Before a social aggregate can be examined for its status as an organic system its status as entity must be evaluated. Indices of common-fate, similarity, and proximity may be appropriate to this task. Social groups as entities do not have an epistemological status different from such middle-sized entities as stones and rats, but are apt to be fuzzier, less discrete, less multiply confirmed, and in this sense less real. The degree of entitativity and the possibility of a sociology at a level of analysis separate from psychology is a matter for empirical determination rather than a priori decision.

COMMON FATE, SIMILARITY, AND OTHER INDICES OF THE STATUS OF AGGREGATES OF PERSONS AS SOCIAL ENTITIES[1]

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THERE is currently considerable interest in efforts to apply concepts about "systems" at the level of social groupings. But for such applications to be meaningful, we should be able to test the hypothesis in specific instances that an aggregate of persons behaves as a system. We should be able to find instances in which the hypothesis of system is confirmed, and instances in which it is not, or in which the systemicity is of lesser degree. Too frequently concepts of "system" or "homeostatis" or "dynamic structure" are made axiomatic and lose their status as testable hypotheses. Too frequently such concepts are used in a way which provides an infinite flexibility in *ad hoc* explanations, and thus lose that essential rigidity which might make them testable. Yet the hypothesis of system is clearly testable in some instances. A pound of hamburger is clearly less of a system than a one-pound living white rat, and there are many measurements possible which would document this difference. If biologists have seldom provided lists of such criteria, it is not because the difference is undemonstrable, but rather because it is so obviously demonstrable as to be a waste of laboratory effort to verify.

Those interested in treating social and political organizations as systems are most frequently offered the biological organism as an example of a system. This is true both of recent conceptualizations in the behavioral science movement and of those available at the founding of modern social science. For those interested in a functional theory of social organization, Herbert Spencer's *Principles of Sociology, Part II, The Inductions of Sociology* (20), can still be recommended. The behavioral scientist will find it unacceptable in many minor details, but also profoundly modern in spirit and brilliantly suggestive of still untested research leads. Spencer is also free from the unwarranted ethical conclusion which has alienated so many from the organismic analogy, to wit, that not only are societies organism-like, but that it is good for them to become more so. As a militant anti-nationalist and pacifist, resisting the temptation to identify with the glories of Queen Victoria's expanding empire, he used the analogy as a source of concepts about process and function, rather than as a pseudo-scientific prop for an ethic. To quote from his closing chapter:

> Here let it once more be distinctly asserted that there exist no analogies between the body

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politic and a living body, save those necessitated by that mutual dependence of parts which they display in common. Though, in foregoing chapters, sundry comparisons of social structures and functions to structures and functions in the human body, have been made, they have been made only because structures and functions in the human body furnish familiar illustrations of structures and functions in general. The social organism, discrete instead of concrete, asymmetrical instead of symmetrical, sensitive in all its units instead of having a single sensitive centre, is not comparable to any particular type of individual organism, animal or vegetal. All kinds of creatures are alike in so far as each exhibits cooperation among its components for the benefit of the whole; and this trait, common to them, is a trait common also to societies. Further, among individual organisms, the degree of co-operation measures the degree of evolution; and this general truth, too, holds among social organisms. Once more, to effect increasing co-operation, creatures of every order show us increasingly complex appliances for transfer and mutual influence; and to this general characteristic, societies of every order furnish a corresponding characteristic. These, then are the analogies alleged: community in the fundamental principles of organization is the only community asserted (20).

Before we can go ahead with testing the hypothesis that political units or social organizations are organism-like systems, there is a prior question which must be answered. Spencer states the problem in his first chapter entitled, "What is a Society." This chapter is but two pages long. To set the stage more specifically it can be quoted in full:

