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Definitions, Measurements, and Classifications of Stimuli, Situations, and Environments[1]

Lawrence A. Pervin[2]

A review is presented of issues relevant to the definition, measurement, and classification of stimuli, situations, and environments. Problems such as the lack of adequate definitions of concepts, error and bias in measurement procedures, confusion between measurement of a concept and measurement of its behavioral effects, and the lack of agreement among alternative measures are emphasized. It is suggested that concepts be defined in terms of objective characteristics while allowing for the study of the transactional relationship between organism and environment. The work of the ethologists in defining stimuli while studying their relationship to different organismic states and situational contexts is emphasized in this regard. Following Brunswik, it is also suggested that wherever possible there be a representative sampling of variables in natural settings.

KEY WORDS: environmental psychology; stimuli; situations; environments.

INTRODUCTION

The goal of this paper is to review the alternative ways in which stimuli, situations, and environments have been defined, measured, and classified, and to clarify some of the relevant issues. While the literature reviewed and issues discussed relate to current concerns with person-situation research, environmental

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[2] Livingston College, Rutgers University, New Brunswick, New Jersey.

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psychology, and organizational psychology, the paper does not attempt to review the literature in these areas. Relevant reviews are, to a certain extent, already available (Bowers, 1973; Craik, 1973; Ekehammar, 1974; James and Jones, 1974; Pervin, 1968). Rather, this discussion calls attention to common conceptual and methodological issues in studies of perception, person-situation interaction research, and environmental psychology. A review of research in these areas suggests that often investigators undertake research without having thought through the alternative definitions and measures that are possible and the implications of choosing one or another definition and measure. One result is confusion concerning the relationships of findings from various studies. A second result is that often alternative types of data that might be collected are not, precluding the possibility of comparisons of data from different measures. Finally, there is the tendency to generalize findings far beyond the limited domain of stimuli, situations, and environments sampled and responses measured.

DEFINING THE CONCEPTS

Stimulus

In his important paper on the concept of the stimulus in psychology, Gibson (1960) observed that the weak link in our explanations of behavior is our concept of the stimulus. His comment that we constantly use the term stimulus but seldom define it would undoubtedly be equally appropriate today. Gibson also defined eight areas of disagreement concerning the concept of the stimulus, and many, if not all, of these remain today. As we shall see, similar issues come up in relation to the concepts of situation and environment.

One major question concerning the stimulus is whether it is to be defined independent of the perceiver. Arnoult (1963), for example, argues for definition and measurement of the stimulus independent of the response and perceiving organism. Gibson (1959) would appear to agree with this position, arguing for independent consideration of causal factors outside the organism and those inside the organism. Brunswik (1950, 1956) differentiated between distal stimuli – stimuli with which the organism was not in immediate contact, and proximal stimuli – stimuli at the boundaries of an organism, such as the representation of an object on the retina. Both were distinguished from central processes inside the organism that function between the reception of the stimulus at the surface of the organism and the production of some response. Thus Brunswik was concerned with objective definitions of stimuli and, as Postman and Tolman (1959) note, Brunswik's concern with constancy in perception ("thing constancy") was essentially in distal terms.

While many psychologists interested in perception have thus defined the stimulus independent of the perceiving organism, other psychologists have insisted that the concept of a stimulus is only meaningful in relation to the actively perceiving organism. Transactional and gestalt students of perception would argue, for example, that the entire process of perception involves an organism that is active in what it attends to and how it incorporates incoming stimuli (Avant and Helson, 1973). Ittelson (1973a), for example, contrasts the traditional view of the stimulus as a source of stimulation with the transactionalist concept of stimulus information. Within the traditional view there is the study of light changes on the retina and a view of perception as mirroring the external world. In contrast with this, the transactional view emphasizes a broader context in which perception mirrors "our innermost values and produces a world we saw because we believed in it" (Ittelson, 1973a: 10).

The question as to whether the stimulus can be defined independent of the perceiving organism is related to the distinction sometimes made between potential and actual stimuli. Gibson (1960) notes that some psychologists allow for potential stimuli and suggest that a stimulus need not excite receptors to be called such. Gibson himself supported such an interpretation, in particular arguing for the utility of the term *subthreshold stimulus.* Chein (1954) similarly suggests that a stimulus is *capable* of initiating a change in the stream of activity. While noting some problems with his definition, Chein argues that whether or not a stimulus *actually* stimulates an individual depends in part on the individual and his state. Presumably, then, there is some merit in defining a concept independently of such individual variables. A similar view is taken by Astin (1972) who views the college environment as consisting of a set of potential stimuli. In this case the stimuli refer to events or other observable characteristics of the college that are capable of changing the sensory input to the student attending the college. In contrast with such views is the view that a stimulus which is not perceived is not a stimulus at all. Osgood (1957) suggested that Brunswik would place emphasis upon the proximal (receptor level) stimulus, regardless of whether the organism made use of the information received. Barker (1968), who focuses mainly on environmental analyses, suggests that an environmental variable must be received by the organism to function as a stimulus. Thus, he would appear to emphasize actual stimuli as opposed to potential stimuli.

Before leaving the concept of the stimulus, it may be worth noting the work of the ethologists in defining the stimuli to which animals respond (Blurton-Jones, 1972; Hess, 1970; Hinde, 1974). Their work may be of particular interest to us because of their emphasis on classification and taxonomy, an issue that we will address later in the paper. The early ethologists rejected the approach of the American animal psychologists as being too tied to the manipulation of artificial stimuli in the laboratory context and to the observation of too few phenomena (Tinbergen, 1972). In observing behavior in the natural environment

they took care to note the stimuli to which animals responded. In some cases, experiments were performed to define the exact nature of the stimulus (sign stimulus or releaser) that elicited specific behaviors in the organism. While considerable progress was made in defining the concept of a sign stimulus and in relating such stimuli to specific behaviors, in many cases the behaviors displayed by the responding organism were influenced by factors inside the animal and by the context within which the stimuli were presented. This was particularly true for many social behaviors and important forms of communication.

Two things are of interest here. First, the concept of sign stimulus as defined by ethologists relates to specific objects in the environment whose relationship to a specific response in the organism is affected by the state of the organism and the context of perception of the stimulus. In other words, they have defined certain stimuli as being important to animal behavior even though these stimuli may not always lead to actual behavior. Sign stimuli are objectively defined potential stimuli. Second, as one looks at a greater variety of forms of communication and as one moves toward humans, it becomes harder to define the exact stimulus to which the organism is responding – individual interpretations (meaning as opposed to message), stimulus sequence, and context all start to become important determinants of the relationship between stimulus and behavior. These multiple and complex determinants also often make unclear the nature of the stimulus to which the organism is responding. The point here is that in some cases the stimulus could be defined quite easily in terms of its relationship to the responses of the animal. In other cases, it was quite difficult to arrive at such definitions. In a similar way, Brunswik (1956) found that subjects were quite successful in the utilization of cues from physical objects in size estimation and much less successful in the utilization of cues from social objects (i.e., persons) in trait estimation. This led to the distinction between overt distal stimuli (e.g., size, shape) and covert distal variables (e.g., energy, intelligence). Definitions of specific stimuli and their relationships to behavior may be more or less difficult according to the nature of the stimuli and behaviors being investigated.

In sum, there has been a variety of definitions given to the concept of the stimulus and these alternative definitions have implications for decisions concerning which stimuli are studied and how they are measured. Regardless of the definition of the stimulus, just about all current students of perception view the organism as actively engaging its surroundings. Whatever the initial presenting object, it is likely to be transformed in some way by the organism – depending upon the state of the organism and the context within which it is functioning. The relationship between organism, situation, and stimulus is such that in some cases (e.g., psychophysics) it may be relatively easy to specify the stimulus characteristics of the object of perception, whereas in other cases (e.g., social perception) it may be quite difficult to do so. It is tempting to believe that at

least some of the differences in definitions may be attributable to concern with different kinds of stimuli and with different kinds of subject responses. Brunswik's distinctions among objective distal stimuli, covert distal stimuli, proximal stimuli, and central mediating processes represent one effort to conceptualize some of these differences.

