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Characteristics of Organizational Environments and Perceived Environmental Uncertainty

Twenty-two decision groups in three manufacturing and three research and development organizations are studied to identify the characteristics of the environment that contribute to decision unit members experiencing uncertainty in decision making.[1]

Two dimensions of the environment are identified. The simple-complex dimension is defined as the number of factors taken into consideration in decision making. The static-dynamic dimension is viewed as the degree to which these factors in the decision unit's environment remain basically the same over time or are in a continual process of change. Results indicate that individuals in decision units with dynamic-complex environments experience the greatest amount of uncertainty in decision making. The data also indicate that the static-dynamic dimension of the environment is a more important contributor to uncertainty than the simple-complex dimension.

Organizational theorists emphasize that organizations must adapt to their environment if they are to remain viable.[2] One of the central issues in this process is coping with uncertainty (Crozier, 1964; Thompson, 1967). The concept of the environment, with its components and relevant dimensions, however, has not been well specified in the literature (Dill, 1958; Emery and Trist, 1965; Lawrence and Lorsch, 1967; Perrow, 1967; Thompson, 1967). If a theory of organization-environment interaction is to be developed to facilitate empirical research, it is necessary that the components and dimensions of the environment be more clearly defined. This is the object of the research presented here.

The components of the environment as well as its specific dimensions, are identified. This identification, in turn, then facilitates the identification of types of environments that contribute to different degrees of uncertainty as perceived by individuals involved in decision making.[3]

Twenty-two decision units are studied in three manufacturing organizations (ten decision units) and in three research and development organizations (twelve decision units). An organizational decision unit is defined as a formally specified work group within the organization under a superior charged with a formally defined set of responsibilities directed toward the attainment of the goals of the organization. Decision making per se may be centered in the formal leader and/or distributed to various members of the specific unit. Decision making for this analysis is more broadly defined than in most decision models to include the gathering and processing of information carried out by groups of individuals, which precedes the actual choice process.

It should be emphasized that environmental uncertainty and the dimensions of the environment are defined here in terms

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[2] The author is also currently developing a model of how organizations learn to adapt to their environments (Duncan, 1971b).

[3] The author has also identified the types of structural modifications decision units implement in making decisions under uncertainty and the relationship between these adaptation processes and organizational effectiveness (Duncan 1971c).

of the perception of organization members. Research has indicated that there are differences among individuals in their perceptions and tolerance for ambiguity or uncertainty (Adorno *et al.*, 1950; Berlyne, 1968). Given the role individual differences play in one's reaction to events, consideration will be given in this research to the differences among individuals in their perception of uncertainty and the environmental dimensions before aggregate measures are constructed.

THE ENVIRONMENT

One of the shortcomings of much of the theoretical and empirical research on organizational environments has been the failure clearly to conceptualize organization environment or the elements comprising it (Lawrence and Lorsch, 1967; Thompson, 1967; Terreberry, 1968). Pugh *et al.* (1969) have studied organizational contexts, that is, origin and history, ownership-control, size, location, and so on—the settings within which organization structure is developed. As they have specified, however, this is not a model of an organization in an environment. Lawrence and Lorsch (1967), for example, have studied how organizations segment their environment into related sectors but have not clearly conceptualized the environment or its makeup. They have also conceptualized the environment as a total entity but have looked only at the environment from the organization outward (Lawrence and Lorsch, 1967: 4). Dill's (1958) concept of the task environment again focused only on those parts of the organization's external environment which were relevant or potentially relevant to the organization's goal setting and goal attainment.

In the present analysis environment is thought of as the totality of physical and social factors that are taken directly into consideration in the decision-making behavior of individuals in the organization.

If the environment is defined in this way, there are then factors within the boundaries of the organization or specific decision making units that must be considered as part of the environment. A differentiation is made, therefore, between the system's internal and external environment.

The internal environment consists of those relevant physical and social factors within the boundaries of the organization or specific decision unit that are taken directly into consideration in the decision-making behavior of individuals in that system.

The external environment consists of those relevant physical and social factors outside the boundaries of the organization or specific decision unit that are taken directly into consideration.

This distinction between internal and external environments is more comprehensive than Rice's (1963) definition of the internal environment as including the interpersonal relations of members and their interactions with each other and the external environment as including other individuals, groups, and institutions.

In an effort to identify environmental components, research was carried out in a large, industrial, manufacturing organization (Duncan, 1968). Nineteen individuals in various decision units in several functional areas and organizational levels were interviewed. A semistructured interview focused on the nature of the decision unit's environment and the decision-making process. From this research a list of environmental components was constructed comprising a decision unit's internal and external environment (Table 1). No decision unit is expected to identify all the components in its particular internal and external environment.