> This question has to be asked and answered at the outset. Until we have decided whether or not to regard a society as an entity; and until we have decided whether, if regarded as an entity, a society is to be classed as absolutely unlike all other entities or as like some others; our conception of the subject-matter before us remains vague.
>
> It may be said that a society is but a collective name for a number of individuals. Carrying the controversy between nominalism and realism into another sphere, a nominalist might affirm that just as there exist only the members of a species, while the species considered apart from them has no existence; so the units of a society alone exist, while the existence of the society is but verbal. Instancing a lecturer's audience as an aggregate which by disappearing at the close of the lecture, proves itself to be not a thing but only a certain arrangement of persons, he might argue that the like holds of the citizens forming a nation.
>
> But without disputing the other steps of his argument, the last step may be denied. The arrangement, temporary in the one case, is permanent in the other; and it is the permanence of the relations among component parts which constitutes the individuality of a whole as distinguished from the individualities of its parts. A mass broken into fragments ceases to be a thing; while, conversely, the stones, bricks, and wood, previously separate, become the thing called a house if connected in fixed ways.
>
> Thus we consistently regard a society as an entity, because, though formed of discrete units, a certain concreteness in the aggregate of them is implied by the general persistence of the arrangements among them throughout the area occupied. And it is this trait which yields our idea of a society. For, withholding the name from an ever-changing cluster such as primitive men form, we apply it only where some constancy in the distribution of parts has resulted from settled life.
>
> But now, regarding a society as a thing, what kind of thing must we call it? It seems totally unlike every object with which our senses acquaint us. Any likeness it may possibly have to other objects, cannot be manifest to perception, but can be discerned only by reason. If the constant relations among its parts make it an entity; the question arises whether these constant relations among its parts are akin to the constant relations among the parts of other entities. Between a society and anything else, the only conceivable resemblance must be one due to *parallelism of principle in the arrangement of components.*
>
> There are two great classes of aggregates with which the social aggregate may be compared—the inorganic and the organic. Are the attributes of a society in any way like those of a not-living body? or are they in any way like those of a living body? or are they entirely unlike those of both?
>
> The first of these questions needs only to be asked to be answered in the negative. A whole of which the parts are alive, cannot, in its general characters, be like lifeless wholes. The second question, not to be thus promptly answered, is to be answered in the affirmative. The reasons for asserting that the permanent relations among the parts of a society are analogous to the permanent relations among the parts of a living body, we have now to consider (20, pp. 447–448).

Forgiving him his haste and superficiality, the non sequitur in the second sentence of the last paragraph, and his mistaken notion about the social life of primitive man, I believe Spencer to be right in his ordering of the problem:

1. Among actual or potential aggregates of persons, there are certain aggregates which meet criteria of being "entities," and other aggregates which do not. The distinction is capable of empirical representation.

2. Among those actual or potential aggregates which meet the criteria of being

entities there are some which meet the further and more specific criteria of being organic systems. These criteria are likewise capable of operational specifications.

But I believe his treatment of the first problem is inadequate, and that its specification poses a major obstacle to the development of usable systems theory in the social sciences. For the anthropologist in isolated areas, the specification of the social units of tribe and clan may pose little difficulty. The status of entity and system, the useful boundaries of aggregation, may be as apparent to him as to a vertebrate biologist. But for groups in the modern western world, the problems become difficult. If we are to test whether "it" is a system, we need to know what the "it" we are dealing with is, what its boundaries are, where it begins and leaves off. It may be, for example, that a modern metropolitan area is in certain features a homeostatic system—but how can we test the hypothesis unless we have criteria for defining a metropolitan area? Political units such as wards, cities, townships, and counties, might fail to meet the test merely because they represented arbitrary fragments of social entities.

The perception of entities

It is to this first problem of Spencer's that I wish to address myself. I wish to do so by reverting to my role as psychologist and raising the more general problem as to how we "perceive" entities. The paper might well be retitled: "Perceiving invisible entities such as social groups." In this elaboration, I am to some extent following another great sociologist, like Herbert Spencer in receiving less attention today than he might, although otherwise he may seem a strange bedfellow. May I quote from Stuart Rice's *Quantitative Methods in Politics* (19), in his chapter most appropriately labeled "a statistical view of a perceptual world."

> It is true that some of the data reported by human sense organs seem more substantial than others. One sees a saxophone and hears the atmospheric disturbances to which it gives rise, but one cannot see or hear or touch or smell the group relationships which in some perplexing manner bind the members of the jazz orchestra together. The first surmise that each member is wholly independent of the others in thought and action eventually breaks down, and it is perceived that they have organization, but the organization seems less tangible than the saxophone.
>
> In actuality the two types of data are not as dissimilar as they seem. The existence of the saxophone is only inferred from sense impressions of it. If the concert patron should become mentally ill and have an hallucination in which the saxophone played a part, the testimony of his senses would later be rejected, if he were restored to sanity, because of the absence of corroboration for the hallucinatory evidence. Corroboration would be required in the form of other sense impressions received directly by the patient, emanating from or relating to the saxophone, or indirectly from other individuals who in turn received sense impressions relating to the instrument in question. When all possible corroboration is secured, belief in the existence of any material thing remains an inference. Belief in the existence of a group relationship is of the same character. It is an inference, based upon a variety of sense impressions concerning the behavior of individuals who are involved.
>
> All data from the perceptual world turn out to be evidences concerning reality, but not reality itself; or, if preferred, such evidences are reality and the latter is nothing more. Whatever the preferred form of statement, it remains true that what is known of a hypothetical world without one's own individual mind is universally subject to error and inexactitude. Scientific method conceptualizes the perceptual data and treats them *as if* they were real and exact entities. This methodological process, like a great deal more of scientific method, is essentially fictional. Its justification is to be found in the results to which it leads. Hence it is as valid for the scientist to speak of a social group as to speak of an ounce of ether, provided he can do something further with the idea. All he knows of either is what he infers through the mediumship of his own or (by a secondary process) of another person's sense impressions (19, pp. 23–24).

