CULTURE AS AN INFORMATION SYSTEM

E. A. Hammel
University of California, Berkeley

The forms and subtleties of human communication have long engaged the interest of social observers, analysts and actors alike. Attention has been directed to the functioning of language in the communication of fact and of emotion, of the importance of gesture and attitude, and of the ways in which speech is amplified and conditioned by the social context in which it occurs.[1] It is clear, too, that the control and manipulation of communication is important in the establishment of specific role relationships between individuals.

An extension and further consideration of the last point, which has been eloquently examined in the works of Simmel (1949) and Goffman (1959), among others, forms the subject of this essay.[2] If we may define society for our purposes here as a system of interrelated statuses and culture as a set of patterned behaviors peculiar to them, we may regard all of culture as a kind of communication with a single general function. The function of culture, in this view, is that of an information system which provides a vocabulary of messages identifying statuses in the social system, for the actors in that system. To say this is to do only a little more than restate the truism that cultural behavior is patterned and that certain ways of acting and speaking are proper to certain statuses in a given society. It is the view of culture as a consciously employed information system, however, with some of the properties of information systems, which may give the truism further utility. The designation of statuses by actors inter se is anything but simple and automatic, and it is their use of culture as if it were an information system (regardless of what else it may be) that interests us here.

One of the most notable features of information systems is that they may differ in their degree of organization, that is, the degree to which specific items of information are intercorrelated. The degree of organization of such systems is measured, in information theory, by the number of discrete items (expressed as binary digits) which must be "sent" in order to transmit the messages in the repertoire of the system. The degree of organization is expressed as the entropy of the system, such that entropy varies inversely with the degree of organization.[3] Consider, for example, a simple information system designed to send only the messages "dog," "bear," "monkey," and "gorilla," and assume that no other messages can exist. Assume further that sender and receiver share the same information system. The system can contain all four messages as discrete items of information and would thus require "space" for all four items. If the structure of messages was so ordered, however, that two items only were sent, and these in a particular order, one could transmit "carnivore" or not transmit it as the first segment and transmit "small" or not transmit it as the second segment. Although each message would have to contain space for two ordered items, the system as a whole would have to contain only these two, rather than four, but could still transmit all four messages. The organization of the second system is higher, and its entropy therefore lower, than that of the first. The degree of

entropy also reflects the uncertainty of the receiver at any point in time as to the specific nature of the message just received or that to be received next; that is, it is also a measure of ambiguity.

Considerations of this kind are also applicable to cultural communication. Two actors must perceive their own and their alter's statuses with some agreement if they are to interact efficiently. If they do not, the communications between them can be appropriately considered as "noise." If the entropy of their mutual information system is low, their respective statuses are quickly identified, and instrumental social action can proceed. In some rather simply organized societies, in which the number of statuses is limited, recognition of respective status may be immediate; it may, for example, depend only on identification of sex and age. (In fact, the actors may already know each other, but we are not concerned with that instance here.) In more complex societies, where the number of statuses is greater, more communication is necessary between strangers in order to establish the status relationship between them. Beyond this, and in both cases, further communication will often take place in order to establish role and subrole relationships, perhaps down to the last detail of personal style in interaction. Social systems clearly can vary in this way, in the number of statuses and roles they contain, or in our analogy, in the number of messages that may be transmitted. Cultural systems, however, can also vary in the number and organization of items of information that need to be imparted in order to signal a given status relationship. Some social systems, or segments of systems, such as military organizations, are rather highly structured, and the items of information, such as insignia of rank, specify a complex message with a minimum of vocabulary. Others, like groups at a cocktail party, require many items of information in order to achieve specification of relationships.

From one point of view, low entropy and efficiency of communication are virtues. But a social system is more complex than a computer, and from a second point of view the flexibility of most social systems demands redundancy and ambiguity in the items of their cultural systems, precisely in order that status relationships may be manipulated by actors. With a reasonable degree of entropy in the cultural system, that is, with the existence of ambiguity, it is possible to delay precise definition of status relationships between two actors. With redundancy it is still possible to identify these relationships with precision and force once they have been established. A cultural system must thus be extremely flexible; it must be capable of defining some relationships with rapidity and precision but of avoiding the definition of others altogether, and of playing all points of the scale between.