The list of environmental components presented in Table 1 may be particularly relevant to industrial organizations and may vary for other types of organizations. These findings go beyond existing research by more clearly conceptualizing the environment and factors comprising it. The empirical analysis of organization-environment interaction is, therefore, facilitated.

THE SIMPLE-COMPLEX DIMENSION

The next step was the identification of the environment's dimensions in order to make predictions about the kinds of environments in which different levels of perceived uncertainty are expected to exist. In the work of organizational theorists such as Emery and Trist (1965), Thompson (1967),

TABLE 1. FACTORS AND COMPONENTS COMPRISING THE ORGANIZATION'S INTERNAL AND EXTERNAL ENVIRONMENT

Internal environment
(1) Organizational personnel component
(A) Educational and technological background and skills
(B) Previous technological and managerial skill
(C) Individual member's involvement and commitment to attaining system's goals
(D) Interpersonal behavior styles
(E) Availability of manpower for utilization within the system
(2) Organizational functional and staff units component
(A) Technological characteristics of organizational units
(B) Interdependence of organizational units in carrying out their objectives
(C) Intra-unit conflict among organizational functional and staff units
(D) Inter-unit conflict among organizational functional and staff units
(3) Organizational level component
(A) Organizational objectives and goals
(B) Integrative process integrating individuals and groups into contributing maximally to attaining organizational goals
(C) Nature of the organization's product service
External environment
(4) Customer component
(A) Distributors of product or service
(B) Actual users of product or service
(5) Suppliers component
(A) New materials suppliers
(B) Equipment suppliers
(C) Product parts suppliers
(D) Labor supply
(6) Competitor component
(A) Competitors for suppliers
(B) Competitors for customers
(7) Socio-political component
(A) Government regulatory control over the industry
(B) Public political attitude towards industry and its particular product
(C) Relationship with trade unions with jurisdiction in the organization
(8) Technological component
(A) Meeting new technological requirements of own industry and related industries in production of product or service
(B) Improving and developing new products by implementing new technological advances in the industry

and Terreberry (1968), two environmental dimensions can be inferred: the simple-complex dimension and the static-dynamic dimension. These dimensions were then conceptualized for this research in the following manner.

The simple part of the simple-complex dimension deals with the degree to which the factors in the decision unit's environment are few in number and are similar to one another in that they are located in a few components. The complex phase indicates that the factors in the decision unit's environment are large in number.

An example of a decision unit with a simple environment would be a lower-level production unit whose decisions are affected only by the parts and materials department upon which it is dependent for supplies, and the marketing department upon which it is dependent for determining its output volume. This environment is thus homogeneous in that the parts and materials department and the marketing department are both under the same environmental component, the organizational function and staff units (see Table 1).

An example of a decision unit with a complex environment would be a decision unit in a programing and planning department. These decision unit members, when making a decision, may consider a wide variety of factors in both the internal and external environment. They may, for example, focus on the internal environmental factors of the marketing and materials departments of the organizational functional and staff unit component. At the same time, they may focus on the external environmental factors of customer demand of the customer component, the availability of raw materials and product parts of the supplier component, and government regulatory control over the industry of the socio-political component in formulating programs and plans for organizational action. This decision unit approaches the complex end of the simple-complex dimension as there are a larger number of factors, N = 6, identified that are dissimilar or heterogeneous to one another. This is due to the fact that they are located in several different environmental components, N = 4 (see Table 1).

A specific simple-complex environmental index is then developed by multiplying the number of decision factors (F) identified by decision unit members that they considered in decision making by the number of components $(C)^2$. This product expresses the contribution of both the number of factors and the degree to which they are similar (found in one component) or are dissimilar (found in several components). Thus, the simple-complex environmental index = $(F) \times (C)^2$.

Squaring the number of components is an indicator of similarity-dissimilarity in that the more components the factors are in, the more dissimilar they are. This is expressed in $(C)^2$. A decision unit with three factors in one component, for example, would have a simple-complex environmental index of 3 $(3 \times 1^2 = 3)$. A unit with three factors in three different components would have an index of 27 $(3 \times 3^2 = 27)$, indicating the increased complexity of their environment as a function of the dissimilar nature of the factors. The rationale for squaring (C) is that the amount of variance between components is greater than the amount of variance between factors and, thus, should be weighted in the development of the index.

The simple-complex environmental index for the lower-level production unit would be $2 \times 1^2 = 2$ (that is, the parts and materials department and the marketing department, which represents two factors and, since both of these factors are in the organizational functional and staff component, there is one component represented).

