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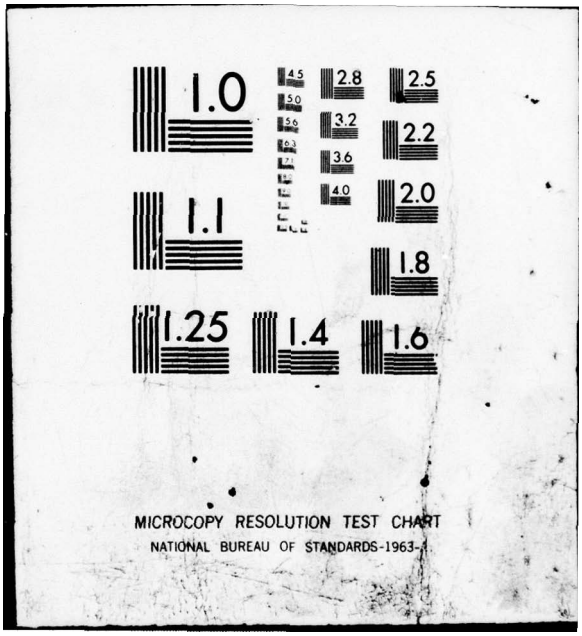
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Observation, Inference, and Cognitive Structure

Richard J. Orend

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street • Alexandria, Virginia 22314

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The purposes of this paper are: (1) to provide a brief conceptualization of of "cognitive structure"; (2) to examine the theoretical relationships between cognitive strucure, on the one hand, and observational and inferential behavior on the other; and (3) to review some of the relevant empirical findings pertaining to the theoretical relationships.

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SUMMARY

The purposes of this paper are: (1) to provide a brief conceptualization of "cognitive structure"; (2) to examine the theoretical relationships between cognitive structure, on the one hand, and observational and inferential behavior on the other; and (3) to review some of the relevant empirical findings pertaining to the theoretical relationships. Our intent was to explore, in a relatively systematic way, what appeared to be a potentially useful theoretical approach to the question of what kind of cognitive processes lead to good observation and inference behavior. This approach was selected partially because of our own previous research in the area of cognitive structure* and partially because of the suggestion of Renato Tagiuri in his summary article on "Person Perception" in The Handbook of Social Psychology.**

Among the many conceptualizations of cognitive structure two basic dimensions are pervasive. They are differentiation and integration. These dimensions were adopted as the basis for the concept of "cognitive capability." Essentially, cognitive complexity is the number of aspects of an object or situation perceived by individuals and the degree to which they integrate those aspects. It is concerned with how people think about objects rather than what they think about them.

Of the two basic dimensions, differentiation exhibits the best possibility for a strong positive relationship to observational ability. People who see more aspects of an object or situation should be better observers. The role of integration is less clear with regard to observational behavior. Also, the role of both differentiation and integration (or complexity level) may be more difficult to specify for inferential abilities. An intuitive approach to this relationship might suggest that individuals with a higher complexity level would be able to bring a greater number of observations to bear in a more integrated manner, thus making correct inference more likely. However, the difficulty in specifying the exact requirements for "good" inference is well known*** and it may be that in certain situations a narrow stereotyped set of judgment criteria is more valid.

The literature on cognitive structure (using various definitions and measuring instruments) provides evidence that a high level of differentiation is related to better observation. There is also some evidence that higher

*Orend, Richard J., *Policy Making Regarding The Drug Problem: An Experimental Study of Cognitive Complexity and Small-Group Decision-Making*, Unpublished Ph.D. Dissertation, Michigan State University, 1973.

**Tagiuri, R. Person Perception. In G. Lindzey and E. Aronson (Eds.), *The Handbook of Social Psychology* (2nd ed.), Vol. 3, *The Individual in a Social Context*, (Reading, Mass.: Addison-Wesley, 1968) pp. 395-449.

****Ibid.*

integration (or a more complex cognitive structure in general) is associated with a more complete appraisal of a stimulus object or situation. But there is no direct evidence that more accurate inferences will result. However, evidence is suggestive enough to prompt more specific examination of the nature of the direct relationship between complexity level, observation and inference in different situations and with somewhat different tasks.

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CONCEPTUALIZATION

"The way an individual receives, stores, processes, and transmits information" may be referred to as his "level of conceptual structure."[1] "Thus, beliefs, hypotheses, attitudes, needs, concepts, and so forth may be viewed as structures for processing information."[2] Cognitive structures are, therefore, the hypothetical link between the stimulus information, on the one hand, and the ensuing judgment about their meaning and appropriate reactions on the other.[3] In studying structure we are deliberately eliminating consideration of content and considering only the degree of articulation and the organization of cognitive systems.[4] Whether an individual holds a particular set of beliefs, is liberal or conservative or is manifesting a particular stage of personality development is not relevant to this formulation. What is of significance is the particular way a person organizes the content of this judgment. It is the nature of the organization which will be called "cognitive structure."[5]

Several dimensions of cognitive structure may be distinguished. Zajonc, for example, proposes four: degree of differentiation (the number of different attributes projected upon an object); degree of complexity (the extent of the organization of those attributes); degree of unity (the interdependence of attributes); and degree of organization (the extent to which one or a few parts dominate the structure).[6] Schroder, Driver, and Streufert add discrimination, which is "the capacity of the conceptual structure to distinguish among stimuli," to differentiation and integration (Zajonc's complexity) to form their model of the components of cognitive structure.[7] Scott discusses several other dimensions of cognitive structure, including attribute centrality, attribute articulation (clarity), affective salience, and ambivalence.[8] Harvey, Hunt and Schroder propose openness-closedness as still another dimension.[9] Notwithstanding the diversity of these and additional dimensions presented by other writers there are two common elements to all major conceptualizations of cognitive structure. They are differentiation and integration.[10]

We shall refer to the combination of these two elements as cognitive complexity; that is, the number and relationship of attributes an individual uses to define some phenomenon in his environment. Cognitive complexity is thus being limited to only those two dimensions of cognitive structure which are common to most other conceptualizations, differentiation and integration.[11] *This formulation does not* preclude the possible significance of any other structural dimension, but merely attempts to isolate the minimum necessary elements of cognitive structure as it has been described in the literature.

Differentiation is simply the number of attributes (characteristics) used by an individual to identify an object or event.[12] These attributes may include descriptive, affective, belief, value or any other characteristics. Differentiation includes as many or as few of these characteristics as are required by the person to orient himself to the object or situation which he perceives as being relevant.

