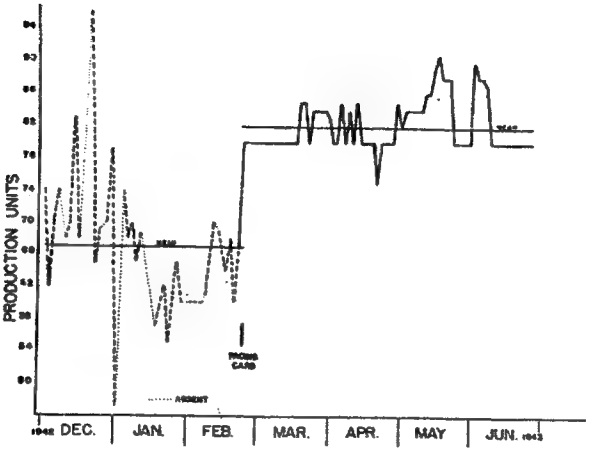


FIG. 13a BEFORE CHANGING LEVEL OF PRODUCTION

FIG. 13b AFTER CHANGING PRODUCTION LEVEL THROUGH STRENGTHENING FORCES TOWARD HIGHER PRODUCTION

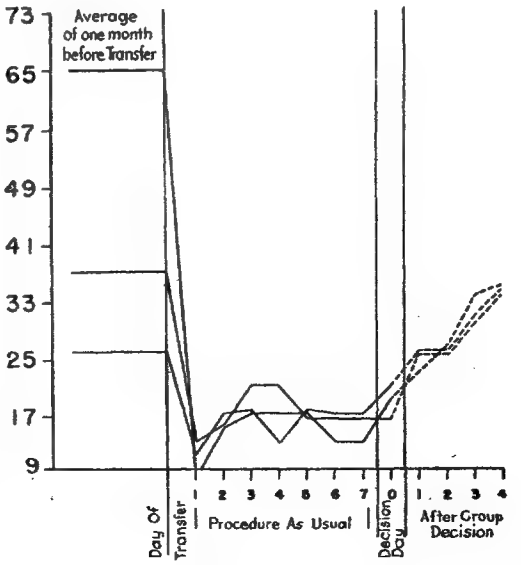
FIG. 13c AFTER CHANGING PRODUCTION LEVEL THROUGH REDUCING FORCES TOWARD LOWER PRODUCTION

FIG. 14 EFFECT OF PACING CARDS ON STABILITY OF PRODUCTION



is a popular term which refers to a multitude of very different facts such as the ability to speak French and the ability to take a beating. Nevertheless, in regard to changes the term ability seems to imply a reference to restraining rather than driving forces. Driving forces—corresponding, for instance, to ambition, goals needs or fears—are "forces toward" ($f_{P,s}$) something or "forces away from" something ($f_{P,\bar{s}}$). They tend to bring about locomotion or changes (14). A "restraining force" is not in itself equivalent to a tendency to change; it merely opposes driving forces. ($rf_{\overline{P,s}}$ means a restraining force opposite to a force $f_{P,s}$; $rf_{\overline{P,\bar{s}}}$ is a restraining force opposing $f_{P,\bar{s}}$).

FIG. 15 EFFECT OF GROUP DECISION ON SLOW WORKERS AFTER TRANSFER
(Double Needle Machine)



A change in ability is equivalent to a change in the "difficulty of a task." Indeed, for the representation as forces in a phase space, both are identical. Always we deal with a relation between an individual or group and a task. The term ability or the term difficulty is used according to whether one views the subject or the activity as the variable in this relation.

Figure 15 shows the drop in work output after a worker is transferred—on the same sewing machine—to a different sewing job (5). Although for the two jobs the learning curve of newcomers and the production level of old hands are equal on the average indicating equal difficulty of the two jobs, transferred workers were found to do less well on the new job. For a transferred worker obviously, the new task is more difficult than the previous one.

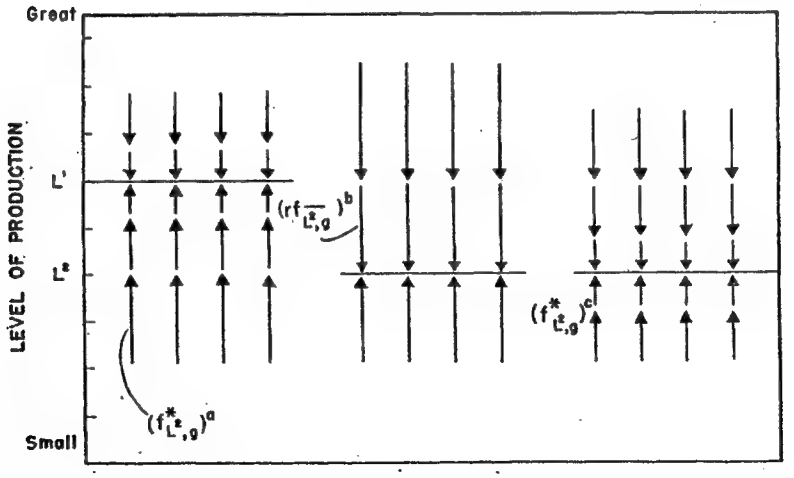
Let us assume that the resultant force field (of the driving and restraining forces) before transfer corresponds to the central field represented in Fig. 16a. Introducing the new task is equivalent to introducing a stronger restraining force or indeed to adding a field of restraining forces against higher output.