In his subsequent chapters on "Group cohesion and likeness" and "The identification of blocs in small political bodies" he puts into operational terms the question, "when is an aggregate of persons an entity?" While I shall make little use of his specific solutions, the perspective on the problem is the same.

One other source must be acknowledged: Karl Deutsch's chapter on "Mapping and measurement" in his *Political Community at the International Level* (9) represents the sophisticated statement of a behavioral scientist who uses the concepts of system, boundary, and organization in such a way

that empirically verifiable exemplifications of his concepts are made explicit. One quotation from this chapter will help further set the stage for the discussions.

> The concept of reality will be employed here in its operational meaning. It will be appropriate to speak of reality in those cases where such limited tests, qualitative and quantitative, as are at our disposal indicate some historical or social structure from which we can predict the outcome of other tests, including kinds of tests not yet devised. Tentative descriptions of historical or social processes or structures will of course be in terms of symbols, such as maps or words or numbers, which will describe the inferred structures to which they apply. The more verifiable such descriptions prove to be (that is, the wider the range of mutually independent testing operations by which they are confirmed), the more reality may be ascribed to the tentative models or constructions. In other words, models will be more realistic the larger the number of mutually independent operations, present or future, by which they are confirmed (9, p. 47).

You will note a common preoccupation with the "reality" of social units in these three quotations spanning the 80 years since 1876. These represent, however, only mild and methodologically sophisticated statements of the "realist" position. They perhaps should better be called the "as real as" position, recognizing as they do the fallible and mediate nature of our knowledge of common-sense objects as well as of social entities. As such they could also be the expression of a consistent nominalism. More strident denials (1) and affirmations (23) are of course available. The promising aspect of these three statements is that they all propose empirical tests of the "reality" of social units, and it is this feature that I want to elaborate. But there lies behind these chronic protests and denials a stubborn psychological problem which will continue to plague us. The natural knowledge processes with which we are biologically endowed somehow make objects like stones and teacups much more "real" than social groups or neutrinos, so that we are offended by the use of the same term "real" to cover both instances, and are thus tempted to an attitude of conventionalism toward the latter which we would reject if applied to the former. Two sources of the feeling can be suggested. First: according to certain objective criteria to be discussed below, groups are in most instances less "solid," less multiply confirmed, of less sharp boundaries, less "hard." Second, and most important, we have evolved in an environment in which the identification of certain middle-sized entities was both useful and anatomically possible (14). As a product of this evolutionary process we have the marvelously effective mechanism of vision, which, within a limited range of entities, analyzes entitativity[2] so rapidly and vividly that all other inferential processes seem in contrast indirect, ponderous, and undependable. More important, the visual process is so powerful and seemingly direct that we usually do not stop to notice the inferential steps involved in it and the nature of the clues employed. My proposal is that we look to the empirical clues of entity used in the visual perception of middle-sized physical entities and then employ these clues in the analysis of social aggregates as entities.

Wertheimer, (24, 26 p. 625) has given us a basic list of principles of perceptual organization, demonstrated through research on vision under limiting conditions of low entitativity. His inquiry was as to the factors which lead discrete elements to be perceived as parts of a whole organization, and which determine the organization they will be perceived as parts of. These are his general principles insofar as characteristics of the stimulus elements are concerned:

1. Proximity: elements close together are more likely to be perceived as parts of the same organization.

2. Similarity: similar elements are more likely to be perceived as parts of the same organization.

3. Common fate: elements that move together in the same direction, and otherwise in successive temporal observations

[2] Entitativity: the degree of being entitative. The degree of having the nature of an entity, of having real existence. (The present writer regrets adding two suffix syllables to the word *entitative*, already three fourths suffixes. Probably the "ity" of entity at one time connoted "degree of" being, but that term was so long ago preempted for categorical uses allowing no consideration of degree that some new term must be employed.)

share a "common fate" are more likely to be perceived as parts of the same organization.

4. Pregnance, good continuation or good figure: elements forming a part of a spatial organization or pattern, as a line or more complex form, tend to be perceived as a part of the same unit.