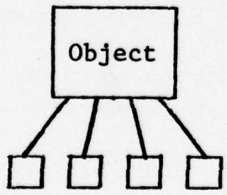
Integration is the organization of the descriptive attributes in a given cognitive structure. The attributes may be conceived as coming "from a single class or category of discriminanda, or they may represent many categories."[13] Zajonc uses the example of a painting which may be perceived in terms of its objective qualities, size, subject matter, type of frame, etc. Or, it may be perceived partly in terms of objective qualities, partly in terms of formal qualities (period, style, symmetry, etc.) and partly in terms of its impact on the viewer.[14] The number and intricacy (extent of interrelationship) of the discriminations among attributes constitute the degree of integration of the individual. In Zajonc's example, perceiving the painting only in terms of its physical characteristics would constitute a rather low integrative structure, no matter how many attributes (differentiation) there were. An individual's use of all of the mentioned dimensions would indicate a more complex integrative structure.

An individual's level of cognitive complexity is the degree to which he exhibits a simple or complex structure with regard to a particular object. It incorporates both differentiation and integration. We shall refer to simple structures as having low complexity (or as being cognitively simple) and to complex structures as exhibiting high complexity (or as being cognitively complex). The designation is, of course, relative to the group of individuals being described.

A low complexity individual perceives relatively few descriptive attributes in a particularly uncomplicated way. See Figure 1.[15] At the extreme end of the scale attributes are also isolated from one another.

Figure 1. Low Complexity Representation

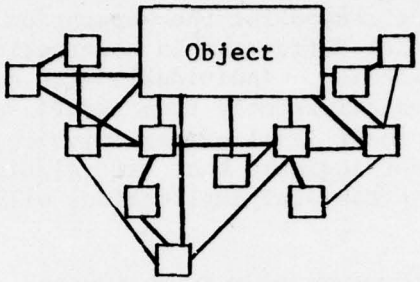
Lines represent connections or "rules" for perception of the object. "Rules" are in a fixed relationship.



The cognitively "complex" person tends to perceive a large number of attributes and these attributes are interrelated in some manner. See Figure 2.[16] (Possible intermediate steps will be discussed below.)

Figure 2. High Complexity Representation

"Rules" are in an interdependent relationship; making new rules possible.



Attributes

The particular subset of possible attributes used to identify the object for the individual is not relevant in determining integration level. We are interested in the degree of interrelationship, not its content. Once we know the number and degree of interrelationship of an individual's perceptions of a particular object; i.e., an indication of how a person thinks, we should be able to predict, at least partially, how that person will behave in certain situations. More importantly, we should have an indication of how an individual perceives (observes) certain situations and the complexity of inferences which are likely to be drawn based on those observations.

Our approach thus far has limited cognitive structure and complexity to a single object or event; i.e., it is "issue specific." This is consistent with Zajonc.[17] Others have developed the concept of complexity as a general characteristic of cognitive functioning;[18] i.e., individuals exhibit the characteristics in all situations. The "issue specific" test we use does not preclude the possibility that complexity is a general characteristic. But we may assume that if cognitive complexity is a general characteristic, subjects who score as cognitively simple or complex in one area would exhibit the same characteristics in other issue areas.

In using our conceptualization of cognitive complexity we also must treat the question of the relative role of differentiation and integration. Previous theorizing has usually stressed one or the other.[19] Witkin, Crockett, and Bieri, for example, emphasize differentiation as a major determinant of behavior.[20] The interrelationship of the differentiated aspects of cognition is of less concern than "the degree to which information processing occurs through a heterogeneous conceptual state."[21] Harvey, Hunt and Schroder; Scott; Tuckman; and Schroder, Driver and Streufert emphasize the integrative dimension of complexity.[22] They argue that the way in which individuals relate their perceptions of the environment is more than the number of perceptions. In all approaches, however, the role of differentiation as a partial precondition to integration is recognized.[23]

Zajonc includes both dimensions in theorizing and measurement without attempting to emphasize either.[24] Despite separating them conceptually he does not offer individual predictions about their independent contributions to behavior. He also measures them together. We shall conceive of cognitive complexity in this balanced way and, also, separate the two components despite the general lack of empirical evidence that this division leads to behavioral differences.[25] The reason for the separation of differentiation and integration is the potential difference in observational and inferential abilities related to each dimension. Individuals with high differentiation and low integration may behave differently from individuals with the opposite characteristics, even though their level of cognitive complexity may be the same. This difference does not indicate that the relative importance of each is unequal.[26] Specific behavioral implications will be discussed below.

BEHAVIORAL CONSEQUENCES OF DIFFERING COMPLEXITY LEVELS

One conception of cognitive complexity is as a continuous variable with individuals normally distributed along a single dimension. Differences in the level of cognitive complexity lead to different behaviors, but given the primitive state of theorizing, we can deal only with the degree of dissimilarity in certain kinds of behavior rather than qualitative differences predicted by some scholars. Harvey, Hunt and Schroder, and later Schroder, Driver and Streufert, for example, have developed a typology of complexity level and behavior.[27] This typology includes four nodal points of general levels of complexity; the authors feel that this classification scheme could serve as a basis for describing qualitatively different modes of behavior. In the present context our primary concern will be with the first and fourth "systems" (the author's term for lowest and highest complexity levels) rather than with all four.[28] It is in these systems that the individual behavior patterns of interest to us are most prominent and, therefore, most suseptible to testing.

Low Complexity. The lowest level of cognitive complexity is characterized by compartmentalization of a small number of attributes. Each attribute is isolated from the others, as illustrated in Figure 1, and the attributes tend to be hierarchically organized.[29] This means that the object being perceived would tend to be seen unidimensionally. The fewer the number of attributes perceived, the lower is the potential for generating internal conflict; i.e., dissonance, and the greater is the likelihood that potential conflict will be resolved by excluding the potentially dissonant attribute from further consideration. Attributes will also tend to be dichotomous. Schroder, Driver and Streufert argue that "a single hierarchy of rules for stimulus placement in a given category, which is compartmentalized..., has little potential for developing scaled dimensions."[30] Stimuli tend to be seen in yes-no categories, either they do or do not fit. Less categorical discriminations will emerge, when it is possible for the individual to apply more than a single interpretation to the stimuli. Schroder, Driver and Streufert summarize this level of cognitive complexity in the following manner:

> "In information processing, a concrete structure (low complexity) has comparative certainty and determinate character. Stimuli are evaluated more or less unidimensionally, and, from the subject's point of view, the problems of choice and error arise less frequently. Rules can be explicated more definitely and there is a minimum of ambiguity."[31]

In this pattern of cognition there are four characteristics present: (1) A minimum number of categories will be observed in a given situation; (2) Stimuli tend to remain in the original categorization and are "minimally affected" by placements on other dimensions (compartmentalization); (3) "New stimuli are either distorted to fit existing dimensions or excluded;" and (4) Environmental conditions may affect categorization, but have little effect on the level of complexity.

