

An Information-Theoretic Scale  
for  
Cultural Rule Systems\*

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\*This research was supported by the Russell Sage Foundation.

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ABSTRACT. Important cultural messages are expressed in nonverbal media such as food, clothing, or the allocation of space or time. For instance, how and what a group of persons eats on a particular occasion may convey public information about that occasion and about the group of persons eating together. Whereas attention seems to be most commonly directed toward the individual character of the information, the present concern is the quantity of public information, as observed in the pattern of nonverbal cultural signs. To measure this quantity, it is proposed that the pattern of cultural signs be encoded as a sequence of abstract symbols (e.g. letters of the alphabet) and its complexity appraised by a suitably adapted form of the measure of Kolmogorov and Chaitin. That is, an algorithmic language is constructed and the mathematical information quantity is reckoned as the length of the shortest program that yields the sequence. In this cultural context, the measure is called "intricacy". By focusing on syntactic structure and pattern variation rather than on background levels, intricacy resists some influences of material wealth that tend to distort comparisons of individuals and groups. A compact mathematical overview of the theory is presented and an experiment to test it within the social medium of food sharing is briefly described.

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## 1. Introduction

The information that concerns us here is from the set of public meanings shared by persons of the same culture. Certain categories such as day and night, times of the year, life-cycle events, and some social relationships fall clearly into the domain of public meanings. Such information is continually conveyed, implicitly and explicitly, by messages expressed as patterns of public signs. For instance, food or clothing generally tells something about the occasion and about the persons present. Clearly, the more our choices of food, clothing or other public signs respond to the public categories of occasion and social relationship, the more possibility there is that observation of such signs can reveal something about those categories. We describe herein a method for measuring the quantity of information latent in a pattern of public signs, which would provide a new basis for sociological comparison. The measurement itself is called "intricacy".

The concept of responsiveness is the key to understanding intricacy. If our choices are too few, or if we fail to avail ourselves of existing opportunities, then our behavior carries less information than its capacity. On the other hand, if our choices are intentionally arbitrary or intrinsic, then different choices do not express different public meanings, and the information content of our behavior is less than it might be, despite the seeming variety of choice. The most highly intricate system of choices is the one that is most responsive to public distinctions. Of course, in a given culture most of the choices are implicit in the sense that few persons expend any effort deciding whether it is time for breakfast or time for dinner. Such public information is transmitted without the burden of decision.

The notion of intricacy presented here arose in the course of an attempt to construct a mathematical measure of what M. Douglas [1970,1978] calls "grid". Her grid-group analysis provides two orthogonal dimensions for ranking social structure, and she describes the kind of behavior one may expect to find in a community, based on the location of its grid and group coordinates. Grid is identified with the strength of the public classification system and group with social pressures on the individual. Douglas describes grid and group as counterparts to the concepts of "positional control" and "personal control" developed by B. Bernstein [1971] in his linguistic studies.

In high-grid communities, the classification of social roles is highly developed and there is little room for individual maneuvering. Based on the account by R. Benedict [1934], the noncompetitive Zuni appear to be a high-grid, high-group culture. As an example of the concurrence of high grid and low group, Douglas suggests early 20th century England, with its insulating concept of social rank. Low-grid communities permit more striving for power. Among the highly individualistic Kwakiutl, who seem to be low group as well as low grid, there is continual competition for social supremacy. In the low-grid, high-group gradient one might find certain religious cults that have only a weak hierarchical structure, but are in-marrying and otherwise strongly cohesive as a community.

It might be observed that in this brief review of grid-group examples, the assignment of a grid coordinate to a community is based on nominal reports. One goal of this research is to provide a definitive basis for intricacy ranking. If intricacy is a good represent-

ative of grid, then it might become possible to test whether the social characteristics that Douglas anticipates at various locations on the grid axis are realized.

The quantity of public information carried by the messages in nonverbal media is expected to be of interest in itself, whether or not it corresponds exactly to grid. For instance, one might ask whether a culture transmits proportionally high information content in all the various nonverbal media, or whether it is high in some and low in others. How does the information rate vary as a community adapts to external pressures, such as war or a dominant surrounding culture that threatens to assimilate it? What may be inferred about different individuals or households in a community from different information rates?