These represent by and large objective or operationally specifiable aspects of the stimulus field. In the analysis which follows there will be an effort to state the diagnostic principles which they imply in such fashion as to bypass the direct visual perception of wholes, and in such fashion as to be equally applicable to stones and social groups.

Pregnance or good continuation may be expanded into the notion of closed figure, or completed boundary. How else could the five blind men of the parable have convinced themselves that they dealt with but one entity, with but one and the same elephant, except by extending their surface exploration until they had described a closed surface, at which point they would have joined hands and achieved intersubjective communicability and agreement on the entity and its shape? I will attempt to so state the first three clues so that they generate boundaries which may then be examined for closure or completeness.

Common fate as a source of boundaries

To start with the stone. Let us at some one moment index the molecules (or some larger, more convenient unit, such as cubic centimeters) of substance in a volume including the stone and adjacent substances. Let us subsequently over a series of occasions record the locus of each unit of substance. From these records let us compute between each pairing of the units a "coefficient of common fate" which will be larger the more frequently the two units have been in the same general region at the same time. If our substance sample is in fact discontinuous, then the coefficients will be very high among those bits of substance which we may subsequently identify as an entity, relatively low between these bits "of it" and other bits which are parts of other "things." The rigidity, solidity, permanence which "real things" are reputed to have are expressions of this "common fate," which excepting for adamant is never absolute, is always subject to rupture.

Let us similarly tag a sample of persons, large enough so that all members of one group are included and many more. Let us observe the locations of these persons on a broad sample of occasions, and compute between each person and each other an index of common fate. Such indices could be similarly used to delineate entities. To be sure, the intra-entity coefficients would never run quite as high as those within the stone, and the inter-entity coefficients would run higher, for small groups sampled within a complex western society. The boundaries, in other words, would be empirically less distinct, less sharp. The entities of stone and group are equally "real" insofar as the formal epistemological procedures for knowing them are concerned, but the stone when known turns out to be more solid, harder, and of sharper edges than the group. Similarly, a band of gypsies is empirically harder, more solid, more sharply bound than the ladies aid society, and the high-school basketball team during basketball season falls somewhere in between, as judged by the average level of the intra-entity common fate coefficients and the ratio between these and the intra-to-extra-entity (inter-entity) common-fate coefficients. On grounds such as these, the zoologist of social insects has scarcely more trouble identifying colonies of bees, ants, and termites than he does in identifying a single bee as an entity, provided he is privileged to observe the behavior of the colony's members over a period of time. (But then, insect groups have sharper boundaries than do human groups.)

The use of coefficients of common fate, differing from zero to unity, enables us to deal with entitativity as a matter of degree, and even in the physical world intergrades occur. Thus between the teapot and the teapot lid the inter-entity coefficients are high, though not quite as high as the intra-entity coefficients. Lower, but still high, are the inter-entity coefficients between cup and saucer. The intra-entity common fate coefficients are higher for a platoon than for a

battalion, and higher for a destroyer crew than for either, etc.

If the three preceding paragraphs have succeeded in conveying the purpose of the common fate coefficient and the general mode of application intended, it is perhaps appropriate to spell out in more detail how such a coefficient might be constructed. It seems easiest to begin for both stones and social groups with common fate in a single physical dimension. Figure 1 shows the scatter diagram for the common fate coefficient for two particles over a population of 12 occasions (t_1–t_{12}). Computing a product-moment coefficient on this scatter diagram would give an index of approximately .99. It seems likely that the two particles are parts of the same entity. Note that had the two particles been labeled spots on opposite surfaces of a rolling stone, the scatter diagram would have been fuzzier, in that sometimes particle A would have been west of particle B, and sometimes east. But if the general range of movement was many magnitudes greater than the diameter of the stone, the coefficient would approach unity. Note that it is possible although perhaps unlikely for common fate coefficients to be unity for particles widely separate in space, and this fact has been suggested by the location of the regression line of Figure 1 off from the diagonal of identity values. Thus the geographical common fate coefficients between two Rockettes at opposite ends of the chorus line may be as high or higher than that between any two adjacent girls. Note that movement of both A and B in longitude must occur before the computation of a common fate coefficient is possible. However, the movement of A may be much less in absolute distance than that of B, i.e., the slope be other than 45°, and the coefficient still be unity.