The behavioral characteristics associated with this level of complexity include:

(1) Categorical, black-white thinking. There is a reduced ability to see nuances or gray areas. If Blacks are perceived as being "good" or "bad," all Blacks will be seen the same way.[32] Corresponding to this categorical way of thinking will be a lack of interest in new and different aspects of the relevant situation. The amount of new information sought will be low because the issue has already been decided and any new information that does arise will tend to be forced into an existing category or excluded. Thus, once a situation has been observed and "relevant" descriptive variables extracted, further refinements are not likely and inferences will be based on a limited sampling of available cues. If persons being observed happen to fit stereotypes based on limited cues, inferences could be correct. But, if most behavior prediction must be based on a large number of subtle cues, as we believe it usually is, then the cognitively simple individual will be less effective at making correct inferences about future (or past) behavior.

(2) There will be a tendency to minimize conflict. Stimuli either fit or are excluded. There is little possibility for alternative ways of viewing the subject. Dissonance is quickly minimized or resolved.

(3) "If a stimulus is categorized in an absolute way, there is a corresponding restriction of interval integrative processes, and alternative resolutions or interpretations fail to arise."[33] Therefore, if low integration exists there is an increase control of "external stimulus conditions." With greater integration the same information can generate more alternative interpretations, thus increasing the role of "self" as agent, "going beyond any single or externally given interpretation, increasing the conception of internal causation," and making "correct" inferences based on broader observations more likely.

(4) The more absolute and rigid rules of integration will, when they are changed, produce a greater more abrupt change. Conflicting interpretations tend to be "warded off" because of the lack of ability to sense shades of difference. If, however, the changes in a situation reach a certain threshhold, the categorization of the individual will change rather abruptly.[34]

High Complexity. The highest levels of cognitive complexity are characterized by a large number of attributes and a complicated interrelationship among those attributes. The hierarchical organization present in low complexity levels disappears and is replaced by a more flexible organization of attributes and rules for relating attributes.[35] The larger number of attributes generate a greater likelihood of conflict, but the flexible organization minimizes the effects of that conflict. The individual is able to see differences, but he can also more easily account for them through the utilization of more aspects of the situation and/or the interrelating of those characteristics available. The larger number of differences is less likely to be disturbing because they will tend to be less significant. That is, the complex individual's ability to form more intricate scales for judging produces the ability to observe differences not observable in less complex subjects.[36] But he is also better able to assimilate these and larger dissimilarities. He is able to apply a greater number of interpretations to what he observes which means that he can make greater use of more information and fewer observations are excluded.

High complexity people develop the ability to deal with things in an abstract manner; what Schroder, Driver and Streufert call a "theoretical" rather than an "empirical" orientation.[37] This faculty results from the ability to manipulate large amounts of information in such a way as to be independent of the current empirical situation. The individual can generate laws or principles which transcend the immediate empirical relationships. High complexity facilitates the development of alternative ways of perceiving the same phenomenon without "the imposition of new external conditions."[38] Abstract functioning also provides the individual with a more effective means of adapting to a complex changing situation.

A high complexity level leads to cognitive functioning which is the opposite of that associated with low complexity individuals:

(1) The large amount of information processed and the extensive interaction between attributes contributes to more open thinking. There is less tendency to categorize and force diverse attributes into inappropriate categories. Nuances are perceived and dealt with as individual cases. They are tied together at a higher (more abstract) level.

(2) The differences between stimuli will be recognized and managed. The ability to perceive nuances and to integrate these differences in more than one way will create a greater tolerance for conflict. A high complexity individual will not be threatened by this kind of conflict and will more easily come to terms with it because of a greater ability to modify part of his conceptual system. He need not make as great a change as the low complexity individual in the same conflict situation. He will also be more flexible in handling dissonance.[39]

(3) The role of the "self" in generating alternative solutions to problems is also increased with increasing complexity.[40] In a complex situation the complex individual would be able to generate a greater number of problem solution alternatives independent of external impetus. The same information can generate more alternative interpretations. It will also allow the complex individual to recognize the validity of alternative solutions to problems.

(4) The high complexity individual will be more likely to change his own opinions on a subject because that change is likely to be much smaller and less abrupt than would be true of the low complexity individual. A "shade" of difference produces a "shade" of change in behavior. Such a change is much less threatening and much easier to handle within the framework of a complex cognitive structure. This willingness to change will also be accompanied by uncertainty in decisions. As the number of alternatives increases so does the perceived likelihood that a particular alternative is not entirely correct.

The ability to perceive conflicting and subtle alternatives, while promoting minor change, works against radical change by enabling the individual to modify his position (attitudes, behavior, etc.) to a lesser degree than his low complexity counterpart. Any change will be a product of arguments (or whatever inducements) that are subject to the same cognitive consideration that produced the original position. This does not mean high complexity individuals will not make radical changes, but that they are much less likely to encounter the overwhelming pressure (of whatever type) to make such changes than low complexity subjects.

Between these two extreme levels of complexity lies the somewhat less explored area of middle range complexity. A score in the middle range can be derived in several different ways, which leads to some of the confusion about how to predict behavior. We have conceptualized complexity as being composed of differentiation and integration. An individual could thus fall into one of four complexity level groupings if both dimensions were dichotomized as in Figure 3.

Figure 3.

		DIFFERENTIATION	
		High	Low
INTEGRATION	High	1	2
	Low	3	4

We have already discussed types number 1 and number 4. Type 2 appears potentially among individuals of "moderate" differentiation (the borderline between "high" and "low") with high integration. An individual operating at this level of complexity would seem to represent the halfway point between the extreme types already examined. We expect to find quantitative, but not qualitative, differences in behavior between this middle group and the extreme groups. That is, there should be more or less of the same types of behavior (depending on who is being compared), but no substantial differences in the nature of that behavior.