If the transfer to the new job were to leave the force field otherwise unchanged we could make the following conclusion (Fig. 16a and b): the strength of the added restraining force on the second (lower) level L^2 at the time b ($rf_{\overline{L^2,g}}$)^b equal the strength of the resultant driving force existing on the level L^2 at the time a before the change ($|rf_{\overline{L^2,g}}|^b = |f^*_{L^2,g}|^a$). This would mean that the lowering of the output would be accompanied by an increase in tension.

FIG. 16a. FORCE FIELD BEFORE TRANSFER TO NEW JOB

FIG. 16b. FORCE FIELD AFTER TRANSFER IF ONLY RESTRAINING FORCES ARE ADDED

FIG. 16c. FORCE FIELD AFTER TRANSFER IF DRIVING FORCE $f_{L^2,g}$ IS DIMINISHED



This is but another example for the theorem: that a change brought about by adding forces in its direction leads to an increase in tension. (In the previous case we had applied this theorem to a change upwards, this time to a change downwards).

This conclusion, however, is not in line with observations. Actually, the tension after transfer seemed lower, indicating that the change to the lower production level was accompanied by a decrease in the strength of the driving forces toward higher production (Fig. 16c):

$$|f^*_{L^2,g}|^c < |f^*_{L^2,g}|^a$$

There are indications that the transfer in these cases is indeed accompanied by a marked lowering of work moral in the sense of drive to higher production. If this interpretation is correct, learning after transfer should be slow, and indeed it is astonishingly slow (Fig. 15). Although these workers are familiar with the machines, their speed improves so slowly that it is more profitable for the factory to hire new workers than to change the job of experienced workers.

Probably, several factors combine to decrease the force $f_{L^2,g}$ after transfer: a worker in good standing who is proud of his achievement is thrown back into a state of low working status. This is likely to affect his moral and eagerness. The goal of working at a level " above standard " has been a realistic possibility before transfer; now it is " too " high, it is out of reach. The studies on level of aspiration (18) have shown that under these circumstances a person tends to " give up." This would explain the decrease in $f_{L^2,g}$. After group decision the learning curve rises, probably because the setting up of new goals brings about a resultant force toward higher levels without which learning may not take place (15).

(b) Learning Curves as Base Line for Equilibria Considerations

There are circumstances under which equilibria must be related to a base line defined in other than absolute values.

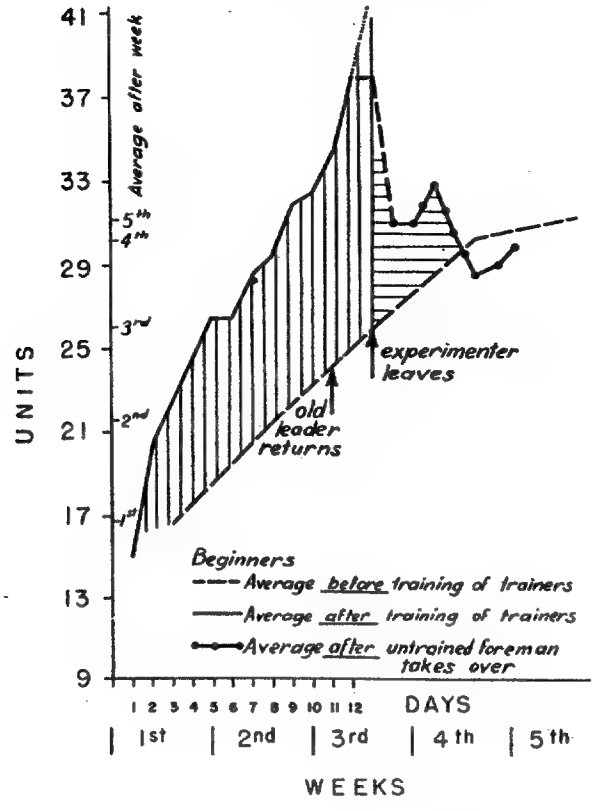
Bavelas gave special training to a person in charge of training beginners in a factory (5). This led to a considerable steepening of the learning curves of the beginners (Fig. 17). After a few weeks when the specially trained trainer was withdrawn and replaced by the previously employed trainer, the learning curve promptly returned to the level it would have had without the training of the trainer. This and other cases make it probable that under certain circumstances a learning curve can be treated as the base line, that is, a line of " equal level " for determining of force fields.