This mode of approach becomes cumbersome, even at the conceptual level, because it generates a multiplicity of common fate coefficients, one for each measurement dimension, one for longitude, one for latitude, one for elevation, etc. The physicist may be able to suggest an elegant unification in terms of location in phase space, but short of that, the working psychometrician might

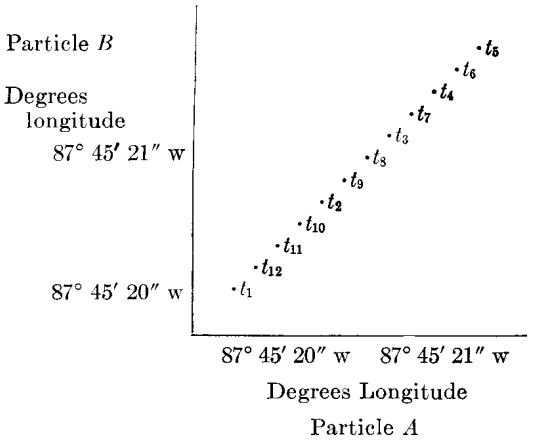

FIG. 1. HYPOTHETICAL COMMON FATE PLOT BETWEEN PARTICLE A AND PARTICLE B.

suggest a composite common fate coefficient. For this, each scatter diagram would be remetricized in standard score units separately for A and B values, and the scatter diagrams then superimposed: each measure at each occasion providing a separate entry, and a single coefficient being computed for the whole set.

The band of gypsies, the basketball team, and the ladies aid society would probably all be diagnosable in terms of a common fate coefficient based upon spatial parameters alone. Other groups might not be, including members of an Indian pueblo, for want of sufficient variability in space or for other reasons. The essence of the common fate coefficient is co-variability in time, and other variable parameters such as activity level, temperature, reflected light, morale, hedonic tone, nutritional status, etc. could be employed.

There was considerable implausibility in the initial supposition that we label all of the particles of the rock. In practice one might paint labels on the surface portions of the stone and compute common fate coefficients among these, and between these and the labeled surface sections of other stones, but the very magnitude of the common fate coefficients, the very solidity (and brittleness) of the stone would have prevented the intrusion of the labeling process for the interior segments, or this intrusion would have fragmented the stone. The

TABLE 1
COMMON FATE COEFFICIENTS FOR THE PARTICLES OF THREE ENTITIES

		1.			2.			3.			
		A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
1.	*A*											
	B	.90										
	C	.91	.92									
	D	.93	.90	.91								
2.	*E*	.55	.52	.54	.53							
	F	.52	.55	53	.52	.85						
	G	.53	.54	.51	.55	.84	.86					
3.	*H*	.15	.10	.16	.17	.32	35	.33				
	I	.18	.11	.14	.16	.34	.31	.36	.95			
	J	.15	.13	.13	.16	.38	.35	.34	.96	.94		
	K	.17	.15	.11	.17	.36	.35	.38	.97	.95	.96	

hypothetical procedure would thus have been in actuality more applicable at the social group level than at the level of stones.

The absolute level of the coefficients is not sufficient to the diagnosis of groups, as that level will vary depending upon the breadth of the sampling of occasions and the amount of activity, the degree to which the gravel pit has been stirred. The boundaries will always be relative, and the degree of correlation which is interpreted as intra-entity will depend upon the general level of the coefficients, both intra- and inter-entity which obtain. The relativity is also implied in the requirement that the diagnostic pool contain particles more numerous than those belonging to a single entity. Table 1 shows a matrix of interparticle coefficients diagnostic of three entities after a process of rearrangement akin to factor or cluster analysis. If the particles are persons, then both primary and secondary group membership are indicated.

Using roll calls as the population of instances, such an approach was employed by Stuart Rice in his chapter on "The identification of blocs in small political bodies" (19), his index of agreement being the practical equivalent of a point correlation between legislators. As he indicates, the purely inductive process becomes overwhelming in magnitude as large numbers of particles are involved. Where a coefficient of common fate is employed as more than a heuristic referent, it will be most easily employed to test already present hypotheses about the location of group boundaries, or to decide which of two modes of classifying a specified population into groups is the more efficient. Applied thus, there are useful shortcut approximations available. If a mean position of all particles in an hypothesized group are computed for each sampled occasion, the variance of these means compared with the variances of the values for the individual particles generates an estimate of the average intercorrelation among the particles, on the basis of acceptable approximating assumptions (15, 17, 18). The mean values of hypothesized group 1 and the means of hypothesized group 2 can be correlated, and this correlation converted into an inferred inter-entity particle correlations, or group 1 and group 2 can be pooled and the inferred average intercorrelation of the composite compared with that of the separated parts, etc. To apply this approach to the composite common fate coefficient, each separate time-measure combination would be treated as a separate occasion, a separate group mean being computed for each.