For type 3 individuals this may not be the case. Individuals with a high level of differentiation and low integration may be expected to exhibit entirely different modes of conduct. Schroder, Driver and Streufert, for example, identify some middle level persons as manipulators ("Machiavellian").[41] These, we feel, could correspond to the high differentiation, low integration individual represented by type 3. Type 3 people would exhibit high observation abilities, but be unable to relate their observations in an integrated manner. Thus, we would expect them to be less adept at making self-initiated accurate inferences about others' behavior. They simply would not have the capability of bringing to bear all of the different elements of their observations in a total integrated picture. However, they might be able to make more accurate inferences than type 1 individuals because of the sheer number of their observations (i.e., a greater likelihood of finding a useful predictor variable). They could be as capable of purely observational tasks as type 4 individuals. At this point there is no evidence to indicate the exact nature of the behavior of these individuals and predictions in this area are tenuous. Hopefully, empirical results will serve as a useful heuristic for this type.

INTELLIGENCE, INFORMATION AND COGNITIVE COMPLEXITY

One final set of possible distinctions requires discussion. We have stressed the structural nature of the concept of cognitive complexity as opposed to content and affective elements of cognition. The exclusion should also include other commonly used individual cognitive attributes, namely I.Q. and information. We would not expect the individual's level of cognitive complexity to be significantly related to either his intelligence or the amount of information he had about a particular subject. In both cases the procedures for measuring these attributes are important to our discussion. Intelligence has been conceived of and measured in many different ways. It would be unlikely if some conceptualization did not include concepts similar to our ideas of differentiation and integration, since both are concerned with cognitive processes and the processing of information. In addition, some scholars have been concerned with both cognitive structure and intelligence, the most notable being Jean Piaget.[42] To our knowledge, however, our conceptualization of cognitive complexity is quite different from any general approach to intelligence.[43] We would therefore expect an empirical relationship only insofar as there is overlapping in measurement procedures. This position is in general agreement with that taken by most cognitive complexity researchers, although there is some evidence that the overlap is greater for some measures of complexity than others.[44]

The relationship of information to complexity level is similar. Information about a particular subject area could be related to differentiation in that area depending on the kind of test used. In our own research the use of an information measure dependent upon the number of different aspects of an object perceived could raise his total complexity score. For example, one can conceive of a student who possesses a great deal of memorized information about a subject, but who cannot integrate the various details into a coherent pattern. Such a person might do well on the differentiation part of our complexity test because he could list a large number of descriptive details. Such a result would not necessarily mean that the individual would be classified as being complex since that score is also dependent on the amount of integration exhibited. The integration element would necessitate that the individual be able to relate the various aspects of the object he perceived. Possessing a large amount of information about a subject does not mean that it is organized in a complicated way. Using our previous example, we may know a large number of physical characteristics of a picture and find them all important in describing the picture, but we may not be able to relate these characteristics to other aspects.

PREVIOUS EXPERIMENTAL RESULTS

There has been a steady flow of research results on cognitive structure since the middle 1950's, but results are often difficult to compare. The theory and methodology (particularly measurement) vary greatly from one researcher to the next. The differences in theoretical orientation (e.g., differentiation vs. integration, issue specific vs. generalized, interpersonal vs. all perception, and the number of different dimensions involved) are only exceeded by the number of different measures of cognitive structure.[45] We have attempted to skirt many of these problems by using a narrow definition of cognitive complexity and limiting our interest to those areas which are common to most formulations. In choosing Zajonc's measurement technique we have selected that measure which we feel best manifests the aspects of cognitive structure we describe.[46] The additions of a short measure of interpersonal perceptions to test differentiation (as well as dimensionality) will hopefully help establish the validity of that dimension of Zajonc's measure as well as provide another predictor for those subjects who differ on differentiation.

When attempting to compare experimental findings the problem of multiple approaches cannot be avoided, particularly in the light of findings such as that of Vannoy, Cox, and others that most of the measures are not empirically related.[47] It is curious that in spite of this confusion, many findings of these studies are remarkably similar. One likely explanation for the convergence of findings is the presence of the two basic elements of differentiation and integration in virtually all theoretical models, and the use of measuring instruments which accurately assess at least one of these dimensions. The kinds of general behavior predictions made above are common to most formulations of cognitive structure and in each of these formulations there is evidence to support at least some of the hypotheses, despite the measurement differences. These results make

it useful to briefly discuss earlier research findings. We shall limit our discussion to the four behavioral areas mentioned in the previous section.[48] Other factors, such as the effects of stress and failure, types of group initiated organization, leadership patterns, and different levels of environmental complexity, will not be considered here because they are not part of our research interest.

(1) A finding supported by most experimental research is that complex subjects tend to engage in more information search. Three studies using the Sentence Completion Test (SCT) in widely varying situations exhibit this result.[49] In addition, Tuckman, using the IFT and Lunderg, using both the IFT and the Rep test as indicators of complexity achieve the same result.[50] Driver has the same finding in a Stock Market game, but the measure of complexity is not reported.[51]

However, these findings must be carefully weighed in the light of some complicating factors. In an experiment using homogeneous dyads playing the Inter-nation Simulation Game, Streufert and Castore found no difference in self-initiated information seeking among subjects of differing complexity levels.[52] Environmental complexity and the amount of stress present in the experimental task produced a modification to the expected pattern. Streufert, Suedfeld and Driver found that self-initiated information search was higher for sample subjects in a low stress situation, approximately equal at moderate levels of stress, and lower at high levels or stress. Delegated information search showed a similar pattern for the low and moderate stress levels, but the pattern was reversed at high stress levels.[53] There is no consistent evidence that high complexity leads to greater information search or the ability to see the nuances supposedly associated with this capability.[54]

(2) The ability of high complexity individuals and groups to recognize and deal with a larger volume of aspects of a situation is well-documented. In two studies by Driver, one using a Stock Market game and the other using a version of the Inter-nation Simulation, it was found that high complexity subjects use a greater number of dimensions when making judgments and are more attentive to complex information.[55] In the former experiment it was also found that low complexity individuals attend to less complex and more salient (to them) information. The significance of this finding is the implication that the "best" strategy is not always the most complex. <u>The usefulness of a particular approach to problem solving is dependent on the situation, not just the subjects' level of complexity</u>.