The inclusion of the learning curve as a possible base could be interpreted as an expression of a general principle:

(8) Social forces should be analyzed on the basis of the relation between social processes and the ability (capacity) of the group (or individual) concerned.

If one accepts this general principle, the treatment of " absolute " standards of processes (height of production, of friendliness, etc.), as the frame of reference for analyzing the forces which determine quasi-stationary equilibria is permissible only if the capacities of the groups concerned do not change during that period.

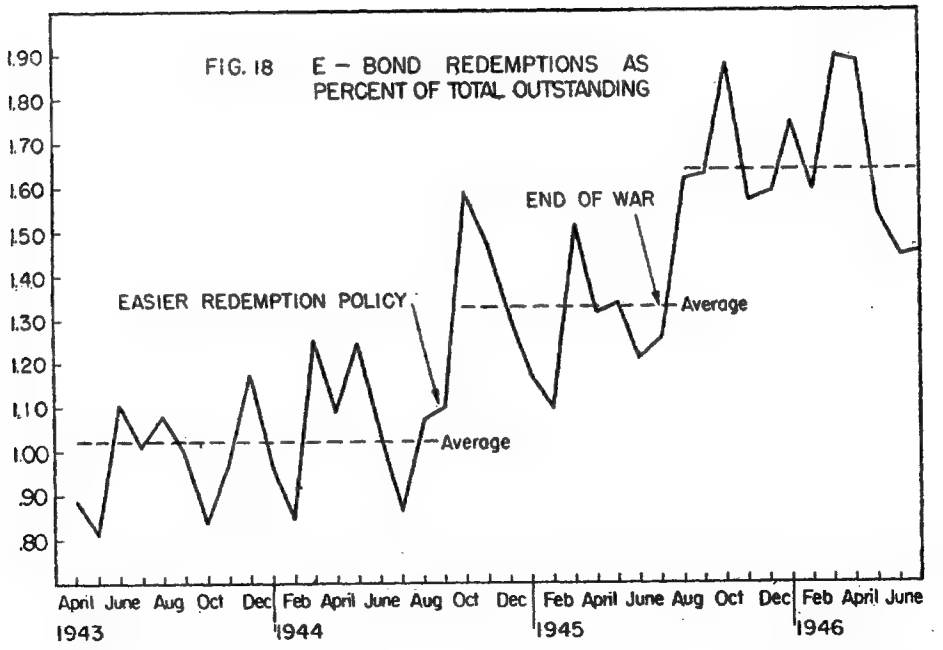
FIG. 17 TRAINING OF BEGINNERS
(All Stitching Machines)



7. The Combination of " Subjective " and " Objective " Methods

To determine the nature of the forces which are the main variables in a given case a great variety of procedures can be used. An analysis of both the cognitive (" subjective ") and behavioral (" objective ") aspects of group life requires a combination of methods which lays open the subjective aspects and permits conclusions concerning conduct which can be checked. An example may illustrate the principle involved.

The Division of Program Surveys of the United States Department of Agriculture during the war carried out for the Treasury Department periodic studies of motivation for buying and redeeming war bonds. Interviews indicated the nature of some of the forces toward and away from redemption for individuals in various sections of the population.



The force toward redemption most frequently encountered was found to be financial pressure resulting from an actual emergency like sickness. Forces against redemption were the need for security which is provided by a financial reserve, patriotism, or gaining a higher interest return if bonds are kept longer.

To relate the "subjective" data about the nature of the forces to the curves representing equilibria, such "objective" data as the "capacity" of a population to redeem war bonds, has to be taken into account. Since this capacity depends upon the total amount of war bonds outstanding, it is appropriate according to theorem (8) to base considerations of forces on curves which represent levels of redemption as percentages of this total.

Pearl Harbor, the official entrance of the United States in the war, was accompanied by a marked decline in the level of redemption. From interviews with the population it appears that this is due to an increase of a force against redemption (rather than a decrease of the forces for redemption), namely, a heightened patriotism. From this explanation one would expect that at the end of the war an opposite change would occur. Indeed, Fig. 18 shows an increase of the level of redemption at that time; it can be understood in part as the result of the diminished patriotic motive.