Situation

While the concept of the situation as an important determinant of behavior has been with us for some time, it has become increasingly important in relation to the recent emphasis upon situationism and person-situation interaction research. According to the extreme situationist, behavior is situation specific – one accounts for behavior in terms of the situation in which it occurs. In contrast with this view, the interactionist emphasizes the interplay between person variables and situation variables in determining behavior (Bowers, 1973; Ekehammar, 1974). What is of interest in relation to both these approaches is that often the concept of situation is left undefined and frequently it is used interchangeably with the concepts of stimulus and environment. Chein (1954), for example, speaks of a social situation as a potential stimulus. Bowers (1973) ties the situationist view to stimulus-response psychology and behaviorism, and then criticizes it, in part, for its inadequate definition of the stimulus. While making an important contribution in his emphasis on person-situation interaction, Bowers fails to define and conceptualize the situation. As Ekehammar (1974) notes, both the situationist and interactionist views emphasize the situation, yet explicit and detailed definitions are rare.

When one looks at how the concept of the situation is used, one confronts issues similar to those concerning the concept of the stimulus: Are situations to be defined objectively or by the perceiver, are they potential or actual, and do they motivate the organism broadly or trigger specific responses? Sells (1963) defines situations in terms of their objectively measured characteristics, which are external to the individual, i.e., dimensions that are independent of the perceiving organism. But the dimensions he lists appear to vary in the ease with which they can be measured objectively (e.g., terrain, natural resources, social organization, novelty, role expectations, etc.).

Rotter (1955) also emphasizes the situation as an important determinant of behavior. While recognizing that situations have personal meanings, Rotter favors defining situations in terms of their objective characteristics: "Behaviors, reinforcements, and situations may be identified in objective terms although their significance and systematic formulae are concerned with constructs relating to personal or acquired meaning" (1955:260). Whereas Sells lists many dimensions of situations, Rotter focuses attention on the reinforcements that are

likely to occur in a situation and the cues in a situation that influence expectancies for behavior-reinforcement sequences.

Another approach which emphasizes the objective analysis of situations is that of Barker (1965, 1968) and Gump (1971) in their research on behavior settings, a concept similar to that of situation. According to Barker, "even the persons whose behavior is essential for the occurrence of a setting, who construct their own private worlds within the setting, and who are themselves influenced by the setting need not be aware of the setting per se" (1960:18). Barker views behavior settings as having defined boundaries and physical properties that lead them to be associated with ongoing patterns of extraindividual behavior. While behavior settings are perceived differently by various individuals and these varying perceptions often result in some individualistic behavior, the behavior setting itself may be defined by its structural properties and extraindividual patterns of behavior. Behavior settings function as homeostatic systems and thereby regulate and control behavior.

Whereas Sells, Rotter, and Barker tend to define the situation in terms of attributes associated with it, Frederiksen (Frederiksen, 1972; Frederiksen *et al.*, 1973) argues against a definition in terms of attributes and for a definition in terms of behaviors associated with the situation: "A situation is a set of circumstances that is likely to influence the behavior of at least some individuals, and that is likely to recur repeatedly in the same form" (Frederiksen *et al.*, 1973:22). Frederiksen thus rules out the study of temporary and unique situations; for data to be obtained from many subjects, for situation-behavior associations to be made, one must have a general definition which permits many instances to occur for many individuals. While Frederiksen used a factor-analytic approach to the analysis of the data, other approaches are possible. For example, Price and Bouffard (1974) developed a behavior-situation matrix by asking students to rate situations in terms of their relationship to various behaviors. The list of situations to be studied was derived from student reports of situations they found themselves in during the day. No definition was given to the concept of situation and presumably each situation could be defined in terms of the behaviors associated with it in the behavior-situation matrix. Clusters of situations were formed on the basis of similarities of ratings of appropriateness of the behaviors in the situations (Price, 1974).

The approach to defining situations in terms of their associations with behaviors has some similarity to Barker's approach. Both emphasize objective definitions and both view situations as being important in relation to behavior. However, Barker's approach places much greater emphasis upon nonbehavioral characteristics of settings (e.g., physical characteristics) which affect behavior than does the behavior-situation approach. Barker's approach also limits observation of behaviors to those that are constant across individuals. This would be true of Frederiksen's approach if a simple factor analysis were used. However, if, as

Frederiksen suggests, three-mode factor analyses are used, one could look at situations which are defined in terms of their association with behaviors for groups of individuals. Finally, the approach of Price and Bouffard suggests that one part of the definition of a situation may be the extent to which it is associated with prescribed behaviors – the quality of situational constraint. At the same time, in using ratings as a measure of behavioral appropriateness, this approach differs from that of Sells, Rotter, and Barker in defining the situation in a way that makes it dependent on the perceiver.

The situation-behavior approach to defining situations has some interesting relationships to the ethological definition of the stimulus. In both cases, there is a focus on the behavior-eliciting properties of the stimulus or situation. Also, in both cases there is recognition of a range in the specificity with which the stimulus or situation may be associated with specific behaviors. However, it is also important to note that the interest of the ethologist in a stimulus is derived from a *prior* observation of a pattern of behavior and the stimulus can be defined independent of the behavior. In the situation-behavior matrix approach the situations are at least partially defined prior to the gathering of behavioral data and appear to have little to define them independent of their association with these behaviors.

A third approach to defining situations has to do with the perceptions of subjects. While offering no overall definition of the situation, Bowers (1973) suggests this definition in stating that a situation must be specified in terms of the particular organism experiencing it. This approach toward defining the situation appears to be the one supported by Endler and Magnusson (Endler and Magnusson, 1974; Magnusson, 1974) and by Ekehammar (1974) in their emphasis on how the individual represents and constructs the situation. In fact, Ekehammar draws the analogy to the person-perception approach where the perceptions individuals have of people are assumed to be important independent of the validity of these perceptions. The situation-perception approach leads to definitions of situations in terms of their perceived properties or dimensions, as opposed to their objectively defined properties or their behavior-eliciting properties. It is assumed, of course, that such perceptions will have important consequences for behavior. However, in constrast with Barker, it is also assumed that "situations are as much a function of the person as the person's behavior is a function of the situation" (Bowers, 1973:327).

Environment

As with our earlier concepts, the concept of environment is one that is frequently used without definition and occasionally used interchangeably with the concepts of stimulus and situation. It is a concept that has become increasingly

popular with current interest in the environment as expressed in the fields of environmental psychology, human ecology, and social ecology. While these fields have emerged, there remain problems as to how they can be defined. Thus it has been observed in relation to environmental psychology, for example, that "the simple fact is that as yet there is no adequate theory, or even the beginnings of a theory, of environmental psychology on which such a definition might be based" (Proshansky *et al.*, 1970:5). Efforts to define the fields and distinguish them from one another frequently confuse statements of conceptual domain with research methods. This is at least partly attributable to the widespread confusion in definition of concepts and uncertainty concerning methodology.

Most definitions of the environment focus on its molar aspects. Brunswik defined the environment as the natural-cultural habitat of the organism or universe of situations the organism is likely to encounter in daily living (Postman and Tolman, 1959). For some, the major concern is with the physical environment. Thus, Craik (1970) does not define the environment but expresses interest in the molar physical environment. Similarly, Lynch (1960) studied the imageability of various molar physical environments. Others are primarily interested in the social environment. Studies of college environments (Astin, 1972; Pace and Stern, 1958; Pervin, 1967; Stern, 1962; Walsh, 1973), treatment environments (Insel and Moos, 1974; Moos, 1974), and organizational climate (James and Jones, 1974; How and Gavin, 1974) are illustrative here. Finally, in some cases the environment is considered to include both the physical and the social environment. Endler and Magnusson (1974) follow Brunswik's conception and include both physical and social variables as part of the outer world that the individual encounters and acts upon in his or her daily life.