The simple-complex environmental index for the programing and planning department described above as having a complex environment would be $6 \times 4^2 = 96$ (that is, marketing department, materials department, customer demand, availability of raw materials, availability of product parts, and government regulatory control over the industry; this represents six factors and these factors are in the organizational functional and staff, customer, supplier, and socio-political components which represent four components).

THE STATIC-DYNAMIC DIMENSION

The static-dynamic dimension indicates the degree to which the factors of the decision unit's internal and external environment remain basically the same over time or are in a continual process of change. It is composed of two subdimensions. The first focuses on the degree to which the factors identified by decision unit members in the unit's internal and/or external environment are stable, that is, remain the same over time, or are in a process of change. For example, the environmental factors in a production decision unit which are always taken into consideration in decision making may be the marketing department and the materials department. These factors would characterize a static environment if the marketing department's requests for production output remained stable and if the materials department was able to supply a steady rate of inputs to the production decision unit. On the other hand, if the marketing department was continually changing its request for different production outputs and the materials department was variable in its ability to supply parts, these factors would characterize a more dynamic environment for the decision unit. This particular subdimension of the static-dynamic dimension is measured by asking respondents how often each of the factors that they identified as being important in decision making in their internal and/or external environment change. The response categories vary along a five-point scale of: (1) never, (2) almost never, (3) sometimes, (4) frequently, and (5) very often.

The decision units are then given a score on this subdimension from the average response of all the entities as changed. Individual responses are averaged to form the unit's overall score on this subdimension. The members of the production decision unit, for example, may indicate as a group that the marketing department is frequently changing its request for different products (score = 4) and that the materials department almost never changes in its input of parts and supplies (score = 2). The total score on this first subdimension for the decision unit would be $2 + 4/2 = 3$.

The second subdimension of the static-dynamic dimension focuses on the frequency with which decision unit members take into consideration new and different internal and/or external factors in the decision-making process. An example of the second subdimension might be a production unit that always takes the marketing department and the materials department into consideration in its decision making. This would contribute to a static environment as the environment was not changing; the same two factors, marketing and materials, were continually considered in decision making. On the other hand, a programing and planning decision unit's environment would be more dynamic if the members of this unit indicated that they focused on a variety of different factors over time. In developing programs for one type of product, for example, they might focus on the customer demand and the production and marketing departments. In planning and developing programs for a different type of product, the relevant environment to be considered in decision making may have changed to include, in addition to the marketing and production departments, a different group of customers, possible government regulatory agencies with jurisdiction over this type of product, and the implications for this new product on labor-management relations. Thus, the relevant environment for this decision unit is changing. This particular subdimension is measured by asking respondents of a given decision unit how often they consider new and different factors in decision making. Again the response categories vary along the same five-point scale.

The decision unit as a group then receives the raw score as indicated by its members (individual decision unit member's responses are averaged to form the overall unit's score). In the programing and planning department, the members as a group may indicate that the factors that they take into consideration in decision making change very often (score = 5).

The scores obtained on these two subdimensions of the static-dynamic dimension of the environment are then added together to obtain the decision unit's static-dynamic index. Units are then rank ordered according to index scores and split at the median. The high scoring half of the distribution is defined as decision units having a dynamic environment and the low scoring half as units having a static environment.

PERCEIVED UNCERTAINTY

One of the primary tasks of this research was to place environmental uncertainty in a logical framework so that it could be operationalized more effectively in the future. The concept of uncertainty has been defined in a variety of ways in the literature. Information theorists such as Attneave (1959) and Garner (1962) have defined the concept in a narrow fashion. Garner's (1962: 19) definition is representative in stating that "the uncertainty of an event is the logarithm of the number of possible outcomes the event can have . . . ."

Decision theorists such as Knight (1921) and Luce and Raiffa (1957) defined uncertainty as those situations where the probability of the outcome of events is unknown as opposed to risk situations where each outcome has a known probability. At the wider level of analysis, Lawrence and Lorsch (1967: 27) state that uncertainty consists of three components: (1) the lack of clarity of information, (2) the long time span of definitive feedback, and (3) the general uncertainty of causal relationships.

In surveying these different concepts, it was concluded that the wide definitions were too broad in scope and did not facilitate the overall objective of trying to define the concepts in the model more specifically so that they could be operationalized. Lawrence and Lorsch (1967) were vague with their definition of lack of information and general uncertainty of causal relationships. This lack of clarity in definition then inhibits the development of specific operational measures of uncertainty, which is an immediate objective of this research.