But this second point of view, of constant and free manipulation of signals and of the delights of ambiguity, can be assumed in practice only by the most cynical and self-possessed of actors. If only by introspection, one would suggest that cultural systems were also characterized by a constant psychological strain for consistency of messages, for definition of relationships, and thus for some stability of position and security for actors. On other grounds as well a strain for definition is assured, for in the absence of such definition a society would not operate at all; in fact it would not exist. Further, no society is without differential evaluation of statuses or concepts of super- and subordination of social positions. At least among superordinates one might expect to find insistence on status definition, vis-

à-vis subordinate alters, else their relative position in the social structure would be lost. All in all, the forces for consistency, efficiency, and organization of the symbolic system probably outweigh the requirements for redundancy and ambiguity, so that an unequal balance is achieved, with ambiguity remaining as a spice in the stew.

Having begun this kind of analogizing, I will press it further, first inserting an apologia for a dangerous and often fruitless mode of thought. Analogical reasoning is sufficiently common so that it might be regarded as the basis of all generalization and learning. It ought not to be rejected out of hand as disreputable, as some would do, but should be examined in particular cases to see if its results are useful. Our problem here is to see whether a series of analogies with the concept of entropy are at all useful in understanding certain common cultural phenomena. Entropy, as a concept of communications theory, is a perfectly good, rigorous, and mathematically precise tool for the analysis of communications systems. As a concept of statistical mechanics (where it differs in specific nature, but not in general intent) it is equally precise. It cannot be that precise in its application to the analysis of cultural systems, for reasons to be set forth later. Nevertheless, I would not reject the general implications of these concepts (in communication and in mechanics) as an entering wedge into concerns proper to the social scientist. We might well discard the wedge after its use, but let us retain it for a time.[4]

From what has been said above, positing the particular relationship of culture to society as that of an information system to a series of possible messages to be transmitted, several things follow. The more complex a society is in its structure of statuses, the more complex must be its cultural code for the transmission of status identification between actors. If manipulation of statuses is important (and I believe it always is), the cultural code must always be a little more complex than the series of messages it is to transmit; it must have a degree of entropy sufficient to allow both ambiguity and redundancy. It can thus provide emphatic messages about status, misleading ones, and some messages about statuses that do not even exist. The very richness of its vocabulary may in fact allow the development of new statuses, if it does not stimulate them. The elaboration of human culture and of society, often seen as being of a piece, exhibit in this view a particular kind of interrelationship which may aid in understanding their coordinated, self-reinforcing growth. (See also Hammel 1962, for suggestions on a similar relationship between behavior and values.)

The process of expansion and growth just noted is, by and large, a secular one. There is another, often equally unidirectional, which nevertheless exhibits some of the characteristics of cyclical change in that it often appears, in the structural sense, to go nowhere at all. This is the "trickle effect," or that very large component of intrasocietal diffusion which occurs in a downward direction in social hierarchies.[5] (It is in fact possible to argue that all intrasocietal diffusion involves this "trickle" or, in psychological terms, prestige emulation, but there is no need to force the issue here.) Again, the concept of entropy may be analogically useful. First, let us consider why the trickle effect, in a structural sense, occurs at all. To do this, by our analogical route, we must introduce the concept of entropy in statistical mechanics. There, entropy also refers to the degree of disorgan-

ization of a substance (say, a gas), but the arguments relating to it specify that the entropy of a body cannot decrease without some expenditure of energy. In fact, the entropy of most real systems tends to increase over time, since, if they change at all without input of energy, they can only become more disorganized.

Are there any useful features in this concept for social scientists? If there are, they seem to stem from the fact that the analogy between cultural systems and information systems is partially false in a particular way. The concept of entropy in communications refers to systems which are stationary and ergodic--unchanging in the sense that the frequencies of different signals emitted do not change, on the average, with time. Quite clearly, culture is a non-stationary source, even by definition. It does change. But, as an information system it also has a particular degree of organization. Thus, using both analogies, if it changes at all over time, without any input of energy, it must become a more disorganized information system. Cultures need not change in this non-directed way, but they often do, if only because of errors committed in the acting out of roles or in educational transmission of the rules of behavior. The conscious employment of ambiguity by actors must also play its part. In the absence of constraints and corrective action, then, culture must have an inherent tendency to fall apart. The entropy of statistical mechanics will carry us only this far in analogy; it will not "explain" why the trickle effect in any initial state system starts down the hierarchy rather than up. In order to explain that feature (in an initial state), we would have to assume that any point on a hierarchy was in some way more organized than any subordinate point. We can, however, see how such a process of downward "trickling" might be maintained once it has begun.