On the whole redemption during the periods from April, 1943, to September, 1944, from October, 1944, to July, 1945, and from August, 1945, to April, 1946, seem to represent three levels of a quasi-stationary process, each period showing typical periodic fluctuations. The change from the first to the second level coincides with the establishing of an easier redemption policy by the Treasury Department corresponding to a decrease of the restraining forces against redemption.

D. THE CREATION OF PERMANENT CHANGES.

1. Change of Force Fields

In discussing the means of bringing about a desired state of affairs one should not think in terms of the " goal to be reached " but rather in terms of a change " from the present level to the desired one." The discussion thus far implies that a planned change consists of transplanting the force field corresponding to an equilibrium at the beginning level L^1 by a force field having its equilibrium at the desired level L^2. It should be emphasized that the total force field has to be changed at least in the area between L^1 and L^2.

The techniques of changing a force field cannot be fully deduced from the representation in the phase space. To change the level of velocity of a river its bed has to be narrowed down or widened, rectified, cleared from rocks, etc. To decide how best to bring about such an actual change, it does not suffice to consider one property. The total circumstances have to be examined. For changing a social equilibrium, too, one has to consider the total social field: the groups and subgroups involved, their relations, their value systems, etc. The constellation of the social field as a whole has to be studied and so reorganized that social events flow differently. The analysis by way of phase space indicates more what type of effect has to be accomplished than how this can be achieved.

2. Quasi-Stationary Processes and Social " Habits "

Influencing a population to make a change such as substituting the consumption of dark bread for white bread means trying to break a well-established " custom " or " social habit." Social habits usually are conceived of as obstacles to change. What does a social habit mean in terms of force fields and what does " breaking of a habit " mean?

If one regards a social stationary process as determined by a quasi-stationary equilibrium one will expect any added force to change the level. We know that the resultant force on a present level L is zero ($f^*_{L,x}=0$). Adding the force $|f_{L,n}|>0$ should move the level in the direction of n to a different level ($L+\triangle$). The amount of change $\triangle$ is determined by the equation

$$(9)\quad |f^*_{(L+\triangle),L}| = |f_{L,n}|$$

The idea of " social habit " seems to imply that in spite of the application of a force $f_{L,n}$ the level of the social process will change less than $\triangle$ because of some type of " inner resistance " to change. To overcome this inner resistance an additional force seems to be required, a force sufficient to " break the habit," to " unfreeze " the custom.

One could try to deny the existence of such " inner resistance to change " out of social habit.* Perhaps social habits merely refer to cases of such steep gradient that adding the force $f_{L,n}$ does not lead to a perceivable change. Such an interpretation hardly suffices. At best, it transforms the problem of habit into the question, why does the resultant force field show such a steep gradient in the immediate neighborhood of L.

The social habit theory answers that the historic constancy creates an " additional force field " which tends to keep up the present level in addition to whatever other forces are keeping

* The concept " habit " has played havoc with the progress of psychology for decades. Today it can be regarded as a popular term referring to a conglomeration of various processes. It is to be exchanged for several more adequate concepts (15).

the social process at that level. Two statements are implied in such a theory; one asserting the existence of the "additional force field," the other regarding its historical origin. We are here interested mainly in the nature of the additional force field.

Social life proceeding on a certain level leads frequently to the establishment of organizational institutions. They become equivalent to "vested interests" in a certain social level. A second possible source of social habits is related to the value system, the ethos of a group. We shall discuss this in more detail.

3. Individual Conduct and Group Standards

In discussing force fields we have viewed as "point of application" of the force either an individual or a group as a whole. Let us now consider the relation between the individual and the level of social processes.

An individual P may differ in his personal level of conduct (L^P) from the level which represents group standards (L^{Gr}) by a certain amount n ($|L^{Gr} - L^P| = n$). Such a difference is permitted or encouraged in different cultures to different degrees. If the individual should try to diverge "too much" from group standards he will find himself in increasing difficulties. He will be ridiculed, treated severely and finally ousted from the group. Most individuals, therefore, stay pretty close to the standard of the groups they belong to or wish to belong to.

In other words: the group level is not merely a level of equilibrium resulting from whatever forces $f_{L,g}$ and $f_{L,s}$ the circumstances provide. Frequently this level itself acquires value. It becomes a positive valence corresponding to a central force field with the force $f_{P,L}$ keeping the individual in line with the standards of the group.

4. Group Levels With and Without Social Value and the Resistance to Change

Although the value character of a group level is rather common, it does not hold for all types of processes. For instance, few individuals know that the level of redemption of war bonds between April, 1943, and August, 1944, was about one per cent. The values which entered into the decisions to redeem did not include the value of keeping the rate of redemption neither above nor below that level. In this respect, the situation is quite different, for instance, from the situation of an individual who tries to keep up with a working team.