The narrower definitions of Garner (1962), Knight (1921), and Luce and Raiffa (1957) tend to focus on the more mathematical aspects of uncertainty such as the individual's ability or inability to assign probabilities to events. It was concluded that, although this may be an important component of uncertainty, there may be other components that should also be included. Another consideration in not adopting the narrower definition of uncertainty was that the definition of uncertainty implemented here had to provide an operationalization of the concept to which actual organizational members could respond. Given the more specific mathematic definition of uncertainty by the information theorists (Garner, 1962; Attneave, 1959), it was believed that these definitions were too abstract for managers to respond to.

Environmental uncertainty was defined on the basis of the preliminary research discussed above (Duncan, 1968). Although there was difficulty in the preliminary research in getting respondents to verbalize their views of uncertainty, there was a remarkable degree of similarity in the way in which the concept was ultimately defined. Three components of uncertainty were mentioned by some or all of the eighteen individuals who gave a definition: (1) the lack of information regarding the environmental factors associated with a given decision-making situation, (2) not knowing the outcome of a specific decision in terms of how much the organization would lose if the decision were incorrect, and (3) inability to assign probabilities with any degree of confidence with regard to how environmental factors are going to affect the success or failure of the decision unit in performing its function.

The first two components focus on the general lack of information that is involved in decision making. This is similar to Lawrence and Lorsch's (1967) broad formulation. The third component in the present study is similar to narrower mathematical definitions in its focus on assigned probabilities, but it does differ in a fundamental way. Decision theorists (Knight, 1921; Luce and Raiffa, 1957) have normally defined uncertainty as a situation where the individual cannot assign probabilities to the outcome of events. The third component of uncertainty defined above seems to indicate that this definition is too restricted. The individuals in this preliminary research indicate that they could assign probabilities to the outcome of events but that in uncertain situations the question becomes one of how sure or confident the respondent is in his probability assessment. Thus, in uncertain situations the individual can still assign probabilities to the outcome of events, for instance, going to the moon or becoming a millionaire but he is less confident about the probability estimates than under conditions of risk. The real question becomes one of how confident the individual is in his estimate. In uncertain situations there is less predictability with respect to the outcome of events than under conditions of risk. The present definition of uncertainty thus takes a broader perspective and is concerned with the individual's ability to assign probabilities. It builds on both the wide and narrow formulations to provide a definition that is both comprehensive and yet specific, so that it can be used in future research.

THE UNCERTAINTY MEASURE

Dimensions 1 and 2 of perceived environmental uncertainty are measured by scale items similar to those in the Likert system (Duncan, 1971a). The first dimension—lack of information regarding the environmental factors associated with a given decision-making situation—contains six scale items of which the following is an example: how often do you believe that the information you have about this factor is adequate for decision making?

The second dimension—not knowing the outcome of a specified decision in terms of how much the organization would lose if the decision were incorrect—is composed of six scale items. An example is: how often do you feel you are unable to predict how this factor is going to react to or be affected by decisions made in this group?

The response categories varied along a five-point scale of: (1) never, (2) seldom, (3) occasionally, (4) fairly often and (5) always. The factors taken into consideration in decision making were identified by an interview prior to administering the questionnaire. The environmental components in Table 1 were used as a guide in this interview. In the interview decision unit members might indicate that they took Factor A (exproduction department), Factor B (exmarketing department), Factor C (excustomer demand) into consideration in decision making. Each decision unit member was then asked to answer each question in the scales for the first two dimensions of perceived environmental uncertainty for each of the factors taken into consideration in decision making. Individuals then received an average score on each of the questions on the scales for the first and second dimensions by means of the following formula:

$$\frac{\text{total score on a given question}\begin{pmatrix}\text{sum of answers for}\\ \text{each factor}\end{pmatrix}}{\text{number of factors taken into consideration}}$$

The third dimension of perceived environmental uncertainty deals with the respondent's ability or inability to assign probabilities as to the effect of a given factor on the success or failure of a decision unit in performing its function. There are two components to the question that measures this dimension. First, the respondent was asked to indicate on a scale how sure he was of how each of these factors was going to affect the success or failure of his work group in carrying out its function. The scale was as follows:

completely unsure										completely sure
0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

This is the probability assigning task that the strict definition of uncertainty in the literature (Knight, 1921; Luce and Raiffa, 1957) indicates that the individual cannot do. The assumption was, however, that even in uncertain situations, the individual may well be able to assign some probability estimates. The real question then becomes one of how confident he is in this estimate.[4]

The second part of the question for each respondent, after he assessed his certainty, was what range of numbers he was considering between 0 and 1.0 in indicating this certainty, that is, how confident was he in his estimate. For example, if a person answered that he was 0.3 sure about a factor, what was the range he was considering in giving this answer? Was it between 0.2 and 0.4 or 0.1 and 0.7, or 0 and 1.0, and so forth? A wide spread in this range would indicate lack of confidence in his probability assessment.