It should be no surprise that definitions of the environment vary in terms of whether they refer to the actual or perceived environment. Brunswik (1956) and Barker (1965), as noted previously, define the environment in terms of its objective characteristics. The ecological environment is the real-life, objective environment as described by the physical and biosciences. Similarly, Wohlwill (1973) suggests that the "environment is not in the head" and argues for a psychological analysis of the environment in stimulus terms. In contrast to this, Ittelson (1973) suggests that the environment is a product of perception and cannot be separated from the individual. Similarly, Klausner (1971) suggests that the environment can only be defined by or with reference to and never independent of an individual.

Regardless of whether the environment is defined in actual or perceived terms, few definitions do much to limit or focus attention upon specific variables. Obviously, any environment includes many things. Is it important to distinguish among parts of the unit or shall we treat it only at the molar level? What are the building blocks and are there dimensions that can be used to compare environments? Skinner (1971) and the behavior modificationists suggest that we look

at the rewards and punishments found in the environment and the behaviors with which they are associated. Are there alternative units of analysis? If I am going to study the environment, what am I to look for? Does this depend on whether I am interested in the physical environment or the social environment and, if the latter, which social environment I am interested in? Or, can physical and social environments be defined in similar terms, as Mehrabian and Russell (1974) suggest, and can all social environments be analysed along common dimensions, as Insel and Moos (1974) suggest?

Themes, Issues, Comments

As one looks at efforts to define these concepts a number of conclusions become apparent. First, the terms frequently are used without being defined. Second, they frequently are used interchangeably in a haphazard manner. Third, where distinctions are made, they are not always clear, and boundaries often become blurred. The major distinction appears to have to do with scale of analysis – ranging from the concern with molecular variables and behaviors in the case of the stimulus to molar variables and behaviors in the case of the environment. However, this is not always the case, and the distinction becomes blurred when, for example, it is suggested that we concern ourselves not only with the physical stimulus but also with the surrounding context (Jenkins, 1974). If the same units are used for the three concepts and similar relationships are found to behavior, then the issue may indeed be a trivial one. However, if different units are used to define stimuli, situations, and environments, and if different relationships to behavior are found depending upon the scale of analysis, then distinctions may be important. Distinctions may also be important as guides for measurement. For example, when a subject is being presented with a picture of an environment, are we studying phenomena at the stimulus level or at the environment level? Does it make a difference?

Distinctions among the concepts of stimulus, situation, and environment would appear to relate to the kinds of variables and relationships among variables which one considers to be critical to understanding the phenomenon of interest. Thus, we speak of the stimulus when we are interested in a specific object of the organism's attention or response pattern. That the perception of this object or stimulus may be affected by other stimuli does not alter this since it remains the case that the object is one of focal attention and the remaining objects are considered to be background stimuli. These background stimuli may affect the perception of the focal stimulus, but the attention of the subject is oriented toward, and our interest is in, the focal stimulus. In any particular situation we are interested in the organism's engagement with an array of objects and actions which cover a time span. A situation is defined by *who* is involved, including the

possibility that the individual is alone, *where* the action is taking place, and the nature of the *action* or activities occurring. The situation is defined by the organization of these various components so that it takes on a gestalt quality, and if one of the components changes we consider the situation to have changed. While a situation has a gestalt quality, it is defined by who is involved, what is going on, and where the action is taking place. In the case of environments, we are concerned with a still greater array of objects and actions, which also cover a longer time span, i.e., with a different level of organization. The environment of an organism consists of those specific situations it encounters in its daily living, the relationships among these situations, and the qualities of life which may cut across situations. A person may move from environment to environment in the course of a day (e.g., home, school, work) and may find some qualities to be part of his or her total life environment.

It terms of the above distinctions a stimulus may be an organism, place, or thing. A situation always includes an organism or organisms, a place, and action. An environment includes an organization of discrete situations and characteristics which may be continuous across situations but relevant to each of them. An environment may be considered in its own right, in terms of the situations within it, or in terms of the stimuli in it. However, these are different levels of analysis, which may involve the utilization of different units and which may be differentially related to various behaviors. Similarly, any one variable may be considered as a stimulus, as a part of a situation, or as part of the environment. Thus, for example, one may define noise operationally and consider it as a stimulus, as a critical aspect of a situation, or as an important environmental variable. As a stimulus we are concerned with it alone. It is the focal variable. As a situational variable, we are interested in noise in terms of its relationship to other aspects of situations – to the person or persons involved in actions in places. As a stimulus, noise may have very specific effects on the organism, while as a situational variable its effect may depend on the situation. Obviously, noise at a party may have very different effects upon the person than noise in the study hall. Finally, noise may be considered as part of the environment in terms of its being a significant component of many situations or all situations. As an environmental variable, however, it is considered in terms of its relationship to other aspects of environmental life – how it affects people in terms of the situations they are in and how they experience and behave in these situations. Similarly, a response may be considered in relation to stimuli, situations, or environments. To take an example from the ethologists, a response may be considered in relation to a sign stimulus, in relation to a situational context, or in relation to different habitats or environments. Behaviors may be found to occur only in relation to certain stimuli, only in certain situations, and only in the natural environment (Hinde, 1974).

The distinctions drawn here among the three concepts do not have to do with whether one is interested in large or small responses, molar or molecular

behavior, or whether the experimenter is in control of the variable. The effects of a stimulus upon the organism may be simple or complex, specific or widespread. This is also true of situations and environments. In addition, an investigator may or may not be able to control the stimulus, the situations in which the organism behaves, or the environments the organism encounters. The distinctions do suggest that different variables may be treated more or less usefully at the stimulus level, at the situation level, or at the environmental level. Furthermore, these variables may be treated more or less usefully at different levels for different puproses. What is important to keep in mind is the level at which we are observing phenomena and the potential for different relationships to be found at different levels of analysis.

While the above discussion attempts to draw some distinctions among the three concepts, it does not touch upon a number of issues that appear to be common to all three. Drawing upon Gibson's (1960) discussion of the concept of the stimulus, the following issues may be noted.

1. Molar vs. Molecular. Gibson notes that we may be concerned with molar or molecular responses (i.e., what an organism does as opposed to the contraction of its muscles) and with molar or molecular stimuli (i.e., what the organism is responding to as opposed to what excites all the receptors). Even within the distinctions among levels of analysis drawn above, there appear to be differences concerning the proper level of observation. For example, concerning the environment, Wohlwill and Carson (1972) note that "there is the choice of the scale that governs the investigator's definition of a particular environment for analysis. At one extreme, we may talk about the environment of an individual room, or that of a nursery school playground, while at the other extreme we may look at the environment of a large city . . . ." (p. xvi). They suggest that definitions and experimental manipulations become more difficult as scale increases and thus appear to favor the study of environments of lesser scale. The behavior settings studied by Barker would appear to be of a different scale than the situations studied in situation X response inventories. Thus, whether we are defining stimuli, situations, or environments we are confronted with the question of scale of analysis or size of units of analysis.