If the cultural system of a hierarchically organized set of statuses becomes less coherent and less representative of the set of statuses, it can only mean that the statuses are then less distinguishable from one another in the messages that are exchanged between actors. If there indeed exists the strain for consistency posited earlier, actors will make an effort to re-establish the correspondence between culture and social system by reorganizing the content of their messages. They will, in other words, expend energy in order to reduce the informational entropy of the cultural system. Their tactics can take a variety of forms.

First, all actors may agree that the incumbents of statuses should practice only that behavior appropriate to their status. Second, as a variation of the first technique, superordinates may take steps to prevent the acquisition of their status symbols by subordinates, even though they themselves do not reject their own acquisition of behavior appropriate to statuses above their own. Effort expended in these ways tends to preserve the integrity of the cultural system. The popularity of these means to stability is evident in the multiplicity of devices employed. Sumptuary laws are ubiquitous, and indignation at their transgression is often violent and supported by supernatural sanction. To the actors threatened by this kind of cultural disorganization, violation of sumptuary laws is truly an attack on God. (Communism is atheistic for more than just the obvious reason.) There are, however, more subtle means of preventing intrasocietal diffusion. The symbols of status may simply be difficult to acquire in the sense that acqui-

sition presupposes a certain working minimum; money, in a capitalistic economy, is a perfect example. Further, some kinds of qualifications for status can never be acquired but can only be bestowed. The fact that membership in a kin group and other closed rules of recruitment are so common, particularly at the tops of social hierarchies, is testimony to their effectiveness.

Despite these efforts against creeping entropy, other means are always necessary. They relate not to the prevention of disorganization but to its correction. Such correction can only take the form of acquisition of some new form of behavior as appropriate to a status, to replace that behavior which has been lost through intrasocietal diffusion. It is here that the downward direction of such diffusion may be explainable. At any point internal to a hierarchy, where such new behavior must be acquired as a corrective, there is ordinarily only one possible source--the statuses above. Given human evaluation of statuses and of their customary behavior, it is too much to expect that actors will replace the lost distinctive features of their statuses with cultural materials from below them, particularly since the inferior patterns may be recognized as former customary behavior of their own. (An exception to this point will be noted below.) By and large, actors will acquire cultural materials both which are appropriate to statuses above them and with which they are familiar. If the behavior they borrow has been public, they may borrow it from far up the scale (if they can afford to acquire it). If it has been private, but they nevertheless know of it, they must borrow it from a status more nearly adjacent to their own. Songs and dances, which are cheap and public, move rapidly through hierarchies. Airplanes and Cadillacs, which are public and expensive, move more slowly. Sexual habits, private and inexpensive, move even more slowly. (My imagination and sense of decorum will not cooperate to provide examples of behavior which are both private and expensive.)

These phenomena have been discussed from the standpoint of preservation and strengthening of existing cultural information systems. Nothing, in fact, has been said about status hunger, about emulation, only about a desire to preserve the structural status quo. This is a conservative attitude, to be sure, but the most radical departures from expectations can be traced to conservative forces if one wishes. Consider, for example, a marked exception to the general rule of downward diffusion in social hierarchies-- the folkloristic revival. Boston Brahmins dance to Cotton-Eye Joe, and Peruvian debutantes sample sebiche and step to the marinera. There are many explanations for such adoptions of lower class behavior by the elite. (Not a few Peruvians eat sebiche because they like the taste.) But from a systemic viewpoint, and with attention to the markedly nationalistic context in which such folkloristic revivals occur, it is clear that the conservative view may again have its utility. Elites, in the modern world, have much in common--so much, in fact, that they are often hard put to distinguish themselves one from another. Often, they will compete in their rates of borrowing from some mutually prestigious source, such as Paris. But even Paris has its limits as a supplier. Ultimately, intercommunicating national elites can only distinguish themselves by borrowing from those segments of their own populations which are normally the most isolated and therefore culturally most different--their peasantries.

A borrowing of this kind from below in fact contradicts our earlier remarks only in part, since it does not occur between adjacent points in the hierarchy. It is as if the route of diffusion were a loop, from the elite by stages to the plebes, and then directly again to the elite--from the minuet to the reel. In its final folkloristic jump back to the elite, the "peasant" custom is more often than not reintroduced by experts in nationalism and does not constitute a direct borrowing at all.