Similarity as a source of boundaries

If we were upon a single occasion to describe the attributes of each molecule or person, one could in parallel fashion compute one (or many) coefficients of similarity. These could then be used to draw boundaries. Many of the boundaries would be sharp. But in the gravel pit, among the social insects when several colonies of the same species are pooled, and for human social groupings, the boundaries drawn by similarity seem somewhat secondary to those based upon common fate. Thus "red heads" are less a "real" group than "Negroes," in the sense that the latter boundary is confirmed by some degree of common fate, while the former usually is not (except in the one instance recorded by Watson [10].) But perhaps it is more important to emphasize that usually the boundaries concur, but that one criterion may draw a boundary where another does not. Thus common fate may not separate a stone from the spot of tar adhering to it (unless our sample of occasion includes a solvent bath)

while similarity does. Thus the piece of reinforced concrete is less "unified" than a piece of soft limestone by the coefficient of similarity, more unified by the coefficient of common fate, if pulverizing pressures are included in the sample of events.

Many specific procedures and coefficients are available for similarity, and the elaboration in practice has been much greater than for common fate, probably because of the practical difficulties of accumulating data extended in time. To begin with, one could take measures of particles on some single attribute, and then by a sorting procedure applied to the raw scores achieve groupings on this single dimension of similarity which might show relatively sharp boundaries, discontinuous distributions, or types. It must be stated, however, that where applied in this way in practice, single dimensional approaches have rarely discovered types or entities of any clear discreteness or multiple confirmability. On the other hand, starting from hypothesized boundaries or groupings, single dimensions may occasionally be discovered which are reasonably dependable diagnostic clues for entities confirmable by common fate or other diagnostic procedures. Analysis of variance is applicable in such cases. Uniforms, fraternity pins, and shibboleths approach this limiting case.

More common and more generally useful are composite similarity indices elaborated in psychology as indices of profile similarity (8), *Q*-type correlations, (7), etc. The initial use in the social sciences was probably in anthropology. Driver and Kroeber (11) have summarized the early usage and provided a number of applications of their own, trying out a variety of measures based upon the shared and nonshared presence and absence of specific culture traits. While they employed this technique to classify residentially localized social units into spatially dispersed culture areas or historically connected families, it would certainly have been applicable to the classifying of specific individuals, had that been a problem. Indeed, the procedure represents a formalization of the means by which any anthropologist would classify a single person, dressed in his native costume and interviewed about his customs, etc.

In the employment of dichotomous data and fourfold indices of similarity (as tetrachoric correlations, phi coefficients, percentage agreement or percentage of shared traits, etc.) there is a special problem not found when more refined measures of degree are used, having to do with the number of entries in the cell indicating traits absent in both cultures. The count in this cell can be expanded up to the limits of the investigator's ingenuity. Winer (25) has proposed a coefficient invariant in this respect, and Adkins (2) has applied it to a classification of groups. The more general problem of what traits to employ and how many highly similar traits to use probably has no general answer, each set being in the nature of a hypothesis. Once again, it is the relative level of intra-entity coefficients against the background of inter-entity coefficients that provides the boundary.

If a *Q*-correlation type of index is employed, and if extant hypotheses about grouping are being tested, then the procedure of inferring average interparticle correlations from average values for the particles of an hypothesized group is available, as for the common fate coefficients.

While in general, common fate may be found to be more central to the diagnosis of entities than similarity, there is often in practical diagnostic procedures an iteration between similarity and common fate criteria in which an observed similarity dimension may provide a hypothesized grouping which is then tested for intragroup homogeneity on various dimensions of common fate. This iteration makes possible the extension of common fate procedures into situations otherwise inaccessible. Note that the common fate procedures already suggested require the reidentifiability of the individual particles on successive occasions. This is an extremely difficult requirement to fulfill, and is unnecessary if we are testing the hypothesis that a similarity grouping shares common fate on other dimensions than the one used for classifying similarity. Thus even if the football players had no numbers on their backs, on the basis of the spatial

distribution at various moments of each uniform type one could diagnose the separate teams and their discreteness from each other and the onlookers. Analysis of variance techniques seem most appropriate here. The simultaneous handling of multiple-attribute common fate, as latitude, longitude, and elevation, may require extensions in the direction of covariance analysis or discriminant function analysis.

If one were to apply the ancient distinction between primary and secondary qualities, and stop short of regarding all diagnostic procedures as secondary, then similarity might be judged more secondary than common fate. But in the elaboration of diagnostic procedures as in the vertebrate eye and the procedures of science, similarity plays the larger role, and the traditional primary qualities the least elaborated role of all.