2. Objective vs. Perceived. The issue that perhaps arises most consistently is whether we define phenomena objectively or in terms of perceptions. While Gibson does not state the issue in exactly these terms, he approaches it in a number of places, including the following: "Must a stimulus be defined independently of the response it produces – in physical terms rather than terms of behavior or sensory process?" (1960:696). His own conclusion is that stimuli can be defined objectively, independent of the perceiving organism: "The hypothesis only assumes that the energy flux is the same for two individuals in identical situations and that consequently any differences between their perceptions are differences in what the individual is responding to" (Gibson, 1959:467). The issue comes up in relation to Koffka's (1935) distinction between the geo-

graphical (objective) environment and the behavioral (perceived) environment, Lewin's (1951) emphasis upon the life space and psychological environment as opposed to the objectively defined environment, and Murray's (1938) distinction between the alpha press (i.e., environment as it is) and the beta press (i.e., environment as it is perceived by the individual). In reviewing the person-situation interaction literature, Ekehammar (1974) concludes with an emphasis on the person's psychological representation and construction of the situation. Schneider (1975) similarly suggests that the concept of organizational climate be used to refer to the perception of the external world (i.e., perception of organizational practices and procedures) but James and Jones (1974), in their review of the organizational climate literature, favor reserving the term for organizational attributes that can be defined independent of the individual. The latter authors also favor the study of what they call the psychological climate, having to do with the perceptions of the individual, and this emphasis upon the study of both sets of phenomena appears to be common and worthwhile. Thus, Brunswik (1956) expressed interest in distal stimuli, proximal stimuli, and central mediating processes, and Rotter (1955) suggests that situations be identified on the basis of objective characteristics and then studied in terms of their psychological significance or meaning for individuals. While definition of stimuli, situations, and environments in both objective and perceived terms is often recommended, and study of the relationships between the two would appear to be a valuable endeavor, most studies define phenomena in either objective or perceived terms and gather data accordingly.

3. Relationship to Experience and Behavior. Stimuli, situations, and environments may be conceptualized as having simple or complex relationships to experience and behavior. Gibson poses a relevant question as follows: "Does the stimulus motivate the individual or does it merely trigger a response?" (1960:695). Do stimuli, situations, and environments arouse the organism in a nonspecific way, operate to elicit specific responses, serve to block behaviors, and/or alter the probabilities of future behaviors? For Barker (1968), environments select and shape people, and how they do so is the question for ecological psychology. Thus, human environments are seen as having a coercive influence, a view which appears to be similar to that of environments as constraints (Parsons and Shils, 1951) and situations as constraints (Price and Bouffard, 1974). Chein (1954) speaks of stimuli triggering responses or at least being capable of triggering responses and environments as having features which constrain or preclude some behaviors and support or make more feasible other behaviors. Mehrabian and Russell (1974) see the environment as directly affecting the emotional state of the person and thereby his or her behaviors in the environment.

The potential roles of stimuli, situations, and environments appear to be many. They may provide information, induce feelings, affect attitudes, provide a context for action, affect expectancies concerning rewards and punishments,

and support or inhibit behaviors (Ittelson *et al.*, 1974). While many roles are possible, often the issue is unmet by the investigator. The matter is undoubtedly complex, since it may be that different stimuli, situations, and environments are capable of serving different and multiple roles for different people. Recognition of, responses to, and utilization of these alternate roles then also become interesting developmental questions (Lewis and Freedle, 1973).

4. Nature of the Units. Running throughout the above discussion and the prior issues is a question concerning the units to be utilized in studying stimuli, situations, and environments. Gibson defined the issue as follows: 'How do we specify the structure of a stimulus?" (1960:699). Similarly, Lowenthal (1972) suggests that there are too many lexicons utilized for environmental analysis and urges an effort toward a standardization of environmental descriptors. But can one standardize on the basis of inadequate theory and limited data? Are we to define situations by the dimensions outlined by Sells (1963; five major categories, 16 subcategories, and over 50 further subdivisions), in terms of rewards and punishments, in terms of cues concerning which behaviors will be followed by what reinforcers (Rotter, 1955), in terms of behaviors with which they are linked (Price, 1974), in terms of dimensions common to responses to climate questionnaires (Insel and Moos, 1974), in terms of variables common to diverse sensory modalities (Mehrabian and Russell, 1974), or a combination of all of these? Should distinctions be made between physical and social stimuli, and physical and social environments, or are these and other such distinctions unnecessary? The issue of units and structure has implications for what we measure, how we measure phenomena, and efforts toward taxonomic classification, and thus it will continue to be with us as we consider these further questions.

MEASURING THE VARIABLES AND THEIR EFFECTS

In measuring stimuli, situations, and environments we are faced with the issues of what to measure, how to measure, and how to organize our data. Do we use naturalistic observation or laboratory experimentation? Are the two identical, mutually exclusive, or compatible with one another? Does it make a difference if the subject responds to written descriptions of phenomena, to what he or she imagines, to pictures, or to the actual phenomena? Does it make a difference if we obtain verbal reports of attitudes and feelings, if we obtain physiological recordings, or if we measure behavioral responses? Are decisions concerning what is presented to the subject, how it is presented, and what responses are measured reasoned decisions or are they matters of convenience? Do we assume that various modes of presentation and measures of response will yield congruent (if not identical) data – e.g., that verbal and behavioral responses to real and imagined objects are all of the same piece?

Response-Contingent and Nonresponse-Contingent Measures

Depending upon the nature of the concept and how it is defined, a responding organism may or may not be essential to its measurement. In cases where a responding organism is not essential (i.e., nonresponse-contingent measures), the investigator may measure the variable in physical or structural terms. For example, sensory stimuli can be measured in terms of energy (Gibson, 1959), course material in terms of complexity and information rate, a learning environment in terms of degree of structure (Hunt, 1975), an organization in terms of size and complexity of hierarchical organization (Forehand and Gilmer, 1964), and a college environment in terms of variables such as size and distribution of enrollment in majors (Astin and Holland, 1961). In each of these cases the investigator does not need to have responding organisms to measure the variables. In response-contingent measures, however, such responses are essential. Thus, for example, stimuli can be measured in terms of their judged degree of intensity or pleasantness, and college environments in terms of the characteristics ascribed to them by their respective student bodies (Pace and Stern, 1958; Pervin, 1967). In some cases, both response-contingent and nonresponse-contingent measures are used. For example, Barker (1968) measures behavior settings in terms of both nonbehavioral factors (e.g., structure of the physical environment) and behavioral factors (e.g., dominant action patterns of participants). In fact, it is the synomorphic relationship between the behavior and the physical environment that is the outstanding characteristic of the behavior setting. Finally, two concepts may be closely related but defined differently in terms of their measurement procedures. Thus, for example, a distinction has been made between density, denoting a physical condition involving the limitation of space, and crowding, referring to the environment's space limitations as experienced by the organism (Stokols, 1972).

The distinction drawn here is similar to, though not identical with, that made between reactive and nonreactive (i.e., unobtrusive) measures (Webb *et al.*, 1966). Nonreactive measures involve responding organisms who are not aware of their participation in the research. In nonresponse-contingent measures, a behaving organism is not involved in the measurement of the variable at all. Nonresponse-contingent measures always are free of the potential sources of error or bias associated with reactive measures while response-contingent measures may or may not be free of such distortions. While the distinction between response-contingent and nonresponse-contingent measures relates to the measurement of the variable of interest, it has little if any relevance to measurement of the effects of stimuli, situations, and environments. In this case we are just about always concerned with a responding organism, and the distinction between reactive and nonreactive measures is particularly applicable.

In some cases the nature of the concept has dictated the use of response-contingent measures. In other cases such decisions are matters of convenience

and most often response-contingent measures are used. This is unfortunate since response-contingent measures, particularly those that also involve the active cooperation of the subject, have two major disadvantages. First, to the extent that they involve the cooperation of the subject they are open to the sources of error and bias associated with reactive measures generally. Second, response-contingent measures lend themselves to conceptual ambiguity as to what is being measured – the variable or its effects. For example, if an organization is measured in terms of perceptions of workers, is one measuring the organization or its effects? James and Jones (1974) note that organizational climate has become a fuzzy concept which at times refers to organizational attributes and at times to the effects of such attributes upon working individuals. In studying stimuli, situations, and environments we want to be able to distinguish clearly between measures of the concepts and measures of their effects upon the organism, even while considering the two within an interactive or transactional framework. This distinction is particularly critical where we are using response-contingent reactive measures.