Invention is of course another possible answer to the problem of the differentiation of elites, but it is rare. Significantly, it seems to be concentrated in the hands of artists and members of the intelligentsia in modern society, actors occupying an anomalous social position. Below the "top" of the hierarchy in many dimensions of value, they nevertheless hold superordinate positions in particular aspects of their culture. Like others, they lose the ability to communicate the nature of their status as soon as others borrow from them. Scorning to borrow from below, yet rejecting much of the behavior which signalizes generally superior status, they must create entirely new patterns to revalidate their positions. They, too, will borrow, but when they borrow for themselves one often finds the curious phenomenon of scorn for their own peasantry and avid borrowing from someone else's.

If the concept of entropy is at all useful in considering these phenomena, its employment should lead to the formulation of testable hypotheses that could not conveniently stem from another set of concepts, or which at least seem obvious from the nature of entropy and the arguments following from it.

(1) If the general effects of entropy are as given, so that intrasocietal diffusion tends to occur down hierarchies (even if they are multiple and complex), outright innovation should be commonest at the tops of such hierarchies, as should borrowings from other cultural systems. Internal borrowing should be most frequent in the body of a hierarchy, and innovation and external borrowing rarer. In general, the evidence of observation seems to be in accord. Most new items in a complex culture start at or near the top of at least one dimension of value and work down.

(2) If diffusion indeed acts as a stimulus to innovation at the top, societies in which intrasocietal diffusion is common should exhibit a greater rate of innovation than others. Since such diffusion should occur more frequently when hierarchies are multiple, complex societies should exhibit a greater rate of innovation than simple ones. A similar conclusion is evident when one considers that complex societies must, of necessity, have a more complex cultural information system, with greater opportunities for error and ambiguity (both conscious and unconscious) in the transmission of status-signalling messages. That higher degree of entropy, in itself, should stimulate efforts at reorganization, part of which would result in innovation. The greater innovative activity of complex societies also seems confirmed by observation.

(3) Hierarchies have one characteristic which is frequently ignored--that is, they have a bottom. Consider the fate of this bottom in intrasocietal diffusion. It obtains new cultural elements via the trickle effect but passes them on to no one, since there are no subordinates. At any other

point in the hierarchy, two things can happen to an item of the cultural information system: it can be diffused downward, or it can pass out of existence. Both processes would stimulate replacement. At the bottom, however, only one of these--outright disappearance--can occur. The stimulus for replacement must on that account also be less frequent. If that is so, less borrowing from above should occur, so that the next point above in the hierarchy would longer retain its integrity as a unified set of cultural signals. These effects should be felt up the hierarchy, perhaps in diminishing degree. If these speculations are correct, some negative feedback is present in intrasocietal diffusion, a feedback which acts as a brake on an otherwise self-reinforcing process. General corroboration of these speculations may perhaps be found in the greater traditionalism and reluctance to change found in lower segments of social hierarchies.

In defense of the proposition that these speculations have not been idle, I can only suggest that they may arrange a variety of cultural and social phenomena in a relatively unified way, so that their interrelationships may be compared along a single dimension. That more than the straw man of entropy is involved in culture change and in manipulation of information cannot for a moment be denied, but to think of it as being at least partially involved is an aid to the sociological imagination. Apart from its general analogical utility, however, the concept of entropy seems to pose many operational difficulties. In a most rigorous view, the analogy is useless unless it can be applied precisely, and that does not seem possible at the moment. First, social systems are not stationary sources of information, so that the concept of information entropy applies only to ideal systems of cultural information. Second, the complexity of messages, unit by unit and through various levels of contrast and context, is so great as to defy measurement. Even these difficulties could be overcome if one were to regard the concept of entropy as proper only to a model of ideal sociocultural systems, with all actual implementations only as approximations. But there is a more serious difficulty--that of the nature of the message.

In a telegraph system, the output message is a telegram. It can be objectively compared with the message specified at the source to see if it is the same or different. Indeed, in all of the communication systems in which the concept of entropy is legitimately applied, the messages are in some sense objects in the real world. But in the speculations offered, the messages are constructs, either of the analyst or of the actors in a social system. We may quite properly calculate the number of bits necessary to send the message "dog," because we can see it printed out, d-o-g. We are not concerned whether our code, be it 1011 or anything else, specifies a "real" dog but only the word, "dog." All of the calculations of information theory are concerned with messages in natural (and sometimes artificial) languages which have some objective existence in themselves. If we are to extend these concepts to the cultural language which describes status, we must be sure that it is a language with objective validity. The problem occurs with natural languages as well, but there it is possible to determine whether or not the words of the language designate some identifiable referential object or not and whether or not actors are in accord about such designations. (At least one can ask whether the words, spoken, correspond to certain written forms that can be identified.) With statuses as our referential objects, the anchor is much less secure. If we depend on native

conceptions of social status we are culture-bound and faced with the difficulty of investigating a communication system only by means of itself. If we attempt to use a universal scientific language of description, we find that no such language exists, except for restricted spheres of culture and in the most general terms.