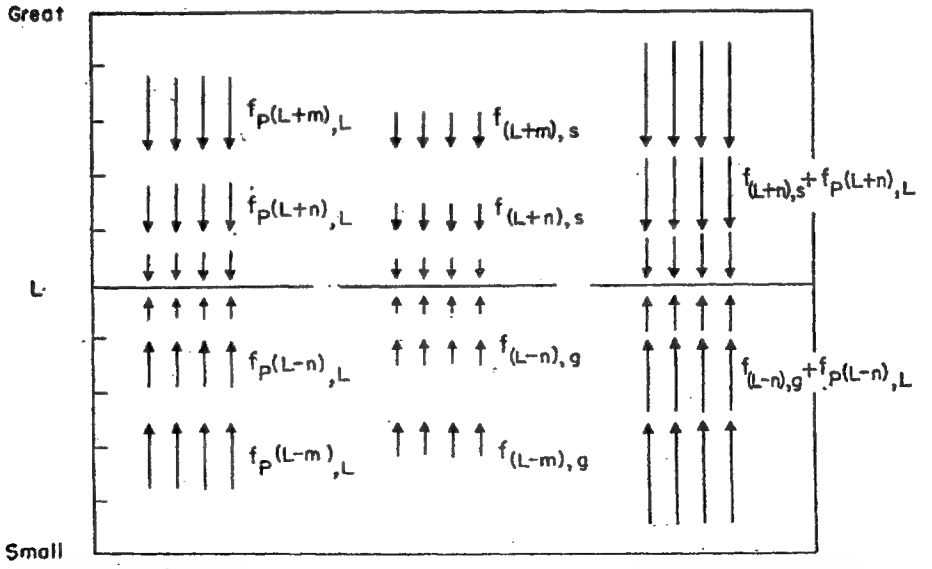
Whatever the reason that a certain level acquires or does not acquire value, the difference is important for the problem of change.

Let us assume that for two groups Gr and Gr^1 the resultant force field corresponds to Fig. 19b if we do not take into account the social value of L. In the case of Gr^1, but not in the case of Gr, the level L should have social value for the members; it should correspond to the force field represented in Fig. 19a. Let us assume that a force f were applied on the individual to change his conduct towards g. In Gr^1 the amount of change will be determined by the gradient of the counter-force $f_{(L+n),s}$ in Gr by the combined counter-forces $f_{(L+n),g} + f_{P,L}$ (Fig. 19c). This means:

(10) The greater the social value of a group standard the greater is the resistance of the individual group member to move away from this level.

Many cases of "social habit" seem to refer to group standards with social value and resistance to change can frequently be explained through theorem (10). If this theory is correct certain derivations can be made in regard to the breaking of social habits.

FIG. 19 FORCE FIELDS IF THE GROUP STANDARD DOES AND DOES NOT HAVE SOCIAL VALUE



a. FORCES ON THE INDIVIDUAL CORRESPONDING TO THE VALENCE OF THE GROUP STANDARD(L)

b. FORCES ON THE GROUP STANDARD TOWARD A LOWER OR HIGHER LEVEL

c. FORCE FIELD RESULTING FROM SUMMATION OF a. AND b.

5. Individual Procedures and Group Procedures of Changing Social Conduct

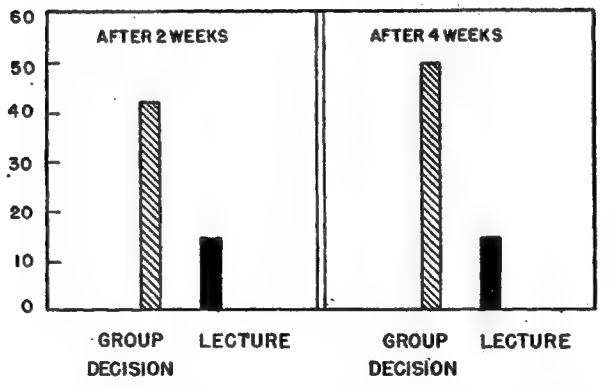
If the resistance to change depends partly on the value of the group standard for the individual, the resistance to change should be diminished if one uses a procedure which diminishes the strength of the value of the group standard or which changes the level that is perceived by the individual as having social value.

This second point is one of the reasons for the effectiveness of " group carried " changes (26) which approach the individuals in face-to-face groups. Perhaps one might expect single individuals to be more plyable than groups of like-minded individuals. However, experience in leadership training, in changing of food habits, work production, criminality, alcoholism, prejudices, all seem to indicate that it is usually easier to change individuals formed into a group than to change any one of them separately (19). As long as group values are unchanged the individual will resist changes more strongly the farther he is to depart from group standards. If the group standard itself is changed, the resistance which is due to the relation between individual and group standard is eliminated.