This question is then scored to determine the individual's degree of ability to assign probabilities as to the effect of a given factor on the success or failure of the unit in performing its function. For each factor he indicates that he takes into consideration in decision making, he receives a score measuring his degree of ability to assign probabilities as to the effect of that factor on the decision unit's performance. This score is derived by weighting his certainty about the effects of a given factor (part one of the question) by the range between 0 and 1.0 he considers in making this assessment (part two of the question). The specific formula is as follows with larger scores indicating greater ability to assign probabilities:

$$\text{degree of ability to assign probabilities} = (\text{certainty of effects of factor}) \times (\text{1-range of certainty estimate})$$

If a person, for example, responds by indicating he is 0.3 sure about the effects of Factor A on the performance of his work group and the range he is considering in giving this answer is between 0 and 0.5, his degree of ability to assign probabilities score for this factor would be $0.3 \times (1\text{-}0.5) = 0.15$.

The respondent's total score for this question is then averaged for the number of factors taken into consideration in decision making which may vary from individual to individual:

$$\frac{\text{sum of degree of ability to assign probabilities scores for all factors identified}}{\text{number of factors identified}}$$

The scores of the three components of uncertainty are added to form a total uncertainty score. The rationale is that these three components are conceptually related in the sense of representing a general lack of information about the environment.

HYPOTHESES

Both the simple-complex and static-dynamic dimensions are important in deter-

[4] Some direct support of this procedure is found in Raiffa (1968: 161–168); Professor Gerrit Wolf of Yale University was also helpful in the development of this measure.

mining the state of the decision unit's environment. By considering the interaction of these two dimensions, different states of the decision unit's environment can be identified. Once these are identified, predictions can then be made as to the degree of perceived environmental uncertainty expected to exist in these different types of environments. Table 2 represents a conceptualization of these two dimensions for the combined internal and external environment. Thus, Table 2 is a simplified presentation in that there is no distinction being made between the internal and external environment.[5]

TABLE 2. ENVIRONMENTAL STATE DIMENSIONS AND PREDICTED PERCEIVED UNCERTAINTY EXPERIENCED BY INDIVIDUALS IN DECISION UNITS

	Simple	Complex
	Cell 1: low perceived uncertainty	Cell 2: moderately low perceived uncertainty
Static	(1) Small number of factors and components in the environment (2) Factors and components are somewhat similar to one another (3) Factors and components remain basically the same and are not changing	(1) Large number of factors and components in the environment (2) Factors and components are not similar to one another (3) Factors and components remain basically the same
	Cell 3: moderately high perceived uncertainty	Cell 4: high perceived uncertainty
Dynamic	(1) Small number of factors and components in the environment (2) Factors and components are somewhat similar to one another (3) Factors and components of the environment are in continual process of change	(1) Large number of factors and components in the environment (2) Factors and components are not similar to one another (3) Factors and components of environment are in a continual process of change

From this simplified typology the following hypotheses can be derived.

Hypothesis one. Decision units with simple-static environments (Cell 1) will experience the least perceived environmental uncertainty. In environments that are characterized by simple-static dimensions where there is a smaller number of relatively similar, unchanging factors considered in decision making, little uncertainty is expected to exist. Here, decision unit members are predicted to be able to have the relevant information regarding the factors associated with a decision so that the outcome of the decision can be assessed.

Hypothesis two. Decision units with complex-dynamic environments (Cell 4) will experience the greatest perceived environmental uncertainty.

In environments characterized by complex-dynamic dimensions where a large number of changing factors differ from one another, uncertainty is predicted to be high. Both Thompson (1967), in his theoretical analysis of organizational adaptation, and Udy (1959), in his comparative research, indicated that environmental uncertainty increased when organizational environments were changing and heterogeneous. Here, it is predicted that decision unit members will not have the relevant information available for the factors associated with a decision, so the outcome of the decision cannot be assessed.

Hypothesis three. Decision units with simple-dynamic environments (Cell 3) will experience greater perceived environmental uncertainty than individuals in decision units with complex-static environments (Cell 2). Decision units having simple-dynamic environments (Cell 3) are predicted to have a more difficult time obtaining the relevant information for decision making than units

[5] The sample size of this research did not allow for this more differentiated analysis (Duncan 1971a).

having complex-static environments (Cell 2) because of the continually changing nature of factors in their environment. As a result, they were predicted to experience greater perceived environmental uncertainty than decision units in Cell 2 type of environments.