If intricacy proves to be a useful concept in cultural analysis, it will be because it provides insight not already easily accessible. The purpose of this inquiry is to obtain a new model for social processes that might enhance our ability to predict cultural evolution, not merely to provide an alternative description. (For a more direct examination of cultural evolution, see L.L. Cavalli-Sforza and M.W. Feldman [1978].) Precisely, we are inferring from the patterns of public signs the strength of the hold of the store of public meanings.

This paper outlines a new approach to behavioral structure and a supporting program of research now in progress. Adherents to the top-down philosophy of computer programming will surely wish to read this overview before examining the numerous details in the supporting papers. Douglas and Gross [1979, 1980] have already presented an anthropological

perspective on intricacy and behavioral structure, which anthropologists might want to read prior to the present paper.

## 2. Measuring the information content of messages

The mathematical sense of information quantity in a message is identified with the syntactic complexity of the message structure, rather than with semantic attributions of meaning or importance of the message content. This paper outlines a methodology by which the concept of information quantity, introduced to mathematics by A.N. Kolmogorov [1965] and G.J. Chaitin [1966], can be applied to cultural systems as an index of structuredness. As discussed by Douglas and Gross [1979], such an index might provide insight into the strength of social norms, independent of the individual character of the norms.

In a cultural context, a message is a pattern of ethnographically significant signs generated in a social medium such as the use of clothing, the allocation of space or time, religious assembly, or the sharing of food. For some media - perhaps clothing is an example - the bulk of the meaning might be in the presence or absence of specific signs. Is a hat worn? Are the limbs fully covered? For other media - food sharing seems a prime example - the pattern itself carries strong meanings. A long succession of courses might mean an important feast, even if we are insufficiently familiar with the specific food varieties to identify the occasion. The sequence breakfast-lunch-dinner marks a workday for certain cultural groups, regardless of which foods are served.

In an experiment described here, food sharing is adopted as a fixed medium through which to study differences in persons and differences in cultures, while the issue of differences in media is temporarily set aside. A fundamental hypothesis to be tested is

that persons and cultures can be distinguished according to the syntactic complexity of their cultural messages in food sharing activities. The term "intricacy" is introduced here for an information-theoretic measure of syntactic complexity, because it suitably suggests the difficulty of mastering the rules by which the cultural message is generated. A somewhat sharper form of this first hypothesis can now be stated:

H<sub>1</sub>. In general, the intricacy of a food distribution pattern is inversely related to the variance over social time of the per capita food quantity preparation.

Both the quantity allocated per person and the distribution pattern (e.g. course structure) are capable of responding to differences of social occasion. Hypothesis H<sub>1</sub> states that the responsiveness of either of them is inversely related to the responsiveness of the other. Measurement of quantity allocations does not require new theoretical tools, but the syntactic structure of the food distribution rule system has not previously been quantified.

In seeking to compare the amounts of syntactic structure in rule systems for the same sort of activity in two different social groups, an obvious place to start might seem to be trying to count and compare the number of rules. However, it is not clear what is meant by the notion of a single rule. Natural languages (such as English) include both syntactic and semantic tricks, such as compounding and redefinition, that permit any collection of rules, no matter how long or complicated, to be reformulated as a single sentence. It is well-known to logicians that this is a serious problem, not readily circumvented by imposing



simple restrictions on natural language constructions. Furthermore, there exist rules that are known to all but rarely obeyed, rules that would be obeyed if anyone could remember them, and rules that are obeyed implicitly, despite the fact that there is little consciousness of them. Which set of rules should one count, and how?

Counting rules in social systems seems hopeless only if one uses naive models for the systems. If instead, social systems are represented as programs in an algorithmic language as described in Section 5, then counting rules makes perfectly good sense. Adopting a pragmatic philosophy, we strive to achieve an optimally efficient algorithmic representation of the behavior actually observed during a well-chosen time interval. Consistent with the viewpoint of algebraic information theory, we identify the complexity of a social system with the minimum number of rules needed to represent it. Calculating the exact minimum is ordinarily very difficult, but the practical problem of obtaining complexity rankings can be simplified by using approximations. The objective of this paper is to provide a top-down explanation of how this method of appraising complexity can be applied to social systems.