Modes of Presentation

Mode of presentation refers to the nature of the engagement between the subject and the variable that is of interest to the observer. These may be looked upon as falling along a continuum from direct engagement with the variable of interest to imagined engagement. Also, in some cases the variable of interest is presented as a totality, whereas in other cases it is presented in parts or along dimensions determined by the investigator. There may be some association between mode of presentation and subject of study (i.e., stimuli, situations, environments), but there is considerable overlap. Craik (1971) has differentiated among a number of models for the assessment of places, and there appear to be four basic modes of presentation:

1. Direct Contact. Here the variable of interest is studied as it is engaged directly by the subject. The variable of interest to the investigator and the one presented to the subject are one and the same. In most instances this is the case in research on perception of the stimulus. Indeed, one of the reasons for focusing on the stimulus level of analysis is the potential it offers for directly presenting the variable of interest. Thus, whether it involves visual, auditory, olfactory, or tactile perception the stimulus presented to the subject is one with the stimulus of interest to the investigator.

Note that direct engagement is not identical with naturalistic observation. In most perception research there is direct engagement with the stimulus in the laboratory setting, though research may also be done in the natural setting. In most ethological research there is direct engagement with the stimulus in the natural setting, though stimuli and/or settings may be simulated to identify the exact basis for the organism's behavior. Naturalistic observation always involves

the direct contact mode of presentation, but direct contact need not always be in the natural setting.

2. Simulation. In the case of simulation, the investigator presents to the organism the variable of interest in a form as close as possible to the actual variable while recognizing that in trying to duplicate this variable some distortion may have occurred. The Hartshorne and May (1928) studies involved an effort to simulate real-life situations in which children cheat. Simulation modes of presentation are commonly used in studies of organizational behavior. The interest may be in how individuals function in an authoritarian organization. An authoritarian setting may then be created in the laboratory with an effort made to duplicate as many key aspects of the actual setting as possible.

3. Photographs, Drawings, Sketches. Somewhat further removed from direct contact with the variable of interest is the presentation of photographs, drawings, sketches, movies, etc. Note that it is not the nature of the material itself that defines this category but rather its degree of removal from direct engagement. Thus, for example, if the investigator is interested in subject responses to drawings *per se,* this would be an example of direct contact. On the other hand, if the investigator is interested in images of the actual urban environment and presents photographs as an approximation to this, then in this mode of presentation the engaged object is a number of steps removed from the actual variable of interest.

4. Written Descriptions, Imagined Phenomena. The final category involves considerable active input from the subject. Here the subject is given a written description, lengthy or brief, of the variable of interest or is asked to imagine it. For example, in person-situation interaction research the subject may be asked to response to situations such as "waiting to see the doctor" or "wanting to tell off a friend." The investigator is interested in behavior in actual situations but uses this questionnaire approach, presumably to sample an array of situations that might otherwise be difficult or impossible. In studying a variety of environments, Moos (1974) has subjects indicate whether various activities occur in the environment. Here the subject is again responding to descriptions of activities and also is responding to parts of the environment which the investigator groups together to define its relevant parts and whole. In behavior therapy, imagination may be used as a mode of contact with the stimulus. Thus, for example, in the systematic desensitization treatment of a snake phobia the person may be asked to imagine a snake while relaxing. This kind of engagement with the stimulus may be contrasted with the direct contact found in the Behavioral Avoidance Test (BAT), where the subject actually responds to the snake (Bernstein, 1973).

The four modes of presentation may be illustrated in relation to the three concepts under consideration as follows:

Stimuli. As previously noted, in most stimulus research there is direct contact with the variable of interest. In ethological research it was noted that

there may be study of the actual or simulated sign stimulus. In addition, the contrast between study of the stimulus in the Behavioral Avoidance Test (direct contact) and in systematic desensitization (imagined) has been noted. The study of the face offers another illustration of the use of alternative modes of presentation of the stimulus. For example, in studies of affects expressed in the face, the subject may see a person expressing the affect. However, in most such cases the cues suggested by the rest of the body and surrounding context will be used. To eliminate these cues and focus on affective cues in the face, investigators may present the subject with posed photographs or with drawings that vary different parts of the face (Ekman *et al.*, 1972; Tagiuri, 1969; Tomkins, 1962).

Situations. In some current research on the effects of situations the emphasis is on direct contact. This is true of the work of Barker (1968) on behavior settings. Also illustrative is one study by Moos (1969) in which psychiatric patients were observed in each of six psychiatric ward situations. In some of the work of Magnusson there has been an effort to simulate real-life situations and study behavioral consistency across situations (Magnusson *et al.*, 1968a; Magnusson and Heffler, 1969; Magnusson *et al.*, 1968b). However, in most of his recent research on person-situation interaction the emphasis has been on imagined situations. In the Endler-Hunt studies the subject responds to one-sentence descriptions of situations (Endler and Hunt, 1968; Endler *et al.*, 1962). The same mode of presentation is used by Ekehammar and Magnusson in their efforts to analyze perceptions of and reactions to stressful situations (Ekehammar and Magnusson, 1973; Ekehammar *et al.*, 1975; Magnusson and Ekehammar, 1975). In the studies of Pervin (1977), subjects are asked to describe situations in their lives and their responses to them. Again, there is the imagined mode of presentation, though in this case the situations relate to actual situations in the subjects' lives as opposed to general statements of situations which may or may not relate to them.

Environments. Some environmental research includes observation of individuals in direct contact with the environment. Thus, for example, Ittelson (Ittelson *et al.*, 1972) and Lawton (1972) have both mapped the behavior of individuals in their living environments. Winkel and Sasanoff (1970) studied patterns of user behavior in a museum through two modes of presentation – behavior in the actual museum (direct contact) and behavior in a simulated museum using photographs within a "simulation booth." In fact, in this case the effort was to develop techniques for simulating natural environments. Simulation was also the mode of presentation used by Frederiksen in his study of the effects of organizational climate (Frederiksen *et al.*, 1973). Photographs are commonly used in environmental research (Canter and Thorne, 1972; Ward, 1974), as is the imagined mode of presentation in which the subject describes a city, a rural environment, or a college environment (Craik, 1971; Mehrabian and Russell, 1974; Pace and Stern, 1958; Pervin, 1967; Stern, 1962).

Comment

The following conclusions may be drawn at this point. (1) For most studies of stimuli, situations, and environments a number of modes of presentation are possible. (1) Some concepts lend themselves to the utilization of one mode more than another: For example, use of direct contact is more difficult in studies of environments and situations than in studies of stimuli. (3) In some cases the distinctions among modes of presentation are clearer than in others. (4) It may be possible to study some phenomena only through the utilization of specific modes of presentation: For example, studies of infant responses to the face can be studied through direct contact, simulation, or photographs but not through the use of imagined phenomena. (5) There appear to be advantages and disadvantages to each mode. Direct contact research gives one a chance to study the variable of interest as such but may limit the number and range of variables that can be studied, particularly in the case of environments and situations. Simulation offers one a chance to study responses in a form that approximates direct contact, but many variables are difficult, if not impossible, to simulate and one may distort the true nature of the variable of interest. Photographs and imagined modes of presentation allow for responses to a wide array of stimuli, situations, and environments but one is left wondering about relationships to the actual variables of interest. In essence, as one moves from direct contact to written descriptions one gains in ability to sample an array of phenomena but loses in certainty of relationship of responses to the actual variables of interest. (6) One rarely finds the use of multiple methods of presentation in any one study. The results of two studies, however, are worthy of note in this regard. The Winkel and Sasanoff (1970) study of behavior in real and simulated museums found some similarities but also major differences in response. The authors remained hopeful that the simulation technique could be improved but wisely cautioned against making practical decisions on the basis of simulation data. In the Lowenthal and Riel (1972) study striking differences were found between responses of subjects walking through an environment and responses of subjects who knew the environment but responded to their images of it: "What we think we like or should like (or dislike) about certain kinds of environments is often not what we *do* like (or dislike) when we actually experience them" (p. 205). In the light of such results, Brunswik's (1956) emphasis on the need for representative design in research seems particularly worthy of our attention. As Brunswik noted, we must guard against unscrutinized ecological generalizability and should attempt to study variables as closely as possible to the general or specific conditions under which the organism comes into contact with them.