The implication of the third hypothesis is that the static-dynamic dimension is a more important contributor to uncertainty than the simple-complex dimension. In a dynamic environment, where the factors taken into consideration in decision making are continually changing, it is going to be difficult to have available the relevant information for the decision-making situation. When the environment is changing, the system must continually learn to readapt. The system cannot rely on past procedures and practices; rather, it is faced with a new situation in which its members will have to learn new methods. In a dynamic environment the system is faced with many possible outcomes whereas with an unchanging, static environment, there is only a finite number of outcomes to events. This will exist regardless of whether there are many or few factors taken into consideration in decision making, that is, whether the decision unit's environment is simple or complex. The result is that moderate to high levels of perceived environmental uncertainty were predicted to exist for decision unit members. This prediction is consistent with both the work of Emery and Trist (1965) and Terreberry (1968). They found that organizations in dynamic-turbulent environments often exceeded their capabilities for prediction and control with the result that the outcome of events became less certain.

METHODOLOGY

Unit of Analysis

Since the unit of analysis is the organizational decision unit, responses obtained from decision unit members on all the items on a variable are pooled to reflect the degree of the given variable experienced by the unit as a whole. This is accomplished in three steps. First, a mean score on each of the items of a variable is computed for each type of social role in the decision unit. Second, the decision unit's score for a given item is then determined by computing the average of all social role means in the unit on the given item. Third, the decision unit's total score on a variable is then computed by adding the scores on the items making up the variable. For a more complete discussion of this pooling, see Lazarsfeld and Menzel (1960) and Hage and Aiken (1967).

Pooling Responses

One of the initial problems in pooling perceptual measures is to determine the degree of variance among individuals making up the group. Are individuals responding to the variable under measurement in the same way or are individuals in the group responding differently to the same variable? If there are large variances in the way individuals are responding, it is difficult to pool individual responses to represent the group as a whole.

A five-point change scale was used to investigate these questions: (1) never, (2) almost never, (3) sometimes, (4) frequently, and (5) very often. If in a group composed of individuals I_1, I_2, I_3, I_1 responds with 1 indicating very low change, I_2 responds with 3 indicating medium change, and I_3 responds with 5 indicating a very high level of change experienced, the average pooled score for the group would be $\frac{1+3+5}{3} = 3 =$ median level of change experienced in this group. This pooled group score would be misleading given the wide variance in the way individuals are experiencing change in their environment. Thus, in assessing perceptual measures, consideration must be given to determining how individual members respond to the same phenomenon. Schneider and Bartlett (1970) support this view in their research on perceptual measures of organizational climate. Their research indicated a lack of congruence between the manager's and agent's view of climate in life insurance agencies. Forehand and von Haller Gilmer (1964) in their analysis of environmental variation in organizational behavior have also indicated that for individual scores to be pooled to represent a group score, there must be some evidence that the dimension under consideration is perceived similarly by all those in the group.

To assess the homogeneity of group members' perception of a particular variable, oneway analysis of variance was computed across individuals in a given decision unit to discover any significant differences among individual perceptions. This was done before individual scores were pooled to get total decision unit scores on the simple-complex and static-dynamic environmental dimensions and on the perceived environmental uncertainty variable. The data indicate no significant differences across individuals in groups for the simple-complex environmental dimension and perceived uncertainty. On the static-dynamic environmental dimension, in one of the twenty-two groups in the sample, individuals exhibit a significant difference in their perception of this dimension of their environment ($F = 7.630$ $p < 0.01$). Given the general homogeneity of group member perceptions on the variables, however, individual responses are summed to form group scores.

RESULTS

Before specific hypotheses derived from Table 2 are tested, a constraint of the research sample must be considered. Type of organization was initially controlled for in the data collection. Examination of the distribution of the sample on the simple-complex and static-dynamic environmental dimensions in Table 3, however, indicates that it is impossible to control for organizational type in the statistical analysis because of the zero entry of research and development organizations in Cell 1 and the zero entry of manufacturing organizations in Cell 4.

In this particular sample, there were no research and development organizations with simple-static environments and no manufacturing organizations with complex-dynamic environments. This confirms the idea that different organizations operate in different environments and seems to suggest that manufacturing organizations tend to have more simple and static environments, while research and development organizations tend to have more complex and dynamic environments. T-tests between the means of the manufacturing and research and development organizations are performed in Table 4 on the simple-complex and static-dynamic dimensions. The results of this analysis confirm that in this sample, research and development organizations have more complex ($t = 4.388$, $p < 0.001$) and dynamic ($t = 3.453$, $p < 0.01$) environments than manufacturing organizations.

Given the wide differences in environments between these two types of organization, it is important to consider whether it is the nature of the environment or type of organization that is most important in a decision unit experiencing uncertainty. It has been indicated that the initial statistical control for organization type had to be eliminated because of zero entries in some cells in Table 3.