Our general objective is to establish a meaningful sense in which the syntactic complexity of social behavior is reliably measurable. One may then identify behavior syndromes consistent with high, low, or medium complexity. For instance, one might hypothesize that high intricacy correlates to high social predictability. In an experiment described in Section 6, we are testing, in addition to  $H_1$ , a special case of this latter hypothesis:

$H_2$ : High intricacy in food sharing activities is culturally consistent with high predictability of the participant list.

Social predictability is only one of many cultural traits that might be associated with high intricacy. Once syntactic complexity is measurable, one might also investigate issues such as the different ways in which high and low intricacy cultures adapt to social change, if indeed they are different. For instance, is a low intricacy society more tolerant, perhaps because it imposes lesser structural demands on behavior, or is a high-intricacy society more tolerant, possibly because it institutionalizes responses to deviance?

### 3. Symbolic representation of behavioral patterns

The first step in calculating the intricacy of a behavioral system is to choose a level and to decide what are the signs at that level. This choice is a matter of ethnography, not of mathematics.

For instance, in a food system, the types of events, such as breakfast, lunch, and dinner, are signs at the same level. Breakfast means the day is starting, and so on. One might treat these types as elementary signs or one might drop-down a level and analyze a type of event into its course structure, such as appetizer, main course, and dessert. At the next level, one might further analyze a course into the categories of food variety permitted or required, such as meat, green vegetable, and starch. Food varieties may be analyzed into ingredients and recipes, and ingredients may be analyzed for their chemistry. Presumably, an ethnographer would stop the process of finding new levels before the social meaning is lost. An intricacy measurement might reasonably be made at any level before then.

As a paradigm for the structural analysis of a food system, consider the work of Douglas and Nicod [1974] on the food system of a segment of the British working class. Table 1 tells what type of meal is appropriate, according to the time of day and to the day of the week. The three basic types in this system are called A, B, and C, and they may be described briefly as a main meal, a secondary meal, and a tea and biscuits meal, respectively.

Table 1. A British working-class meal system (simplified).

	12:30 pm	1-2 pm	4:30 pm	5-6 pm	6:30 pm	9:30 pm
Weekday	B		C		A	B
Sunday		A		B		C

In the accompanying deeper analysis, Douglas and Nicod describe not only the breakdown of meals by course structure and the courses by category of food variety, but also flavor and thermal aspects of structure, elaborations for holidays, the invariant biscuit to end the meal, and much more. To keep to a simple situation that will facilitate explanation of intricacy measurement, we will stay with Table 1 and regard the meal types as elementary signs.

The second step in calculating the intricacy of a behavioral system is to record the sequence of signs that occurs during a reasonably long time interval, ideally long enough for several repetitions of the fundamental pattern. Of course, what seems an ideal interval to a mathematician might seem utterly unfeasible to an anthropologist. Fortunately, in view of Nicod's experience, this possible conflict of ideals need not always be troublesome. In particular, an observation period of one month for food events might well be enough to capture most of the complexity of a system, if one has some prior knowledge of that system.

Suppose that an anthropologist interested in the complexity of the food system arrives in the community to which Table 1 is applicable. After spending enough time to learn how to correctly classify food events into categories A, B, and C, the anthropologist records the sequence of events. For the sake of simplicity, suppose that no holidays, life-cycle events, special visitors or other phenomena caused any changes

from Table 1 during the observational period. For the sake of discussion, suppose that the recording of the events starts when the time happens to be 4:30 pm on a Wednesday and continues for 120 events. Then the pattern is as follows:

CABBCABBCABBCABABCBCABBCABBCABBCABBC  
ABABCBCABBCABBCABBCABBCABBCABABCBCABBCAB  
BCABBCABBCABBCABABCBCABBCABBCABBCABBCABB