Proximity as a clue for entity

Contemporaneous spatial contiguity of particles seems still less "essential" than either common fate or similarity as a cue for entity.[3] However, the fact that it is used by the visual perceptual machinery indicates its general usefulness, and certainly the ethnologist finds it highly correlated with social entitativity, although Tryon's data (22) indicate some interesting exceptions for high social level groupings in the San Francisco Bay area.

Perhaps most significant is the employment of proximity to draw group boundaries where the distribution of interparticle spacings becomes large. Certainly boundaries so drawn would confirm most atomic, molecular, indigenous social group, and other entity diagnoses. For human groups, face-to-face communication processes made possible by proximity generate similarity and feelings of belongingness which make coordinated action and hence common fate more likely.

The value of proximity as a predictor of common fate is primarily a function of the kind of adhesives which hold the particles together in common fate. For atoms, molecules, and the run of inanimate physical objects including the solar system, these adhesives require adjacency. For modern social groups, this may not be essential. Thus the FBI may be a group with sharper boundaries, a harder, more solid social entity than is Davenport County, Iowa.

Reflection or resistance to intrusion of external energy, matter, or diagnostic probes

Still more basic to the visual machinery than the Gestalt organizational principles is diagnosis of boundaries through the reflection or alteration of the speed of particles of matter or wave energy (6). Thus we could locate the boundaries of the stone through the interruption, absorption, or slowing of electromagnetic waves of the light or heat frequencies, of acoustic air compression waves, of tossed ping-pong balls, or of probing fingers. The stone is "opaque" to a wide variety of waves and substances in motion. Its boundaries can thus be plotted, and would be highly coincident or multiply confirmed between the various procedures. It is here that the traditional distinction between primary and secondary qualities has most direct relevance. The primary qualities represent interruptions of the locomotion or manual probes of the diagnosing organisms. The secondary qualities represent probes of lower energy content (as light, sound, or radar waves) when these are employed so as to substitute (6) for the primary ones.

Analogously, group boundaries may occasionally be plotted by the sentry's challenge, by the deceleration locations in the traveler's locomotion, by indoctrination procedures, etc. Hemphill and Westie (16)

[3] Brunswik and Kamiya (5) have estimated it to have an ecological cue validity of only around .20, although their method of computation was different than that implied here which would probably in general give a higher value. Consider the space of an area as divided into cubic centimeter units. Taking pairs of units at random, ask if these are part of the same thing (as judged by all other available diagnostic clues) and how far apart are they. A biserial coefficient, or a coefficient of contingency could be based upon such data, relevant to the Brunswik and Kamiya question of cue validity. The absolute magnitude would, however, vary with the size of the units of reference chosen, the size of the entities in the area, and the breadth of the area sampled.

have suggested permeability as a clue for the rigidity of group formation. It remains to be seen whether practical diagnostic procedures using the reflection of probes will be usable at the group level.

Internal diffusion, transfer, communication

For certain inanimate entities, particularly those of metal, and for animate entities, boundaries can be plotted by diffusion limits and diffusion rate uniformities within the entity, or diffusion rate discontinuities between the entity and adjacent substance, as for heat or electrical potential within metals, and as for blood sugar and oxygen with animals. Thus by use of a radioactive tracer potassium introduced into an animal's food, one could plot the animal's body boundaries with a Geiger counter or photographic paper, plotting essentially the boundaries of internal substance transfer. Plotting the distribution of manufactured products or foodstuffs would similarly diagnose the boundaries of an economic system. Tracings of the boundaries of distribution of a given message have a similar logic. The communication rate between particles, boundaries implied by depressions in the interparticle transaction rate, etc. represent ways of plotting the boundaries of functional social units which Deutsch (9) in particular has emphasized.

At this point we are getting beyond the task of this paper, into Spencer's second question: if there are social groups that meet the criteria of being entities do they also meet the further, more restrictive and more complicated criteria of being organism-like entities? This problem has perhaps already been given adequate attention (e.g., 3, 12, 13, 20). It is to be hoped that such criteria always be understood as implying data series predictions confirmable in degree in any specific instance. As the problem becomes more complex, this operationalizing becomes more difficult. Note that in spite of the obviously greater rigidity of organization in the white rat as opposed to the stone, the latter has higher interparticle common fate and similarity coefficients, although the white rat would still be diagnosed as an entity by these sieves.

Illusions and multiply confirmed boundaries

In the diagnosis of middle-sized physical entities, the boundaries of the entity are multiply confirmed, with many if not all of the diagnostic procedures confirming each other. For the more "real" entities, the number of possible ways of confirming the boundaries is probably unlimited, and the more our knowledge expands, the more diagnostic means we have available. "Illusions" occur when confirmation is attempted and found lacking, when boundaries diagnosed by one means fail to show up by other expected checks. Most frequently, these illusions involve "superficial" similarity contours, as in two-dimensional paintings of "real" objects, distracting contours in camouflage, and the wearing of enemy uniforms in espionage.