A somewhat rougher analysis is performed to indicate the amount of variance in uncertainty that is explained by environmental type and organizational type. A T-test between the mean amount of uncertainty experienced by manufacturing and research and development organizations is computed. The amount of variance explained for uncertainty by organizational type is then identified by computing ω^2, omega squared (Hays, 1963: 324–332).

To indicate the amount of variance explained by environmental type, a one-way analysis of variance (Table 6) is performed across the four different types of environment in Table 3 and then ω^2 (omega squared) is computed to indicate the amount of variance explained for uncertainty by environmental type (Hays, 1963: 381–384).

The data presented in Tables 5 and 6 indicate that organizational type explains approximately 30 percent of the variance in uncertainty, while environmental type explains 70 percent of the variance. The conclusion, then, is that it is the nature of the organization's environment rather than the kind of organization that is most important in explaining the degree of uncertainty experienced in decision making.

In testing the hypotheses derived from Table 3, a 2 × 2 (simple-complex × static-dynamic) analysis of variance is performed. The results of that analysis are presented in Table 7. The multiple comparisons of the four cell means based on the a priori pre-

TABLE 3. DISTRIBUTION OF DECISION UNITS SAMPLED ON SIMPLE-COMPLEX AND STATIC-DYNAMIC ENVIRONMENTAL STATE DIMENSIONS

	Simple		Complex	
	Cell 1:		Cell 2:	
	manufacturing organizations	research and development organizations	manufacturing organizations	research and development organizations
Static	# 1 # 2 # 3 # 4 # 5 # 7 #10		#6	#20 #22 #23
		N = 7	N = 4	
	Cell 3:		Cell 4:	
	manufacturing organizations	research and development organizations	manufacturing organizations	research and development organizations
Dynamic	# 9 #11	#13 #14		#12 #15 #16 #17 #18 #19 #21
		N = 4	N = 7	

TABLE 4. MEAN DIFFERENCES BETWEEN MANUFACTURING AND RESEARCH AND DEVELOPMENT ORGANIZATIONS ON THE SIMPLE-COMPLEX AND STATIC-DYNAMIC ENVIRONMENTAL DIMENSIONS

	Number of observations	Means	Standard deviation	Student's T-test	Degree of freedom	Bartlett's test results
			Simple-complex variable			
Research and development organizations	12	600.25	117.738	4.388*	20	Chi Sq. = 2.775 (1 D.F.) variance assumed equal;
Manufacturing organizations	10	296.00	203.277			pooled variance = 26218.912
			Static-dynamic variable			
Research and development organizations	12	6.774	1.092	3.453†	20	Chi Sq. = 0.2925 (D.F.) variance assumed equal;
Manufacturing organizations	10	5.014	1.301			pooled variance = 1.417

* $p < 0.001$
† $p < 0.01$

TABLE 5. MEAN DIFFERENCES BETWEEN MANUFACTURING AND RESEARCH AND DEVELOPMENT ORGANIZATIONS IN PERCEIVED UNCERTAINTY

	Number of observations	Means	Standard deviations	Student's T-test	Degree of freedom	Bartlett's test results
Research and development organizations	12	43.967	12.345	3.224*	20	Chi Sq. = .235 (1 D.F.) variances assumed equal; pooled variance = 108.150
Manufacturing organizations	10	29.610	7.354			

* $p < 0.01$
$\omega^2 = 0.299$

TABLE 6. ANALYSIS OF VARIANCE ENVIRONMENTAL TYPE AND PERCEIVED UNCERTAINTY

Source	Mean square	Degree of freedom	F-test
Between	829.896	3	18.727*
Within	44.316	18	

* $p < 0.001$
$\omega^2 = 0.707$

dicted differences in different levels of uncertainty to be experienced in the different types of environments is presented in Table 8.

Tables 7 and 8 confirm the first hypothesis in that decision units with static-simple environments experience the least amount of perceived uncertainty (25.960). This is significantly lower than the groups in Cells 3 and 4, while not significantly lower than the groups in Cell 2.

Tables 7 and 8 confirm the second hypothesis in that decision units with dynamic-complex environments experience, on the average, the greatest degree of perceived environmental uncertainty (51.729), which is significantly different from all the other three types of environment (Cells, 1, 2, and 3).