6. Changing as Three Steps: Unfreezing, Moving, and Freezing of Group Standards

A change toward a higher level of group performance is frequently short lived; after a " shot in the arm," group life soon returns to the previous level. This indicates that it does not suffice to define the objective of a planned change in group performance as the reaching of a different level. Permanency of the new level, or permanency for a desired

FIG. 20 PERCENTAGE OF MOTHERS REPORTING AN INCREASE IN THE CONSUMPTION OF FRESH MILK



period, should be included in the objective. A successful change includes therefore three aspects: unfreezing (if necessary) the present level L^1, moving to the new level L^2, and freezing group life on the new level. Since any level is determined by a force field, permanency implies that the new force field is made relatively secure against change.

The " unfreezing " of the present level may involve quite different problems in different cases. Allport (1) has described the " catharsis " which seems to be necessary before prejudices can be removed. To break open the shell of complacency and self-righteousness it is sometimes necessary to bring about deliberately an emotional stir-up.

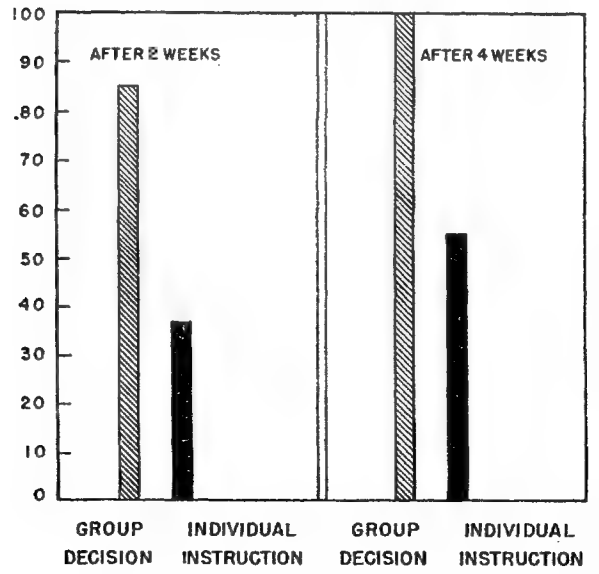
The same holds for the problem of freezing the new level. Sometimes it is possible to establish an organizational set up which is equivalent to a stable circular causal process.

7. Group Decision as a Change Procedure

The following example of a process of group decision concerns housewives living in a Midwestern town some of whom were exposed to a good lecture about the value of greater consumption of fresh milk and some of whom were involved in a discussion leading step by step to the decision to increase milk consumption (9.25). No high-pressure salesmanship was applied, in fact pressure was carefully avoided. The amount of time used was equal in the two groups. The change in milk consumption was checked after two and four weeks. Figure 20 indicates the superiority of group decision. Similar results were found in regard to evaporated milk.

The effect of individual treatment was compared with the effect of group decision among farm women who had come to the maternity ward of the State Hospital of Iowa. Before their release they received individual instruction concerning the proper formula for feeding babies and the advisability of giving them orange juice and cod liver oil. This procedure was compared with a procedure of discussion and decision carried out with six mothers as a group. In the first case the nutritionist devoted about twenty-five minutes to a single mother, in the

FIG. 21 PERCENTAGE OF MOTHERS FOLLOWING COMPLETELY GROUP DECISION OR INDIVIDUAL INSTRUCTION IN GIVING ORANGE JUICE



second the same amount of time to a group of six mothers.

Figure 21 shows the superiority of the group decision procedure. At four weeks every one of the mothers in the decision group was giving to the baby the advised amount of cod liver oil. Surprisingly, after both procedures there is an improvement between the second and fourth weeks. Figure 22 presents an example of the effect of three group decisions of a team in a factory reported by Bavelas (24) which illustrates an unusually good case of permanency of change measured over nine months.