Several studies using the Rep test duplicate this finding. Plotnich, Price and Campbell all find that higher complexity individuals are more likely to differentiate, or see more aspects of, the particular subject being considered in the respective experiments.[56] Campbell finds that low complexity subjects tend to make judgments only along a "good-bad" dimension. Plotnich and Campbell also find that high complexity is an aid in making "correct" perceptions in the experimental situations. Bieri found that higher complexity subjects were better able to provide veridical prediction in interpersonal situations, but he interpreted these results as indicating the subjects' ability to discern when others differed from

themselves rather than a clear ability to see inherent differences.[57] On the other side Sechrest and Jackson found no significant differences between high and low complexity subjects with respect to predictive accuracy.[58] In this study four of the early measures of complexity were used. These results, again, bring the questions of task similarity and measurement into the discussion. On the question of task similarity it is clear that considerable research is necessary to separate out the specific functions being performed and differences that might exist between them as they relate to complexity level. The question of measurement, particularly the separation of differentiation and integration is important also. If prediction is more related to integration than differentiation, most of the early tests would not pick up differences in predictive capability.

The ability to differentiate and absorb a wider variety of information, among high complexity subjects, carries with it the capacity to tolerate conflicting information. High complexity individuals are less threatened by the conflict generated in a wider variety of alternatives perceived. This tendency has been noted in a number of different studies. Mayo and Crockett, Tripodi and Bieri, and Nidorf all find the tendency to discriminate and integrate conflicting information higher in cognitively complex subjects than in cognitively simple subjects under certain conditions.[59] All these experiments were done using measurement instruments biased toward the differentiation dimension of complexity and should be interpreted in that light.

(3) In a third behavioral area the evidence is much more indirect and consequently less clear. High complexity subjects are expected to produce a greater number of internally developed solutions to experimental tasks and offer more alternative interpretations of the situation. Tuckman found that high complexity groups have a more "integrated" strategy, which may be interpreted as a direct link to the ability to generate a complex solution employing constructs and propositions not obviously contained in the available discreet pieces of information.[60] Driver calls a quite similar phenomenon the ability to develop "higher level strategies."[61] Harvey found that with subjects who are "taking the other's position" those of high complexity are able to generate more opposing arguments (to their own position) than those of low complexity.[62] In a somewhat related finding Terhune and Kennedy report that as integrative complexity increases so does a group's reliance on conceptual, as opposed to objective, information.[63] All of these studies seem to indicate an increased ability, on the part of high complexity individuals, to formulate more complex solutions to certain kinds of experimental tasks. The tasks in these studies, the Inter-nation Simulation game, two different stock market games, and a role playing situation in which subjects argued against their own viewpoint, were varied enough to provide evidence of the general applicability of the ability to high complexity subjects to abstract information. The implication for interpersonal inference seems to be that the greater ability to develop complex solutions based on equal information (observation) will allow the more integrated individual to draw less direct and more complicated conclusions. Thus, a cognitively complex individual should be "better" at drawing inferences from observations than a less complex individual, although "better" is not necessarily more accurate.

The varied tests of complexity level used in these studies support this interpretation. Driver used a Multidimensional Scaling technique to measure abstractness, Tuckman used the SCT, and Harvey used the "This I believe. . ." test, the scoring of which is oreinted toward the content of responses. Terhune and Kennedy were cited by Schroder, Driver and Streufert and the study is not generally available. The problem is that none of the studies provide direct objective measures of the increased ability to generate alternative solutions from within (i.e., without supplied outside information). Mayo and Crockett provide some negative evidence with their finding that in some situations high complexity subjects do not go beyond given information to any greater degree than low complexity subjects.[64]

(4) The final behavioral manifestation we discussed was the greater uncertainty about positions and increased likelihood of attitude or opinion flexibility exhibited by high complexity individuals. Scott found that when attacking a subject's stand on the distribution of nations across descriptive areas (the Object Sorting Test) high complexity subjects exhibited greater flexibility or more willingness to change than low complexity subjects.[65] Higgins, using a modified Rep Test, reported that high complexity subjects were less confident of their judgments in all conditions except where the information was highly incongruent (i.e., where opposite).[66] In an experiment using social pressures, similar to S.E. Asch's classic experiment, to test change in judgment of the distance between two lights, Janicki found that high complexity subjects were more likely to change their opinion.[67] Janicki used the SCT, as did Streufert, when he found that the attitudes of concrete (low complexity) subjects were less affected by incongruent information under all tested conditions.[68] Stager, using groups varying in their proportion of high complexity subjects from 25% to 100%, found that as the proportion of high complexity subjects went up so did the amount of uncertainty within groups.[69] Suedfeld and Vernon present evidence partially supporting the above results when they find that abstract (high complexity subjects exhibit greater compliance to experimenter pressure for behavioral change (in a sensory deprivation situation), but less attitude change in a post-test than concrete (low complexity) subjects.[70] Lundy and Berkowitz reinforce this finding with their own similar results using a Rep Test instead of the SCT used by Suedfeld and Vernon.[71] The apparent contradiction in these findings is the difference between opinion change (i.e., what is expressed to the experimenter) and attitude change (the underlying position of the individual). The cognitively complex individual is willing to change his opinions, but not his more fundamental attitudes. In the three experiments just mentioned attitude change was measured with paper and pencil tests before and after the experiments. Suedfeld and Vernon measured opinion change by the degree of compliance to experimenter pressure during the experiment. In other words, simple subjects did not cooperate during the experiment, but exhibited greater change on the post experiment questionnaire, while complex subjects behaved in the opposite manner. The high complexity subject is more likely to see the subtleties of the situation and present compromise solutions without modifying underlying attitudes. Attitude changes exhibited by low complexity subjects are no more fundamental depending on the source of the pressure to change.

These results complicate the relationship between cognitive complexity and inferential success in certain situations. When high complexity individuals are subject to outside pressure or influence they are more likely to waiver in their interpretations. This may be good or bad depending on the nature of this influence. We might expect, however, that a complex individual will be able to reject erroneous interpretations through their own skills. In either case, it is possible to control these outside factors in an experimental situation so that the "pure" effect of complexity can be determined.