Tables 7 and 8 provide some support for the third hypothesis. Decision units with simple-dynamic environments (Cell 3) experience, on the average, a greater level of perceived uncertainty (38.337) than groups with complex-static environments (Cell 2) (31.635). Table 8, however, indicates that the difference between the means for Cells 2 and 3 is not significant. Other data do provide support for the general implication of the hypothesis that the static-dynamic dimension of the environment is a more important contributor to the perception of uncertainty. The results of the two-way analysis of variance presented in Table 7

TABLE 7. ANALYSIS OF VARIANCE, SIMPLE-COMPLEX AND STATIC-DYNAMIC ENVIRONMENTAL STATE DIMENSIONS UPON PERCEIVED ENVIRONMENTAL UNCERTAINTY

Source of variance	Sum of squares	Degree of freedom	Mean square	F ratio
A = simple-complex	462.656	1	462.656	10.438*
B = static-dynamic	1,341.926	1	1,341.926	30.504*
A × B	75.775	1	75.775	1.710
Total between cells	1,880.357	3.00		
Total within cells	797.693	18.00	44.316	

* $p < 0.01$

Rank order of cell means predicted low to high uncertainty:
Cell I: static-simple
Cell II: static-complex
Cell III: dynamic-simple
Cell IV: dynamic-complex

Observed cell means:

	Simple	Complex
Static	I 25.960	II 31.735
Dynamic	III 38.337	IV 51.729

TABLE 8. MULTIPLE COMPARISONS OF CELL MEANS OF UNCERTAINTY, SIMPLE-COMPLEX AND STATIC-DYNAMIC ENVIRONMENTAL DIMENSIONS ANALYSIS

Cells compared	Difference between cells	Critical difference for t, 18 degrees of freedom
I & IV	25.769	$p < 0.01$
I & III	12.377	$p < 0.01$
I & II	5.675	NS
II & IV	10.094	$p < 0.01$
II & III	6.702	NS
III & IV	13.392	$p < 0.01$

indicate that the static-dynamic main effect is much higher ($F = 30.504$) than the simple-complex main effect ($F = 10.438$). The potency of the static-dynamic dimension in contributing to perceived uncertainty is further enhanced by the insignificant interaction effect between the two environmental state dimensions.

Inspection of the multiple comparisons in Table 8 provides additional information as to the importance of the static-dynamic dimension. The comparison between static-simple (Cell 1) and static-complex (Cell 2) environments indicates no significant difference in the amount of uncertainty experienced by decision units with these types of environments. Comparison between dynamic-simple (Cell 3) and dynamic-complex (Cell 4) environments, however, indicates a significant difference in the amount of uncertainty experienced. Thus, the difference in perceived uncertainty between static and dynamic environments is always significant regardless of whether the environment is simple or complex. Difference in perceived uncertainty between simple and complex environments is contingent upon the environment being dynamic. Thus, it appears that the complexity of the decision unit's environment does not have much impact on uncertainty until those factors considered in decision making begin to change, that is, become dynamic.

SUMMARY

Two dimensions of the environment are identified. The simple-complex dimension is defined as the number of factors taken into consideration in decision making. The static-dynamic dimension is defined as the degree to which these factors in the decision unit's environment remain basically the same over time or are in a continual process of change. Results indicate that individuals in decision units experiencing dynamic-complex environments experience the greatest amount of uncertainty in decision making. The data also indicate that the static-dynamic dimension of the environment is a more important contributor to uncertainty than the simple-complex dimension. Decision units with dynamic environments always experience significantly more uncertainty in decision making regardless of whether their environment is simple or complex. The difference in perceived uncertainty between decision units with simple and complex environments is not significant, unless the decision unit's environment is also dynamic.

This finding is somewhat consistent with the theoretical work of Thompson (1967), Terreberry (1968), and Emery and Trist (1965) but, in addition, provides the first systematic conceptualization and empirical analysis of the dimensions of the environment that lead to different degrees of perceived uncertainty.

It is also emphasized that uncertainty and the degree of the complexity and dynamics of the environment should not be considered as constant features in an organization. Rather, they are dependent on the perceptions of organization members and thus can vary in their incidence to the extent that individuals differ in their perceptions. Some individuals may have a very high tolerance for ambiguity and uncertainty so they may perceive situations as less uncertain than others with lower tolerances.

Future research should thus focus on the interface between individual differences and organizational properties. If the view that an organization has no properties aside from the way people perceive it (Hunt, 1968) is given some credence, we need to begin to identify more clearly how individual differences affect perceptions of organizational properties. For example, the research reported here should now be expanded to look at the impact of individual differences

on the perception of uncertainty and the complexity and dynamics of the organization's environment. This research would help develop a more comprehensive contingency theory of organizations. Most contingency theories now tend to be one sided (Burns and Stalker, 1961; Duncan, 1971c; Lawrence and Lorsch, 1967) in that they focus on the characteristics of the environment or task situation while ignoring an equally important contingent factor of individual differences among organizational members. It is only by beginning to focus on these individual differences that we can begin to develop our contingency theory more fully.

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