Measures of Response

Whereas mode of presentation refers to the nature of the engagement between the organism and the variable of interest, measure of response relates

to the nature of the organism's response to the variable. In the former case we are interested in *what* the organism is relating to, in the latter case in *how* we study the organism's relationship to it. Naturally the response measure used often shows some relationship to the definition of the concept and the mode of presentation. Sometimes, in fact, the response measure is bound by such considerations. For example, if one has defined the environment in terms of how it is perceived and has decided upon written descriptions as the mode of presentation, the response measure will almost inevitably be one of self-report. On the other hand, in some cases the relationships among concept, mode of presentation, and measure of response are less absolutely interconnected. For example, one can define organizational environments in terms of size and complexity of organization, study individuals in direct contact with organizations or in simulated contact, and look at behavioral responses or verbal self-reports.

Measures of response to stimuli, situations, and environments may focus on the behavioral, affective, and/or cognitive aspects of functioning, and may be of either a behavioral or a self-report nature. In relation to the former, for example, one can study the effects of various neighborhoods on the activity patterns of its residents (behavior), on the level of stress and anxiety experienced by its inhabitants (affective), or the attitudes and images held by them (cognitive). From a personality standpoint, Little (1976) has focused on the behavioral, affective, and cognitive differences in response to the environment by person-oriented and thing-oriented individuals. In relation to the latter, one can look at how students behave in a college environment, at what they report about the behavior of others, or at what they report about their own behavior. One can define and measure the scholarship level in a college environment in terms of variables such as the number and quality of books taken out of the library, student reports of the scholarly activities of other students, student reports of their own scholarly activities, and student perceptions of the general climate of scholarship – however they may see that as being translated into behavior or observable phenomena. As noted by Craik (1973) in relation to environments, there exists a variety of alternative ways of measuring responses to the phenomena of interest.

1. Objective Measures of Behavior. Objective measures of behavior include all measures of response that do not involve the organism making a subjective report. Objective measures are used quite commonly in psychophysics, are used by ethologists in the study of animal behavior and communication (Hinde, 1974), and are well illustrated in Barker's (1968) work on behavior settings and behavior episodes. Barker looks at standing patterns of behavior that are bounded by time and place (e.g., a basketball game, a worship service, a piano lesson). Other examples of the study of behavior in situations are Magnusson's (Magnusson *et al.*, 1968a, b) work on cooperation, self-confidence, and leadership in two different situations, Moos' (1969) study of patient behavior (e.g., hand and arm movement, smile, talk, smoke) in six psychiatric ward settings, and Lewis and Freedle's (1973) research on infant vocalization patterns in different situations.

In studies of the environment, we have already referred to the work on behavior mapping (Ittelson *et al.*, 1972; Lawton, 1972) and to the work of Frederiksen (Frederiksen *et al.*, 1973), who looked at a variety of measures of performance in relation to different organizational climates.

2. Subjective Reports. Subjective reports involve verbal responses to questions posed by the experimenter either in an interview or through the use of a questionnaire. In some cases a self-report technique developed for other purposes is used in the study of stimuli, situations, and environments. Perhaps the best illustration of this is the extensive use of the semantic differential (Craik, 1971; Pervin, 1967). In their review of much of the relevant literature on the semantic differential, Mehrabian and Russell (1974) conclude that semantic differential studies of stimuli, situations, and environments clearly indicate the existence of a limited set of basic emotional responses: "Semantic differential studies, in particular, have shown that human judgments of diverse samples of stimuli can be characterized in terms of three dimensions: evaluation, activity, and potency. We have termed the corresponding emotional responses pleasure, arousal, and dominance" (p. 28). In contrast to this conclusion is the one reached by Craik (1971), that the basic dimensions of environmental meaning are not likely to be equivalent to the dimensions of semantic meaning identified by Osgood.

Other self-report measures adapted to use in this area are the adjective checklist and the Role Construct Repertory (Rep) Test. Thus, the Landscape Adjective Check List (Craik, 1971) has been developed to assess various landscapes along a standard set of visual dimensions and the Kelly Rep Test has been adapted to study how people construe situations as opposed to how they construe people (Bannister and Fransella, 1971; Little, 1976; Wicker, 1969). It is interesting to note here that there is some reason to believe that the constructs used to construe people, and the organization of the constructs, may differ from those used to construe nonhuman stimuli, situations, and environments (Scott, 1974; Signell, 1966). If this is indeed the case, it again suggests that results may vary according to whether physical or social objects are being studied.

In contrast to the adaptation of instruments originally developed for other purposes is the development of questionnaires for the specific purpose of studying situations and environments. One major approach here is the work of Pace and Stern (1958) on the measurement of college environments through reports of students concerning the presence of various activities on campus. Moos (1974) has adapted this subjective perceptual methodology to the development of a variety of questionnaires to assess treatment milieus. In each case individuals in the environment are asked about the characteristics of that environment in terms of ongoing patterns of behavior. Whereas in these questionnaires the subjects respond to the general presence or absence of behavioral patterns, in the questionnaires developed to study person-situation interaction the focus is on how

the individual reports responding to each situation. For example, in the Endler and Hunt studies individuals check the extent to which each of a number of responses is characteristic of them in a variety of situations (Endler and Hunt, 1968; Endler *et al.*, 1962). In a variant of this approach, Ekehammar *et al.* (1975) had one group of subjects rate the unpleasantness each of 24 verbally defined situations would evoke in them and had another group of subjects rate the degree of experienced similarity of the same situations. The study is of interest in two respects. First, in the latter case the authors used the multidimensional scaling methodology to determine the basic dimensions of the situations. This methodology has now begun to be used to study the dimensions of a variety of stimuli, situations, and environments (Messick, 1956; Rosenberg and Sedlak, 1972; Wish, 1970; Wish *et al.*, 1970). Second, the authors found good agreement in the factors found in utilizing the two different methods.

Along with the utilization of standardized questionnaires has been the utilization of free-response descriptions. Craik (1971) notes the use of free-response descriptions of places and Pervin (1977) has utilized free-response descriptions of situations. The latter represents an adaptation of Rosenberg's (1973) utilization of free-response descriptions in the study of person perception. Such descriptions have advantages in allowing subjects to choose their own traits to describe situations. The data obtained thereby represent much closer approximations to the descriptions found in everyday life than is the case with standard questionnaires.

Comment

An effort has been made in this section to delineate the alternative response measures available to the investigator in studying stimuli, situations, and environments. In some cases the response measure tends to be closely tied to the mode of presentation: for example, self-report measures are used with written descriptions as a mode of presentation. In other cases, many response measures may be used with the single mode of presentation, as when either behavioral or self-report measures, or both, are used with the organism in direct contact with the variable of interest. The studies presented above suggest three general questions that are worthy of discussion and comment: (1) Can one clearly distinguish between measures of the concept and its effect? (2) What are the sources of error and bias introduced by various response measures? (3) Are results with different response measures generally in agreement?