The conclusion of this paper will not be a set of specific hypotheses. My purpose was to present a somewhat extended description of the concept of cognitive complexity and some of the research in this area, particularly as it relates to observational and inferential skills in interpersonal situations. Some hypotheses concerning observational behavior seem clearly implied in the conceptualization and in the experimental results. Inferential skills are less clearly connected to complexity level because of the importance of situational variations and the potential role of stereotyping as a means of judging other people. The fact that there are mixed findings in some of the research might make specific hypotheses at this time appear unwarranted or at least questionable. We shall proceed on a more empirical level in our research. Cognitive complexity provides the best single conceptual approach to the problems being studied. Therefore, it will be pursued in some detail, but with the realization that we may fail to find important (even if statistically significant) relationships.

FOOTNOTES

1
Harold M. Schroder, Michael J. Driver, and Siegfried Streufert, *Human Information Processing,* (New York: Holt, Rinehart and Winston, Inc., 1967), p. 8.

2
Ibid.

3
James Bieri, *et al., Clinical and Social Judgement: The Discrimination of Behavioral Information,* (New York: John Wiley & Sons, 1966), p. 184.

4
Ibid.
O. J. Harvey, "System Structure, Flexibility and Creativity," in O. J. Harvey, Ed., *Experience Structure and Adaptability,* (New York: Springer Publishing Co., 1966), pp. 39-66.
O. J. Harvey, David E. Hunt and Harold M. Schroder, *Conceptual Systems and Personality Organization,* (New York: John Wiley & Sons, 1961).
Robert B. Zajonc, "The Process of Cognitive Tuning in Communication," *Journal of Abnormal and Social Psychology,* LXI, 2 (1960), pp. 159-167.

5
This terminology originated in the writing of Lewin and has relatively general usage in the literature on cognitive complexity. There are, however, several other terms used in the literature. Cognitive structure and cognitive style are both used by some authors when referring to cognitive complexity. The same is true for differentiation, which is used by Bieri and integration, which is used by Zajonc to refer to only one aspect of what we shall call cognitive complexity. See
William A. Scott, "Cognitive Complexity and Cognitive Flexibility," *Sociometry,* XXV, 4 (1962), pp. 405-414.
Bieri, *et al., loc. cit.,* Chapter 7.
Zajonc, 1960, *op. cit.,* pp. 159-160.

6
Zajonc, *Ibid.,* and *Cognitive Structure and Cognitive Tuning,* (unpublished PhD dissertation, University of Michigan, 1954).

7
Op. cit., pp. 24-25.

8
William A. Scott, "Brief Report: Measures of Cognitive Structure," *Multivariate Behavioral Research,* I, 3 (1966), pp. 391-395.

9
Harvey, Hunt and Schroder, *op. cit.*, pp. 74-75. The openness-closedness dimension is similar to a formulation presented by Milton Rokeach, *The Open and Closed Mind,* (New York: Basic Books, 1960).

10
Harvey, Hunt & Schroder, *Ibid.*, p. 18.
Schroder, Driver and Streufert, *op. cit.*, pp. 24-25.
Scott, 1962, *loc. cit.*
Zajonc, 1960, *op. cit.*, pp. 159-160.
Bieri, *loc. cit.*, does not use the terminology but does include the roles played by both differentiation and integration in his formulation.

11
We have adopted this strategy for three reasons: First despite the theoretical problems associated with cognitive complexity in the literature, the fundamental aspects of differentiation and integration remail relatively constant. Robert Zajonc, "Cognitive Theories in Social Psychology," in Gardner Lindzey and Ellion Aronson, *Handbook of Social Psychology,* Volume I, (Reading, Mass.: Addison-Wesley Pub. Co., 1968), p. 335. Second, much of the problem in the literature arises when the methodology (i.e., the measurement of complexity) does not coincide with the theory. Few efforts have been made to independently measure the various dimensions of complexity proposed and to make predictions based on these different dimensions. For exceptions see Zajonc, 1960, *op. cit.*, and Scott, 1966, *op. cit.* A measuring instrument closely adhering to the logic of the concepts might alleviate this problem. Finally, there has been a correspondence between general behavior predictions and experimental outcomes. Despite theoretical and measurement problems, researchers have been able to successfully predict experimental behavior based on different theoretical and methodological conceptions. On this basis it can be argued that there is a common element in all notions of complexity and that this element overrides the differences.

12
Zajonc, *Ibid.*, p. 160.

13
Ibid.

14
Ibid.

15
Schroder, Driver and Streufert, *op. cit.*, p. 8

16
Ibid.

17
Zajonc, 1955, *op. cit.*

18
See for example, Schroder, Driver and Streufert, *op. cit.*

19

Siegfried Streufert, "Complexity and Complex Dicision-Making: Convergences Between Differentiation and Integration Approaches to the Prediction of Task Performance," *Journal of Experimental Social Psychology*, VI (1970), pp. 494-509.

20

Witkin, *et al.*, *Psychological Differentiation*, (New York: John Wiley and Sons, Inc., 1962).

William H. Crockett, *loc. cit.*

James Bieri, *et al.*, *loc. cit.*

21

Streufert, *loc. cit.*

22

Harvey, Hunt and Schroder, *loc. cit.*

Scott, 1962, *loc. cit.*

Bruce W. Tuckman, "Integration Complexity: Its Measurement in Relation to Creativity," *Educational and Psychological Measurement*, XXVI 2 (1966), pp. 369-382.

Schroder, Driver and Streufert, *loc. cit.*

23

Schroder, Driver and Streufert, *Ibid.*, pp. 14-15.

24

Zajonc, 1955, *loc. cit.*

25

Streufert, *loc. cit.*, found some differences in attempting to determine the independent roles of differentiation and integration in predicting behavior in a small group situation.

26

Another difference in emphasis by researchers in the area of cognitive complexity is whether it applies only to interpersonal perceptions or all perceptions. We shall assume it is applicable to both areas. The differences result primarily from the fact that much of the earlier research was concerned with the interpersonal aspects of cognitive structure. See William H. Crockett, "Cognitive Complexity and Impression Formation," in B.A. Maher, Ed., *Progress in Experimental Personality Research*, Volume 2, (New York: Academic Press, 1965), pp. 47-90.

27

Harvey, Hunt and Schroder, *op. cit.*, Chapter 4, were also concerned with the developmental aspects of complexity. We shall deal with it only in terms of a single point in time.

Schroder, Driver and Streufert, *op. cit.*, Chapter 2.