It should not be thought, however, that the enterprise is hopeless. The complexity of social and cultural phenomena will be described in time, as analysts develop a culture of investigation which enables them to ignore those aspects of events which are, for any particular theory, irrelevant. It is not too much to suggest that the concept of culture as an information system may aid in that process. By focusing attention on the descriptive problem of just what bits of information are transmitted in behavior and on the inferential one of identifying the status messages involved in these signals it may lead to further refinement of our consideration of the activities of Maxwell's real demon.

NOTES

[1]In anthropology, some of the more recent investigations and reflections in these matters are found in Hall (1963), Gumperz (1961), Hymes (1962).

[2]Versions of this paper were presented at the 61st Annual Meeting of the American Anthropological Association, Chicago, 1962, and to the Stanford Anthropology Club, January 1963. I am indebted to the Center for Advanced Study in the Behavioral Sciences for providing the time and freedom to discuss and develop some of these ideas, and particularly to D. H. Hymes, T. D. McCown, and J. H. Rowe for their criticisms. Rowe has also written on some of the phenomena considered here (1962); the basis for this article was in fact laid in seminar discussions in 1957 (see Rowe 1962).

[3]For general presentations of the nature of information theory see Cherry (1961) and Pierce (1961).

[4]Pierce (1961) is particularly (and rightly) critical of confusions between the entropy of information theory and that of statistical mechanics, as well as of their incautious analogical usages in other fields. There remains, however, a vague similarity between these entropies and some of the phenomena discussed here. This article, in fact, attempts to take advantage of just those tantalizing ambiguities and similarities, with apologies to Pierce's justifiable demands for true rigor in application.

[5]For discussion of the nature and functions of the trickle effect see Fallers (1954), Rowe (1962), Tarde (1903). For some empirical examples in Peru see Hammel (1961).

REFERENCES

CHERRY, C.
1961 On human communication. New York, Science Editions. (Originally published by the M.I.T. Press and John Wiley and Sons, 1957.)

FALLERS, L.
1954 A note on the "trickle effect." Public Opinion Quarterly 18:314-321.

GOFFMAN, E.
1959 The presentation of self in everyday life. New York.

GUMPERZ, J. J.
1961 Speech variation and the study of Indian civilization. American Anthropologist 63:967-988.

HALL, E. T.
1963 A system for the notation of proxemic behavior. American Anthropologist 65:1003-1026.

HAMMEL, E. A.
MS-a Intrasocietal diffusion and the sociology of entropy. Paper presented at the 61st Annual Meeting of the American Anthropological Association, November 1962.

MS-b Culture as an information system. Paper presented to the Anthropology Club, Stanford University, January 1963.

1961 Wealth, authority and prestige in the Ica valley, Peru. Albuquerque, University of New Mexico Publications in Anthropology, No. 10.

1962 Social rank and evolutionary position in a coastal Peruvian village. Southwestern Journal of Anthropology 18:199-215.

HYMES, D. H.
1962 The ethnography of speaking. In Anthropology and human behavior, T. Gladwin and W. C. Sturtevant, eds. Washington, D.C., The Anthropological Society of Washington.

PIERCE, J. R.
1961 Symbols, signals and noise: the nature and purposes of communication. New York, Harper and Bros.

ROWE, J. H.
1962 A social theory of cultural change. Berkeley, The Kroeber Anthropological Society Papers, No. 26, pp. 75-80.

SIMMEL, G.
1949 The sociology of sociability, E. C. Hughes, trans. American Journal of Sociology 55:254-261.

TARDE, G. de
1903 The laws of imitation, Elsie C. Parsons, trans. (from the 2d French ed. of 1895). New York, Henry Holt. (First French ed. published in 1890.)

VEBLEN, T.
1953 The theory of the leisure class. New York, Mentor Books. (Originally published in 1899, the Macmillan Co.)