We have already reviewed at length the problem of definition of concepts. Unfortunately, such conceptual ambiguities often make uncertain what is being measured. In particular, the distinction between measuring the concept and measuring its effects may be blurred. For example, in obtaining semantic

differential responses to the presentation of an environment, is one measuring the environment or the impact of the environment upon the person? In some cases a distinction is made between group response and individual response. The group (mean) response may then be considered to be the measure of the variable and the individual response, or discrepancy from the group response, taken as the individual's perception of the variable or its impact upon him or her. While some investigators do not consider the issue or dismiss it, other investigators argue strongly for independent measures of concepts and their effects: "In order to study environment-behavior relations on any level, the environment and the behavior must be described and measured independently; otherwise one becomes entangled in a tautological circle from which there is no escape" (Barker, 1968:7). To return to the question of conceptual definition, Chein (1954) regards the stimulus as capable of initiating a change in activity with responses viewed as a function not only of stimuli but of factors inside the individual as well. The distinction between stimulus, situation, or environment and response (i.e., impact, effects, etc.) tends to be drawn more carefully by those who define their concepts independent of the observer, as opposed to those who emphasize only the perceived nature of phenomena. This distinction also tends to be drawn more carefully by those who use direct contact modes of presentation and behavioral response measures as opposed to those who use nondirect contact modes of presentation and verbal self-report measures. Barker's (1968) position concerning independent measurement appears to have considerable merit. What is most clearly needed, however, is for investigators to make clear the relationship between the response measure being used and the concept being studied. If a construct validity approach similar to that used in personality research is being used, then the rationale for this approach and the implications of the results for definition of the construct should be clearly presented.

The second question to be considered relates to the distinction made in personality assessment between trait variance and method variance (Campbell and Fiske, 1959). Most of the studies reported in the literature make use of reactive measures without consideration of the possible sources of error or bias thus introduced into the research. Some investigators prefer behavioral measures and are critical of self-report measures: "To make statements about perception we must have confidence in our response measure as an index of perception. Subjective rating scales are deficient in this respect" (Wohlwill, 1973:17). When subjective reports are used with structured questionnaires, we should be aware of the effects of experimenter selection of items to be judged and scales to be used in the judgments. An analogy may be drawn here to the work of Koltuv (1962) in the area of person perception. Varying the use of personally relevant traits and nonrelevant traits, and the judgment of familiar persons and unfamiliar persons, Koltuv found that subjects assumed a greater correlation between personally relevant traits than between nonrelevant traits

and they assumed a greater correlation between traits for unfamiliar persons than for familiar persons. In most studies little consideration is given to such factors. Thus, for example, in the Endler and Hunt (1968) study of person-situation interaction, no attention is given to the possibility that some situations and responses are not meaningful for some subjects, and that this is a critical ingredient of their response.

To a certain extent, the third question follows from the first two. If concepts are ambiguously defined and the method variance is considerable, we can expect to find varying results with different studies. One aspect of this has to do with measures of affect, cognition, and behavior. It is quite possible, even likely, to find different relationships with measures that are different in terms of their relationship to these areas of functioning. Thus, for example, in the area of psychotherapy and behavior change Lang (1971) has noted that a procedure may affect change in one area and not in another, or may first affect change in one area with consequent implicatons for change in another. In studying the effects of stimuli, situations, and environments we must be aware of different kinds of effects for different kinds of people and attempt to understand the variables within this context. The other part of this question relates to the comparability of findings from the use of different instruments. We have already noted that relationships may vary depending upon the mode of presentation; they may also vary according to the measure used. In a study of subjective (i.e., student perception and self-report) and objective (i.e., objective institutional data) measures of the college environment, Centra (1972) found generally good agreement between the two definitions but also found that each picked up something different: "In general, therefore, there are certain kinds of information that can be obtained by only one method, even when it appears that two or more methods assess the same domain" (p. 62). Moos (1974:127) similarly concludes that objective dimensions characterizing environments provide information congruent with but not identical to information obtained from techniques assessing perceived environment and social climate characteristics.

A critical distinction concerning comparability of findings is that between verbal reports and behavioral measures. Unfortunately, behavior may not always be consistent with verbal report (Ittelson *et al.,* 1974:221; Wicker, 1969). For example, individuals may report that they are not afraid of a snake stimulus but may behave as if they are afraid (Bernstein, 1973). The reverse is also true! In his study of the effects of six different ward settings upon patients, Moos (1969) found that the percentage of the response variance accounted for by different situations depended greatly upon the particular behavior or affect studied and on whether questionnaires or observations of behavior were used as the response measure. With such reports of differences in findings, one may adhere rigidly to one method of measurement or seek to compare and understand the results obtained with different methods. The latter approach would appear to be

advisable. Thus we may seek to follow Campbell's (1977) suggestion that we use both quantitative and qualitative methodologies in our research and seek to apply Campbell and Fiske's (1959) suggestions concerning multitrait-multimethod research. In view of the nature of the findings, it is indeed surprising how few studies seek to use more than one method of measurement with more than one stimulus, situation, or environment. While Little (1976) reports good correspondence among cognitive, affective, and behavioral measures of thing and person orientations, other efforts to assess the same dimension of response by alternative measures (multimethod analysis) have generally been disappointing (Burton, 1970, 1971).

TAXONOMY – CLASSIFICATION

> We need a systematic way of conceptualizing the domain of situations and situation variables before we can make rapid progress in studying the role of situations in determining behavior. (Frederiksen, 1972:115)

With the surge in interest in stimuli, situations, and environments there has been an increase in efforts toward classification or the development of taxonomies. These efforts vary in terms of the variables of primary concern (e.g., situations or environments, physical objects or social objects, industrial organizations or college environments, etc.), in terms of the types of data used (e.g., objective characteristics, perceived characteristics, behaviors), in terms of the primary mode of data analysis (e.g., factor analysis, multidimensional scaling, cluster analysis), and whether the effort is directed toward discovery of dimensions along which stimuli, situations, or environments can be classified or directed toward classifications of these variables themselves.

Frederiksen (Frederiksen, 1972; Frederiksen *et al.*, 1973) has perhaps given the best recent explication of the issue in his efforts toward a taxonomy of situations. A distinction is made between taxonomies of attributes and taxonomies of situations. In taxonomies of attributes the effort is directed toward defining the basic characteristics of stimuli, situations, or environments. Quite aside from classification, such efforts may be an important aspect of conceptual clarification, definition, and measurement. The recent effort of Insel and Moos (1974) to define the basic dimensions of human environments is illustrative of this approach. Studying eight different environments, they concluded that the dimensions of Relationship, Personal Development, and System Maintenance-Change are basic to human interpersonal environments. In taxonomies of situations the effort is directed toward classifying the situations themselves. Situations can be classified in terms of combinations of attributes, for example in

terms of where they fall in the three above dimensions, or in terms of some property which members of a category share in contrast with members of another category. Frederiksen's own suggestion is that situations be classified in terms of the behavior they elicit. One could factor analyze a large situation X behavior matrix to determine the situation-behavior categories. The proposal has considerable appeal since it holds promise of facilitating prediction of behavior. The process has, in fact, also been suggested by others. Osgood (1957), in commenting upon the work of Brunswik and emphasizing the importance of situations, suggested that we determine classes of functionally equivalent situations and responses from contingencies in a situation X response matrix. Postman and Tolman (1959), in reviewing the work of Brunswik, called for the independent definition of stimulus and response and the study of situation-behavior (distal-distal) relationships. More recently, Price and Bouffard (1974) have suggested the development of situation taxonomies based on situation-behavior (behavioral appropriateness) matrices. Situations are classified in the same category if the same behaviors are considered appropriate (or inappropriate) in them. Following Rotter (1955), it is also assumed that expectancies for reinforcement of given behaviors are similar for situations in the same category (Price, 1974). On the environment level, Craik (1971) has suggested the use of factor analysis and cluster analysis to define places with relatively similar configurations of activities (environment-behavior linkages).