The two schemes are broadly overlapping so no attempt will be made to separate them here. For a detailed discussion of the differences in those two major works in the literature on complexity see Gary B. Cox,

Cognitive Structure: A Comparison of Two Theories and Measures of Integrative Complexity, (unpublished PhD dissertation, Duke University, 1970), cited in Dissertation Abstracts, Volume 31, 1971, pp. 6237B-6238B.

28

We take this position on theoretical, methodological and empirical grounds. First, the hypothesized qualitative differences in behavior between the systems does not follow neatly from the theorizing done by the authors. It is not clear why System II individuals should be "negative," "unstable," or uncommitted, or System III individuals particularly empirically oriented. Second, the measurement of these Systems leaves much to be desired in terms of establishing the independent validity of each as used by Schroder, Driver and Streufert or Harvey, Hunt and Schroder. Finally, there are several studies in which it is just these system differences which cause the greatest confusion, particularly in terms of distinguishing the two extreme complexity levels from the moderate ones. See for example,

Lawrence Nitz, "Strategies Under Non-Transferable Utility: An Experimental Study of the Effects of Divisibility of Payoff, Cognitive Complexity and Machiavellianism on Strategy Selection in a Mixed Motive Game," (unpublished PhD dissertation, Michigan State University, 1968).

Tuckman, (1966), *loc. cit.*

29

Schroder, Driver and Streufert, *op. cit.*, p. 15. Subsequent descriptions of low and high complexity characteristics will be essentially as they are described by Schroder, Driver and Streufert. Therefore, we shall not cite each statement individually. Deviations from their model will be noted and the first of these is that we do not share Schroder, Driver and Streufert's contention that *the number of attributes or* "dimensions" (p. 15) is irrelevant to behavior. This position is a function of their conviction that "integration" is the key aspect of complexity, which we have questioned above.

30

Ibid., p. 16.

31

Ibid.

32

Ibid.

33

Ibid., p. 17

34

Ibid. Just what kinds of environmental changes will bring about such an individual change is relative. Certainly the source of the conflict statement, its intensity, its impact on the individual's ability to adapt, are all factors. For our purposes the important factor is that the low complexity individual has a much higher threshhold, because of his complexity level, than the high complexity individual.

35
Ibid., pp. 22-23.

36
Ibid., p. 16.

37
Ibid., pp. 22-23

38
Ibid.

39
William Crano and Harold Schroder, "Complexity of Attitude Structure and Process of Conflict Resolution," *Journal of Personality and Social Psychology,* V, 1 (1967), pp. 110-114.

40
Schroder, Driver and Streufert, *op. cit.*

41
Ibid., Chapter 2. Also, see footnote 28 for problems in this approach.

42
Jean Piaget, *The Origins of Intelligence in Children,* (New York: International Universities Press, 1952).

43
See Ernest Hilgard, Richard Atkinson and Rita L. Atkinson, *Introduction to Psychology*, (New York: Harcourt Brace-Javanovich, Inc., 1971), Chapter 15, for a general discussion of intelligence testing.

44
Vannoy, *loc. cit.*, and Streufert and Driver, 1967, *loc. cit.*, and Schroder, Driver and Streufert, *loc. cit.*, found somewhat stronger relationships in their studies.

45
See, for example,
Bieri, *et al.*, *loc. cit.*, Role Construction Repertory Test (Rep test).
Schroder, Driver and Streufert, *loc. cit.*, Sentence Completion Test (SCT).
Scott, 1962, *loc. cit.*, Object Sorting Test.
Streufert and Driver, 1967, *loc. cit.*, Impression Formation Test (IFT).
Bruce W. Tuckman, "Personality Structure, Group Composition, and Group Functioning, *Sociometry*, XXVII, 4 (1964), pp. 469-487. Interpersonal Topical Inventory Test (ITI).
Witkin, *et al.*, *loc. cit.*
Zajonc, 1960, *loc. cit.*, The test used in this study.
Also see Vannoy, *loc. cit.*, for several other less widely used tests.

46
See Appendix A for a copy of this instrument.

47
Vannoy, *loc. cit.*
Cox, *loc. cit.*
Leroy Richardson and Emil Soucer, "Comparison of Cognitive Complexity with Achievement and Adjustment: A Convergent-Discriminant Study," *Psychological Reports*, XXIX, 3 (December, 1971), pp. 1087-1090.

48
We shall also look at only a limited number of their findings. Attempting to examine all studies relevant to the behavior with which we are concerned would be a futile exercise in detail. Any significant contradictory findings will of course be included.

49
M. Karlins and H. Lamm, "Information Search as a Function of Conceptual Structure in a Complex Problem-Solving Task," *Journal of Personality and Social Psychology*, V (1967), pp. 456-459.
Joan Sieber and J.T. Lanzetta, "Conflict and Conceptual Structure as Determinants of Decision-Making Behaviors," *Journal of Personality*, XXXII, 4 (1964), pp. 622-641.
Paul Stager, "Conceptual Level as a Composition Variable in Small Group Decision-Making," *Journal of Personality and Social Psychology*, V, 2 (1967), pp. 152-161.

50
Tuckman, 1964, *op. cit.*
Olaf H. Lundberg, *An Empirical Explanation of Relationships Between Congitive Style and Complex Decision-Making*, (unpublished Ph.D. Dissertation, Pennsylvania State University, 1971), cited in *Dissertation Abstracts*, Volume XXXIII, 1972, p. 19A.

51
Michael J. Driver, *The Relationship Between Abstractness of Conceptual Functioning and Group Performance in a Complex Decision-Making Environment*, (unpublished Master's Thesis, Princeton University, 1960), cited in Schroder, Driver and Streufert, *op. cit.*, p. 113.

52
Siegfried Streufert and Carl Castore, "Information Search and the Effects of Failure: A Test of Complexity Theory," *Journal of Experimental Social Psychology*, VII, 1 (1971), pp. 125-143.

53
Siegfried Streufert, P. Suedfeld and Michael Driver, "Conceptual Structure, Information Search and Information Utilization," *Journal of Personality and Social Psychology*, 2 (1965), pp. 736-740.

54
C.W. Mayo and William H. Crockett, "Complexity and Primacy-Recency Effects in Impression Formation," *Journal of Abnormal and Social Psychology*, LXVIII (1964), pp. 335-338.