This pattern represents only the summary observations reported by Douglas and Nicod. Of course, different commensal groups within the same culture might exhibit somewhat different patterns. To compare the intricacy of several different commensal groups, one records the pattern of events for each over comparable time intervals. If there is a reason to make the comparison at the level of food event types, it is sociological, not mathematical. The comparison of pattern complexities might equally well be performed at the level of course structures, of categories of food variety, or even of ingredients and recipes for food varieties. One question of obvious theoretical importance is whether the same intricacy rank would be obtained at most levels. For instance, does the commensal group with the most intricate pattern of event types also give its meals the most intricate course structure and employ the most elaborate combination of recipes. If so, then a high intricacy permeates the food sharing system of that culture. If high intricacy is also found in other social media besides food, one might suggest that high intricacy is an overall characteristic of that culture.

A larger number of food event types in one commensal group would not automatically imply higher intricacy of the pattern of events, since it is possible to design as intricate a pattern from as few as two characters as from, say, five or eight. It is conceivable, however, that field observation might determine a correlation between pattern intricacy and

the number of event types, or of the numbers of courses or of recipes used in the regular diet. To illustrate that greater variety of signs alone need not imply greater complexity of patterns, compare the following two strings of characters:

ABCDEABCDEABCDE ...

ABBABBBBABBBBBBABBBB ...

The rule for the first string is so obvious that few persons would have difficulty in correctly guessing that the next five characters are ABCDE. The rule for the second is probably less obvious to most persons and surely no more obvious to anyone. One may observe that the subsequences of B's grow in size from two to four to six and infer that such a growth rate continues so that the next five characters would be BBBBA. In case this example does not fully satisfy some persons in regard to the point, we resort to overkill, with the following additional example:

ABAAABBAABAAABABBBB ...

What is the rule for writing the characters? The answer is given at the end of this section.

Roughly speaking, the intricacy of a pattern is what makes it difficult to understand the rule or to explain the rule to someone else. This rough description is not fully satisfactory, however, because of the problems described in the introduction and because difficulty is a perception based on prior experience. Nonetheless, it is a good first approximation to the notion of intricacy.

The overkill example comes from the ratio of the circumference of a circle to its diameter, i.e. from the number  $\pi = 3.14159265358979323846 \dots$ . If the  $n$ th decimal digit of  $\pi$  is odd, then the  $n$ th character is an A.

Otherwise it is a B. The general point being made is that a culture with low material resources, an impoverishment of signs, could still develop a highly intricate system.

#### 4. Inference of rules from small data samples

The third step in the calculation of intricacy is to infer a rule or a system of rules from the recorded pattern. This step is essentially a more sophisticated version of a type of mathematical puzzle.

An extremely elementary illustration, we considered two patterns so simple that it seems unlikely they could have arisen in a food system:

P1: AAAAAAAAAAAAAAAAAAAAAA ...  
 P2: ABABABABABABABABAB ...

The next character in both patterns is "obviously" an A, but our upgraded puzzle is to state the rules. In English, one might say of pattern P1 that "every character is an A", and of pattern P2 that "A's and B's alternate". It would clearly be a mistake to conclude that pattern P2 is simpler because its rule has only four words, while the rule for pattern P1 has five. In the next section, it will be explained why pattern P2 is more intricate, which would agree with our intuition.

There arise immediately two problems. One is the practical problem that if the sample is incomplete or contains errors of observation, then the rule inferred will be incomplete or lead to errors in prediction. This practical problem is tractable in the sense that minor omissions, e.g. of rare events, and minor errors lead only to minor distortion of the complexity of the pattern.

Needless to say major errors in the data will cause major distortions, and the lack of a sound ethnographic basis will render the data meaningless. The other is the mathematical problem that many different rules can be devised to agree on a finite initial segment of a pattern, but to mutually



disagree on what might happen next. For instance, one could explain pattern P1 by the rule that every 25th character is a B, or by the rule that after the first 300 characters, A's and B's alternate. Thus, it seems that the puzzle could be ill-posed.

After a precise definition of rules, of systems of rules, and of the complexity of systems of rules are given, Occam's razor cures the problem of ill-posedness. That is, given several explanations of the pattern, one adopts a least complicated one.