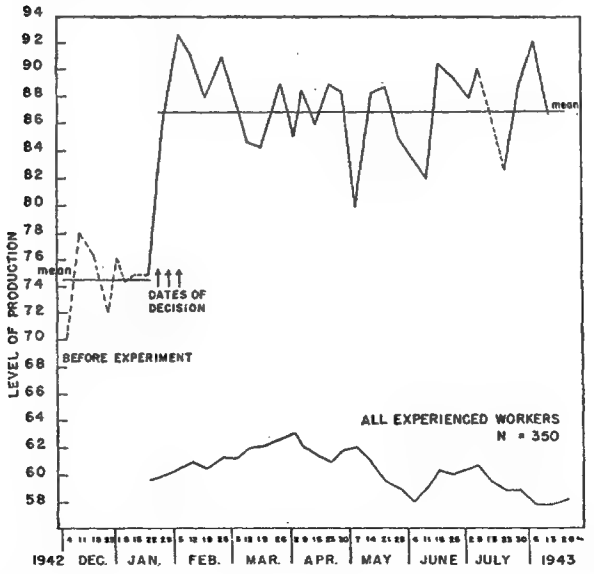
The experiments reported here cover but a few of the necessary variations. Although in some cases the procedure is relatively easily executed, in others it requires skill and presupposes certain general conditions. Managers rushing into a factory to raise production by group decisions are likely to encounter failure. In social management as in medicine there are no patent medicines and each case demands careful diagnosis. The experiments with group decision are nevertheless sufficiently advanced to clarify some of the general problems of social change.

We have seen that a planned social change may be thought of as composed of unfreezing, change of level, and freezing on the new level. In all three respects group decision has the general advantage of the group procedure.

If one uses individual procedures, the force field which corresponds to the dependence of the individual on a valued standard acts as a resistance to change. If, however, one succeeds in changing group standards, this same force field will tend to facilitate changing the individual and will tend to stabilize the individual conduct on the new group level.

Sometimes the value system of this face-to-face group conflicts with the values of the larger cultural setting and

FIG. 22 EFFECT OF GROUP DECISION ON SEWING MACHINE OPERATORS



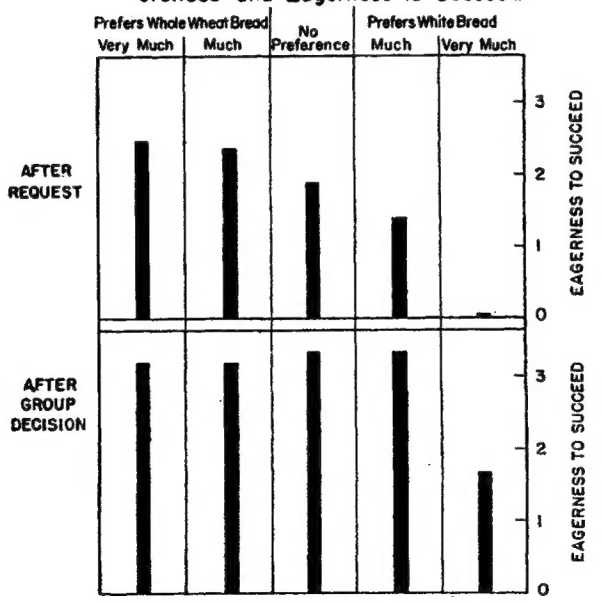
it is necessary to separate the group from the larger setting. For instance, during retraining of recreational leaders from autocratic to democratic patterns Bavelas (4) was careful to safeguard them from interference by the administration of the recreational center. The effectiveness of camps or workshops in changing ideology or conduct depends in part on the possibility of creating such " cultural islands " during change. The stronger the accepted subculture of the workshop and the more isolated it is the more will it minimize that type of resistance to change which is based on the relation between the individual and the standards of the larger group.

One reason why group decision facilitates change is illustrated by Willerman (16). Figure 23 shows the degree of eagerness to have the group change from the consumption of white bread to whole wheat. When the change was simply requested the degree of eagerness varied greatly with the degree of personal preference for whole wheat. In case of group decision the eagerness seems to be relatively independent of personal preference; the individual seems to act mainly as " group member."

A second factor favoring group decision has to do with the relation between motivation and action. A lecture and particularly a discussion may be quite effective in setting up *motivations* in the desired direction. Motivation alone, however, does not suffice to lead to change. That presupposes a link between motivation and action. This link is provided by the decision but it usually is not provided by lectures or even by discussions. This seems to be, at least in part, the explanation for the otherwise paradoxical fact that a process like decision which takes only a few minutes is able to affect conduct for many months to come. The decision links motivation to action and, at the same time, seems to have a " freezing " effect which is partly due to the individual's tendency to " stick to his decision "

FIG. 23 CHANGING FOOD HABITS

Relation Between Own Food Preferences and Eagerness to Succeed



and partly to the " commitment to a group." The importance of the second factor would be different for a students' cooperative where the individuals remain together, for housewives from the same block who see each other once in a while and for farm mothers who are not in contact with each other. The experiments show, however, that even decisions concerning individual achievement can be effective which are made in a group setting of persons who do not see each other again.

It would be incorrect to attribute the permanence of the new level entirely to the freezing effect of the decision. In many cases other factors are probably more important. After the housewife has decided to use more milk she might place a standing order with the milkman which could automatically keep milk consumption high. These questions lead to problems of reconstructurization of the social field, particularly to problems of channeling social processes.