55

Driver, 1960, *loc. cit.*

Michael J. Driver, "Conceptual Structure and Group Processes in an International Simulation," *Educational Testing Services Research Bulletin*, 1962, cited in Schroder, Driver and Streufert, *op. cit.*, pp. 110-112.

56

H.L. Plotnick, *The Relations Between Selected Personality Characteristics of Social Work Students and Accuracy in Predicting the Behavior of Clients*, (unpublished PhD Dissertation, Columbia University, 1961), cited by James Bieri, "Complexity-Simplicity as a Personality Variable in Cognition and Preferential Behavior," in Donald Fiske and Salvatore Maddi, eds., *Functions of Varied Experience*, (Homewood, Illinois: The Dorsey Press, 1961), pp. 355-379.

Leighton Price, *Personality Characteristics and Consumer-Product Perceptions: Methodological Advances and Empirical Verification of a Cognitive Model*, (unpublished PhD Dissertation, Michigan State University, 1972).

V.N. Campbell, *Assumed Similarity Perceived Sociometric Balance and Social Influence*, (unpublished PhD Dissertation, University of Colorado, 1960), cited in Crockett, *loc. cit.*

Crockett, *loc. cit.*, Crockett cites several additional early studies which add validity to the idea that high complexity is associated with greater discriminatory abilities.

57

Bieri, *loc. cit.*

58

Lee Sechrest and Douglas Jackson, "Social Intelligence and Accuracy of Interpersonal Perceptions," *Journal of Personality*, XXIX (1961), pp. 167-182.

59

C.W. Mayo and William H. Crockett, *loc. cit.*

T. Tripodi and James Bieri, "Information Transmission in Clinical Judgements as a Function of Stimulus Dimensionality and Cognitive Complexity," *Journal of Personality*, XXXII (1964), pp. 119-137.

L.J. Nidorf, *Individual Differences in Impression Formation*, (unpublished PhD Dissertation, Clark University, Worster, Mass., 1961), cited by Crockett, *loc. cit.*

60

Tuckman, 1964, *loc. cit.*

61

Driver, 1962, *loc. cit.*

62

O.J. Harvey, "Cognitive Determinants of Role Playing," Technical Report #3, Contract Number 1147(07), University of Colorado, 1963, cited in Schroder, Driver and Streufert, *op. cit.*, pp. 115-116.

63
K.W. Terhune and J.L. Kennedy, *Exploratory Analysis of a Research and Development Game*, Office of Naval Research, Technical Report No. 3, Princeton University, 1963, cited in Schroder, Driver and Streufert, *op. cit.*, pp. 114-115.

64
Mayo and Crockett, *loc. cit.*

65
Scott, 1962, *loc. cit.*

66
J.C. Higgins, "Cognitive Complexity and Probability Preferences," *Student Research Psychology University of Chicago*, II, 2 (1961), pp. 1-28, cited in Bieri, *op. cit.*, p. 368.

67
J.P. Janicki, "Effects of Disposition upon Resolution of Incongruity," *Journal of Abnormal and Social Psychology*, LXIX, 5 (1964), pp. 579-584.

68
Siegfried Streufert, "Conceptual Structure, Communicator Importance, and Interpersonal Attitudes toward Conforming and Deviant Group Members," *Journal of Personality and Social Psychology*, IV, 1 (1966), pp. 100-102. These conditions included groups of mixed attitude and complexity which is similar to the design to be used in this paper. This approach is unusual in the cognitive structure literature.

69
Stager, *loc. cit.*

70
Peter Suedfeld, "Attitude Manipulation in Restricted Environments: I. Conceptual Structure and Response to Propaganda," *Journal of Abnormal and Social Psychology*, LXVIII, 3 (1964), pp. 242-246.
Peter Suedfeld and Jack Vernon, "Attitude Manipulation in Restricted Environments: II. Conceptual Structure and the Internalization of Propaganda Received as a Reward for Compliance," *Journal of Personality and Social Psychology*, III, 5 (1966), pp. 586-589.

71
R.M. Lundy and Leonard Berkowitz, "Cognitive Complexity and Assimilation Projection in Attitude Change," *Journal of Abnormal and Social Psychology*, LV (1957), pp. 34-37.

APPENDIX A

COGNITIVE COMPLEXITY QUESTIONNAIRE

The purpose of this questionnaire is to determine how individuals view other people. In order to do this we are asking you to describe the various attributes and qualities of people in the following questionnaire. We are interested in finding out what aspects of other people, in general, you think are important when you are trying to understand or evaluate them.

Remove the stack of cards from the envelope. On each card separately write one characteristic which describes, or is related to, your evaluation (or understanding) of people. You can put down whatever comes to your mind, since there is no one list of characteristics that can be considered as either "correct" or "incorrect." Every one of us sees things in a slightly different way.

You may have too many or too few cards, but this shouldn't bother you. Put down as many characteristics as you feel are necessary to understand people adequately. Work rapidly. You will have approximately 10 minutes to complete this part of the questionnaire.

AS AN EXAMPLE, if the concept being considered were "cars," you might list: A - big; B - bright; C - shiny; D - fast; E - safe; F - steel; G - expensive; H - square; I - comfortable; J - automatic; K - transportation; L - good pickup; M - Ralph Nader; N - pollution; O - compact; P - sleek.

DO NOT GO ON TO THE NEXT PAGE.

Lay out in front of you all the cards you used for listing the characteristics. Look them over carefully and notice whether they fall into some broad natural groups. If they do, arrange them into such groups.

Do so now.

Continuing our example: The attributes listed on the previous page may be divided into: (1) How the car looks (A, B, C, and H); (2) How the car operates (D, I, J, E); and (3) The function of the car (K).

Stop when you have finished this operation.

Now, look at your groups one by one and see whether these can't be broken down into subgroups. If they can, separate the cards accordingly. It is also possible that these subgroups can be broken down further, and so on.

When you have arranged all cards into groups and subgroups, list your groupings on the sheet provided as if they were points and subpoints of an outline. First, give names or titles to your groups and subgroups. Then in the right-hand column list the letters of all the characteristics that belong in the respective group or subgroup. Letters may be used in more than one group or subgroup if you feel the attribute has more than one aspect.

FOR EXAMPLE:

1. Appearance

    A. Color -- B&C
    B. Size -- A&O
    C. Shape -- H&P

2. Operation

    A. Speed -- D&L
    B. Ride -- E&I

etc.

There are, of course, many other aspects of cars that could have been described and many different groups into which they could have been divided.