5. An algorithmic language for cultural patterns

To represent rules precisely, it is necessary to have a language that is free from ambiguities and other hazards of natural languages. The design of such a language for cultural rules would follow the design of a computer language. In general context, such a language is called an algorithmic language.

Two instruction types are enough to give the language a start. A present instruction tells one to present whatever elementary sign is named as its operand. A go to instruction indicates the number of the next rule, in case the rules are not to be executed strictly in ascending sequence. A list of instructions in this language is called a "program". For example, the following are programs for the systems represented by patterns P1 and P2 of the previous section.

Program for P1

1 Present event A  
2 Go to rule 1

Program for P2

1 Present event A  
2 Present event B  
3 Go to rule 1

One begins the executing of any program with the lowest numbered rule. Thus, the first step in executing the program for P1 is rule 1, to perform event A. After a present instruction, one executes the next rule in ascending sequence, in this case, rule 2. Rule 2 says to go back to rule 1, where one is instructed to present event A again. The way this program is written, one will continue forever to present event A.

To execute the program for P2, one begins at rule 1 of that program, which is to present event A. Rule 2 is next, where the instruction is to

present event B. Then rule 3 says to go back to rule 1, and the process repeats itself, so that events A and B alternate forever.

If one uses only present instructions and go to instructions, then it would take 28 rules to describe the simplified British working-class food system, because in that system a cycle of 27 steps is repeated over and over again. The program would consist of 27 present's followed by a go to to get back to the beginning of the cycle.

According to the viewpoint of Kolmogorov [1965] or Chaitin [1966], the complexity of an abstract pattern equals the number of rules in a minimum length program (in an algorithmic language) to produce that pattern. If the algorithmic language permitted only present's and go to's, then the intricacy of pattern P1 would be 2, the intricacy of pattern P2 would be 3, and the intricacy of the British working class system would be 28.

The defect in this super-simple formal language is that it does not correspond well to the cultural systems it would be used to describe. For instance, the main cycle of length 27

B1: CABBCABBCABBCABABCBCABBCABB

is simpler in the intuitive sense than some other possible patterns with a main cycle of length 27, but also more complicated than some others of length 27. In a well chosen algorithmic language, complexity would be a more meaningful quantity than the length of the main cycle plus one.

One possible analysis of the British main cycle is that there is a minor motif CABB, which occurs five times. Three iterations of this motif are followed by a special motif CABABC, then two more iterations of CABB. However, if the visiting anthropologist learned that the British week begins on Sunday morning, then the main cycle might be transcribed as

B2: ABCBCABBCABBCABBCABBCABBCAB

which is analyzed as a Sunday motif ABC followed by six iterations of the weekday motif BCAB. This second analysis is somewhat simpler.

At the very least, an algorithmic language for cultural rules should have a facility to reiterate minor motifs. This facility is provided by the do instruction. The two programs shown below use the do instruction in representing the first and second analyses of the British food system.

If this augmented algorithmic language were adopted, the intricacy of the British working-class food system pattern would be at most 9, the length of the shortest known program that produces the pattern. To prove that it is not smaller than 9, which happens to be true, one would have to show that no program in the language with fewer than 9 instructions could produce the pattern. Computer scientists know that establishing the exact minimum length is generally an extremely difficult problem. Fortunately, for the present ranking purposes, an approximation may suffice.

It is surely no surprise that the British food system is more intricate than patterns P1 and P2. Even though our long-range concern is what the proposed intricacy measurement might reveal about the most difficult examples, it is essential to confirm that at least it gives appropriate rankings to examples on which nearly everyone's intuition would agree. In Section 5 we consider the problem that many systems look complicated because there seem to be virtually no rules at all. For the moment, however, we examine an additional example whose complexity relationship to the earlier examples is intuitively clear.