Many aspects of social life can be viewed as quasi-stationary processes. They can be regarded as states of a quasi-stationary equilibrium in the precise meaning of a constellation of forces the structure of which can be well defined. These forces have to be identified and will have to be measured quantitatively. A sufficient conceptual analysis is a prerequisite to this step.

The scientific treatment of social forces presupposes analytic devices which are adequate to the nature of social processes and which are technically fitted to serve as a bridge to a mathematical treatment. The basic means to this end is the representation of social situations as " social fields." Some aspects of social processes can be treated by way of systems of coordinates called " phase space."

The use of a phase space for treating a social equilibrium makes it necessary to clarify certain technical questions of analysis, such as the relation between the strength of the opposing forces at a given level of the process, the structure of the force field inside and outside of the neighboring range, the formal conditions of fluctuation and of individual differences, the relation between forces and capacities, and the relation between forces and tension.

This technical analysis makes it possible to formulate in a more exact way problems of planned social changes and of resistance to change. It permits general statements concerning some aspects of the problem of selecting specific objectives in bringing about change, concerning different methods of bringing about the same amount of change, and concerning differences in the secondary effects of these methods. A theory emerges that one of the causes of resistance to change lies in the relation between the individual and the value of group standards. This theory permits conclusions concerning the resistance of certain types of social equilibria to change, the unfreezing, moving, and freezing of a level, and the effectiveness of group procedures for changing attitudes or conduct.

The analytic tools used are equally applicable to cultural, economic, sociological and psychological aspects of group life. They fit a great variety of processes such as production levels of a factory, a work-team and an individual worker; changes of abilities of an individual and of capacities of a country; group standards with and without cultural value; activities of one group and the interaction between groups, between individuals, and between individuals and groups. The analysis concedes equal reality to all aspects of group life and to social units of all sizes. The application depends upon the structural properties of the process and of the total situation in which it takes place.

Our consideration of quasi-stationary equilibrium has been based on analytic concepts which, within the realm of social sciences, have emerged first in psychology. The concepts of a psychological force, of tension, of conflicts as equilibria of forces, of force fields and of inducing fields, have slowly widened their range of application from the realm of individual psychology into the realm of processes and events which had been the domain of sociology and cultural anthropology. From what I have been able to learn recently about the treatment of equilibria by mathematical economics, I am convinced that this treatment, although having a different origin and being based perhaps on a different philosophy, is also fully compatible with our considerations.

The ease of quantitatively measuring economic data on the one hand, and the disturbing qualitative richness of psychological and cultural events on the other has tended to keep the methods of investigating these areas separated. Perhaps, this situation has driven some mathematical economists into an attempt to develop an economics without people and without culture, much in the way that some mathematically inclined psychologists have tried to develop a theory of learning without organisms (12). It is possible, however, to leave the philosophical interpretation in abeyance and to regard the equations of mathematical economics as a treatment of certain aspects of events which are methodologically similar to our treatment of certain aspects of social processes by way of phase spaces; in both cases one has to realize that for prediction it is necessary to refer finally to the total social field with all its essential properties. If one is conscious of the

limitation of the separate analytic treatment of certain aspects of the social field, this treatment is a useful and indeed necessary step.

Certainly, mathematical economics has developed powerful analytic tools for treating some basic aspects of group life. If our considerations are correct they mean that it is possible to join hands with mathematical economics and I see no reason why, for instance, the methods of treating economic equilibria (8, 11, 28) or the treatment of the grouping in competitive constellations (30) cannot be applied to other areas of social life.

The analytic tools of mathematical economics should be of great help for carrying through the task of measuring social forces, a task which thus far has been accomplished only in a limited area of individual psychology (6). This task implies three steps; a sufficient development of analytical concepts and theories concerning social forces, their quantification in principle through equations, and measuring concrete cases. It seems that the first step in the treatment of group life has sufficiently progressed to permit a collaboration of the various branches of the social sciences for the second and third task.

For economics the fusion implies the possibility of taking into account the cultural and psychological properties of the population involved and, therefore, of improving greatly the ability of analyzing concrete cases and making correct predictions. Economics will have to be ready to complicate its analytic procedures at certain points, particularly it will have to recognize the cognitive problems mentioned in Section B in the discussion of the three step procedure.

The fusion of the social sciences will make accessible to economics the vast advantages which the experimental procedure offers for testing theories and for developing new insight. The combination of experimental and mathematical procedures has been the main vehicle for the integration of the study of light, of electricity, and of the other branches of physical science. The same combination seems to be destined to make the integration of the social sciences a reality.

A second article will be published in the next issue.

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