In the typical arena of the anthropologist, it seems likely that a multiple confirmability of boundaries similar to that for biological and inanimate entities may be found. For the sociologist and political scientist, a preliminary scouting indicates that the redundancy of boundary diagnoses may be so considerably less and the number of empirically justified delineations of units open to him may be so considerably greater, that the common attitude of regarding all such delineations as arbitrary may seem justified. However, even here an emphasis on the potential multiple diagnosibility of boundaries seems important, even if the boundaries be more numerous, less sharp, and more overlapping, with multiple group membership being the rule. It might well be alleged that any scientifically useful boundary must be confirmable by at least two independent means. Such an emphasis seems necessary if sociology is to retain those attitudes of discovery, problem solving, independent confirmation and validation of construct which have characterized the successful sciences.

Taking an evolutionary perspective on the visual apparatus, it seems clear that the development was predicated upon an environment populated with stable, solid, clear-cut entities—that it could never have developed in a world of fuzzy-edged amoeboid clouds or in a completely fluid, homo-

geneous material space. By analogy, one might guess that the development of any science is predicated upon the discovery of such natural nodes of material organization, upon stable discontinuities. If discreteness and multiple-diagnosability of entities at the social level turns out upon examination to be lacking, then the possibility of a social science representing a separate level of analysis from the biological or psychological will be eliminated. Most sociologists and behavioral scientists judge from their preliminary scouting that while confusing or complex, the situation is not that bad, and that there is the possibility of a science of social groups per se. In the end, this is an empirical matter not to be decided on a priori grounds (4).

It can be noted that the diagnostic procedures here suggested all seem to depend upon the acceptance or achievement of an entity diagnosis at a lower level. Historically this seems not to be so, as we started with diagnosis of middle-sized entities and have worked down to the neutrinos and up to the solar system. In any event, this should provide no qualms for the social scientist who is certainly justified in basing his diagnosis of social entities upon an acceptance of the biologist's diagnosis of organisms. The behavioral scientist should certainly allow himself an applied epistomology which makes use of the achievements of the more advanced and/or more basic sciences, rather than limiting himself to what can be deductively justified on the basis of the contemplations of a mortal philosopher, sitting immobile with both eyes closed, his mind swept clean by intent at least of the biasing effects of all prior learning.

Consistent nominalism and the status of psychology's individuals as entities

In the so-called nominalists of Spencer's example and of Warriner's recent discussion (23) there is a basic inconsistency in the application of nominalism. The sociologist's entity constructions are treated as fictional while the psychologist's entity constructions, such as persons, individuals, or organisms are given a real status, rather than being treated nominalistically. Needless to say, this inconsistent nominalist is often a psychologist looking over the fence at his neighbor sociologist's area. Given the attunement of the anatomic diagnostic procedures to entities of the size of organisms, this inconsistent position can have great intuitive appeal.

Of course, even as diagnosed by the tedious actuarial procedures suggested by this paper, the biologist's organism of protoplasmic cells would turn out to be a much more discrete, clear-cut, hard, and multiply diagnosed entity than almost any of the sociologist's entities (unless the biologist happened to choose slime mold [13] as an example.) But this is the biologist's organism, not the psychologist's. The psychologist's organism would have to be diagnosed or confirmed by common fate and similarity coefficients among responses. Since responses lack reidentifiability, common fate considerations can only be employed to test the hypothesis that biological boundaries are also the boundaries of psychological entities. Analysis of variance procedures with the biological person as a classification criteria (17) are appropriate at this point. Is there variance among a population of responses collected at various times from various persons which is associated with the individual? This turns out to be equivalent empirically to the problem of the reliability coefficient of a psychological measure. These are often high, but occasionally get as low as zero, and uniformly tend to be lower as the persons under study are more homogeneous sociologically. Certainly the boundaries of the psychological person are fuzzy enough to give the psychologist cause for modesty in setting standards for sociological entities. Often enough one can predict responses better from knowing a person's social locus and immediate setting than one can from a knowledge of this biological person's responses in past situations.

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Obscurity is not at all the same as unintelligibility. Obscurity is what happens when a writer undertakes a theme and method for which the reader is not sufficiently prepared. Unintelligibility is what happens when the writer undertakes a theme and method for which he himself is not sufficiently prepared.

—JOHN CIARDI