Pattern P3 represents a system that uses the British weekday motif BCAB

Program for B1

- 1 Do 3 times rules 2 to 5
- 2 Present event C
- 3 Present event A
- 4 Present event B
- 5 Present event B
- 6 Present event C
- 7 Present event A
- 8 Present event B
- 9 Present event A
- 10 Present event B
- 11 Present event C
- 12 Present event B
- 13 Do 2 times rules 14 to 17
- 14 Present event C
- 15 Present event A
- 16 Present event B
- 17 Present event B
- 18 Go to rule 1

Program for B2

- 1 Present event A
- 2 Present event B
- 3 Present event C
- 4 Do 6 times rules 5 to 8
- 5 Present event B
- 6 Present event C
- 7 Present event A
- 8 Present event B
- 9 Go to rule 1

for every day including Sundays, so it is intuitively apparent that it is more complicated than patterns P1 and P2 but less complicated than the British system itself.

P3: BCABBCABBCABBCABBCAB ...

The following program for P3 has length 5, so the calculated intricacy falls between that of pattern P2 and the British system, assuming that the program could not be shortened, which it cannot.

#### Program for P3

- 1 Present event B
- 2 Present event C
- 3 Present event A
- 4 Present event B
- 5 Go to rule 1

The choice of an algorithmic language for expressing cultural rule systems is another matter of anthropology, rather than of mathematics. This mathematician would suggest that the algorithmic language constructed so far still needs at least an if instruction to represent conditional executions, a counting facility, and an input instructions to permit the pattern to react to other events besides time flow, and a subroutine capacity. Readers not already familiar with computer programming might refer to Brainerd Goldberg, and Gross [1979] .

## 6. An experiment on food systems

During the academic year 1978-79, the Russell Sage Foundation sponsored ethnographic studies of four food systems, under the direction of Mary Douglas. Douglas had suggested that structural patterns in the food system might provide an implicit form of control over various possible excesses, since both the kinds and quantities of foods consumed are often more directly related to their symbolic values, secular or religious, than to their nutritional content.

One fundamental hypothesis to be tested is that the intricacy of the pattern of public signs varies in response to social cues of time and participant lists. That is, given a set of ethnographically significant signs at a fixed level, one can describe the patterns for individual events and measure the intricacy of the events. It is suggested here that certain persons and certain occasions will consistently rate a high intricacy presentation of an event, while others rate a low intricacy presentation. Time cues include not only calendar time, but also meteorological phenomena and life-cycle events. It is expected that intricacy responds to categories of participants and to numbers of participants, not just to individuals. We are also testing hypotheses  $H_1$  and  $H_2$  as formulated in Section 2. Publication of the experimental results is forthcoming.

In many real-world food systems, there might appear to be such a superabundance of signs and such irregular behavior patterns that one scarcely knows whether this is extreme complexity or whether there are no rules at all. For instance, persons eat at vending machine locations and fast food outlets. They skip meals or parts of meals. They go on diets, they eat snacks, and they change their procedures when the children

go to summer camp. Nor can one depend on informants, who are likely to disagree with each other even on what might seem to be clear-cut issues.

While it cannot be easy to establish the correct classifications under such circumstances, the public information principle is a guideline. For instance, if whenever one person goes to a restaurant for lunch instead of the company cafeteria it indicates that a business associate will also be present, then restaurant lunch and cafeteria lunch are different signs, because the attendance list is in the prescribed information subset. If another person chooses between the cafeteria and the restaurant because of a last-minute whim or because of prior knowledge of the cafeteria's menu for a particular day, then for that person the restaurant lunch and the cafeteria lunch are the same sign, since the basis for selection is not in the prescribed subset of public information.

It should be noticed that in Kolmogorov's work, the most complex sequences are to be regarded as random. On the other hand, a random "behavior" is decidedly unresponsive to social input and gives no information about it. The resolution of this seeming discrepancy between the mathematical information and public information lies in the ethnography, as explained just above. If an individual's behavior is totally unresponsive to the public categories of events, then it should all be perceived as the same sign. Although it is obviously possible for a person's behavior to deviate from accepted norms, one must wonder whether total unresponsiveness is a real possibility.



## 7. On the meaning of intricacy

In ordinary English usage, the word "intricate" means complicated, which is precisely the meaning intended here. An intricate pattern is one that is intrinsically difficult to understand. In a behavioral context, it suggests logical complications, such as nested conditional executions of rules, rather than tediousness. Since the word "complex" is some times used by anthropologists as an antonym of "primitive", it seems preferable to adopt "intricate" here. There is certainly no reason to believe that "primitive" societies have simple rule systems. Moreover, computer scientists more frequently use "complex" in reference to the amount of time and workspace it takes to calculate something than to the size of the program. If the rules for behavior are written in an algorithmic language, then the minimum size of a program to represent a particular cultural system can be considered as a measurement of the information content of that system. The word "intricacy" refers to that measure. The mathematical concept of information content is better identified with the quantity of meaning to a detached observer than with the importance to the insiders for whom the message is intended, not that these notions are necessarily opposed.

Intricacy is the first quantification of the syntactic structure of nonverbal social behavior. Other measures of complexity are concerned with different phenomena, such as the interaction of persons or clusters of persons in social organizations. Whether highly intricate behavioral patterns usually coexist with highly complex social organizations, as in the sense of H.A. Simon [1962] or T.R. Laporte [1975], is a matter for further study.

For several reasons, it is difficult to obtain an exact number as the intricacy of a behavioral system. One is the difficulty of recording a complete and correct log of the events, since many occurrences that could affect the events being recorded are infrequent, such as total eclipses, coronations, and centennial celebrations. Moreover, even with very careful ethnography and observational techniques, errors could occur, for instance, if the participants in an observed event were sufficiently preoccupied with expressing some private meanings to distort the public message appropriate for a given occasion.

A second obstacle to exactness is a more serious problem in cultural research, that one never quite knows when one has achieved the optimal analysis. For instance, the "Sunday morning" analysis of the British working-class food system proved simpler than the "Wednesday afternoon" analysis. For another example, the explanation by Douglas [1966] of the Jewish dietary laws would lead to a shorter program than any of the previous explanations. The point is that optimization can be achieved only by insight, not by any automatic process. It is expected, however, that for the class of patterns to be observed in suitably restricted cultural rule systems, it will be possible to calculate sufficiently good lower and upper bounds on intricacy that rank comparisons will be possible.

A third reason is that the calculation of intricacy depends on the choice of an algorithmic language for rule systems and possibly on the choice of weights for the types of instructions in a language. In a cultural context, there are various reasonability criteria that collectively assure that a ranking in one language would not differ greatly from a ranking in another, provided that near ties are scored as

ties. One such criterion is that if a motif is to be repeated a large number of times, then it is negligibly more intricate to repeat it one additional time. Because of this third reason, it is preferable, even from a theoretical viewpoint, to think of intricacy as a rank, not as an absolute score.

One essential feature of a rank comparison according to intricacy is that it is based on the quantity of information conveyed by the system, and not on a judgement of the internal importance of the meaning of that information. For instance, it does not matter to whom in particular or for what particular occasions a food system provides its greatest ceremonies, only that it has a system of ceremonies to distinguish some persons and some ceremonies from others. The same behavior for every occasion would be at the bottom of the scale, regardless of any judgements about that behavior. Although a highly elaborate all-purpose ceremony with many symbols is possibly a very intense message, it carries very little information about the social input, precisely because it is all-purpose.

Another important feature of intricacy ranking is that a materially impoverished culture is at no disadvantage, since a small number of inexpensive signs can be arranged to convey as much information as a large number of signs. Indeed, since behavioral patterns are counted as signs, expense is no consideration. There is no comparison whatsoever of the relative merits of different cultural norms, except to the extent that patterns of variation are themselves cultural norms. Even within a culture, no preference is given to a supposedly refined background mode of behavior, in chewing food, for example, over a less highly regarded mode, except under special circumstances, such as if one group of persons chewed differently on different occasions, according to the social input, and

another group always chewed the same way. Thus, intricacy does not value one person's or one culture's signs over another's. Only their patterns of variation are compared.

The notion that rank comparisons of the amount of structure might apply to cultural contexts is hardly new. For instance, E. Durkheim [1897] perceived that the suicide rate increased in times when structure is declining. More recently, the grid-group analysis of Douglas [1970, 1978] provides two orthogonal dimensions for ranking social structure. What is new about intricacy is the way in which it quantifies social structure, according to its information content.

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