While the concept of a situation-behavior matrix has considerable appeal, and presumably could be applied as well to stimulus-response and environment-behavior matrices, there are problems associated with it. First, it still leaves open the question as to how one defines a situation and a behavior. Many of the questions and issues raised in the section on definitions would apply here. Also, it is interesting that in commenting upon the development of taxonomies of attributes Frederiksen (1972) raises the following question: "How does one obtain a list of variables comprising the domain of investigation?" It would seem that the same question would apply to the behavior X situation matrix approach. On the response side, Wohlwill and Carson (1972) discuss the many problems associated with trying to define and measure responses to environments. A second problem concerns the complexity of relationships between situations and behaviors. Different situations may be associated with the same behaviors for quite different reasons and clusters of related situations and behaviors may be expected to change according to the sample of situation and response variables studied and the population of subjects used. For example, Price (1974) found the situations Class, Church, and Bus to cluster together in terms of similarity of ratings of behavioral appropriateness. However, these situations might fall into different clusters if other behaviors were rated or if actual behaviors as opposed to ratings of behavioral appropriateness were used to define the clusters. In a sense, the argument here is similar to that made by Ekman (1971) that a situa-

tion is capable of eliciting different emotions in different people, with the behavioral consequences being governed by learned display rules. Situations may also trigger the same facial affect program for two individuals, indicating that the same emotions have been elicited, but because of differences in learned display rules they will behave differently. The view presented here also is similar to that noted earlier concerning the work of ethologists on sign stimuli; that is, the relationship of a sign stimulus to a specific response depends on the state of the organism and the context of the perception of the stimulus. Between the distal situation and the distal response are complex central mediating processes involving interpretations of situations, affective responses, and behaviors which reflect affective responses, goals, and perceptions of situational consequences for various types of behavior. Noise may be perceived and responded to in varying ways by different members of different cultural groups (Klausner, 1971). Density, defined in terms of physical conditions, may or may not lead to a perceived sense of crowding. Such a perception depends upon the interactions among physical, social, and personal determinants (Stokols *et al.*, 1973). The general problem was well articulated by Leeper (1966) who noted that complex life situations involve inconsistent and conflicting relationships. In commenting upon the work of Brunswik, Leeper suggested that most cues had low ecological validities and concluded that distal-distal relationships, even when they take into account earlier learning situations as well as the current stimulus situation, can yield no more than very rough predictive principles. Presumably it is exactly these types of questions which the three-mode factor analysis (Tucker, 1965) is designed to handle. Thus, a situation X behavior X person matrix presumably will allow one to speak of the different ways in which groups of people respond to groups of situations. Three-mode factor analyses begin to address the question in its true complexity, but their promise is as yet unfulfilled. Furthermore, and here we come to the third question relevant to Frederiksen's proposal, the utility of factor analysis in defining basic units or structures itself remains open to question. After years of careful work using factor analysis to define the structure of personality, Cattell's approach still remains open to challenge and critique in terms of its reliance on factor analysis (Lykken, 1971; Overall, 1964).

Another distinction among efforts toward classification can be made in terms of the type of data used to determine attributes or categories. Some investigators emphasize objective characteristics. Barker's (1968) discussion of settings is in this spirit though, as noted, Barker is also interested in the definition of settings in terms of the behaviors associated with them. Rotter (1955) suggests the classification of situations on the basis of objective characteristics (i.e., descriptions at the sensory level which result in high agreement among subjects and judges), and in terms of experimentally determined similarities related to the nature of reinforcements that are likely to occur. An interesting illustration of the use of objective data, cluster analysis, and multidimentional scaling

can be found in the work of True and Matson (1970) on the grouping of archeological sites in northern Chile. Using the presence or absence of various artifacts as the data, they arrived at a grouping of sites which closely corresponded to intuitive evaluations.

In contrast to such efforts based on objective (i.e., nonresponse-contingent) data are the efforts of individuals who emphasize perceptions of situations and environments. The work of Insel and Moos (1974) earlier referred to and that of Magnusson (1971) is illustrative here. Magnusson's work is particularly interesting in that it used a multidimensional analysis of similarity judgments of a wide variety of situations. The derived structure consisted of five factors which were interpreted as common cognitive dimensions used by individuals to discriminate between situations: positive-rewarding, negative, passive, social interaction, and activity. Magnusson also found that the judgments of perceived similarity between situations tended to be stable over time, but cautioned that the structure of situational perception might differ between groups of individuals and among domains of situations. In relation to the latter, he suggested that samplings of situations be limited to specific domains (e.g., interpersonal relationship, leisure activities, studies, work duties, job positions, etc.).

We have here two questions of considerable interest – whether one should sample within a domain or across domains and whether one can expect to find similar dimensions basic to different domains. Magnusson suggests sampling limited domains. Pervin (1977), using free-response descriptions of individually derived lists of situations, has sampled across domains and finds many dimensions resembling those defined by Magnusson. While Craik (1971) suggests that the basic dimensions of environmental meaning are not likely to be equivalent to the dimensions of semantic meaning identified by Osgood, Mehrabian and Russell (1974) suggest that environments can be categorized in terms of their emotion-eliciting qualities along lines similar to those defined by Osgood. Thus, the latter authors suggest that three emotional response variables (pleasure, arousal, and dominance, corresponding to Osgood's evaluation, activity, and potency) constitute the basic emotion-eliciting qualities of all stimuli, situations, and environments. The emphasis here upon affects is of interest since, as can be seen above, relevant dimensions have been found by Magnusson. Also, in the work of Pervin (1977) it has been found that individuals tend to perceive and categorize situations in affectively toned terms and that their behavior in situations can be understood partially in terms of the affects aroused. Finally, Lewis (1974) has found it useful to study situations in terms of the emotions they are likely to arouse in the infant. These findings would suggest that it may be possible to sample over large domains and that stimuli, situations, and environments can be classified in terms of their emotion-arousing properties. A significant problem with such a categorization, however, is the enormous variability in affects aroused in people by different situations. A second problem is the enormous variability

in response to different affects, both depending upon other characteristics of the situation and the person involved. What we appear to have here is a number of classificatory schemes based upon central mediating processes whose relationship to classifications based on distal situations and behaviors is not clear.

Comment

Classification involves the orderly arrangement of phenomena according to some scheme of likenesses and differences among the groups. A review of the development of taxonomy in biology may be useful for our purposes here (Hickman, 1961). Early efforts at animal taxonomy were catalogs of convenience and depended upon somewhat arbitrary qualities that the classifier had in mind. Thus, animals could be classified in terms of categories such as harmful or useful, land or water, tree or surface. Later taxonomic efforts were based on structure-anatomical similarity and dissimilarity. As Frederiksen (1972) notes, the comparable development in plant biology was Linnaeus' classification of plants in terms of morphological characteristics, principally characteristics of stamens and pistils. Most recent developments in animal and plant taxonomy are based on theory – the theory of evolution. The degree of homologous resemblance or ancestral relationship is a key part of taxonomy in biology.

What are the implications of the history of taxonomy in plant and animal biology for psychology? While the development of a taxonomy of stimuli, situations, and/or environments need not parallel the history of the development of taxonomies in other fields, there would appear to be some lessons that can be learned. First, most of our current taxonomies appear to be descriptive and catalogs of convenience. Different classifications and categorizations depend upon the specific domain the investigator is sampling, the qualities he or she has in mind, the data gathered, and the analytical tools used. This appear to be true whether based on objective characteristics, perceived characteristics, or linkages to behavior.

Second, we can expect significant progress to be made when our classifications are based on structural, objectively defined properties of stimuli, situations, or environments. This can then form the basis for a classification which is theoretically meaningful, perhaps involving some statement concerning the relationships between characteristics of stimuli, situations, or environments and characteristics of organisms. However, we appear to be far away from this development and enormous amounts of observation will be required before we are able to make significant progress. In biology and chemistry there were years of painstaking observation of the structural and behavioral properties of matter, plants, and animals before progress could be made beyond arbitrary and superficial classifications. This would suggest that we avoid getting prematurely locked into a classificatory scheme and that we direct our energies toward observa-

tions which include, if not emphasize, a broad sampling of phenomena (i.e., stimuli, situations, environments) to which organisms seem to be responsive. Conceptually, the emphasis upon rewards and punishments and the emphasis upon emotion-eliciting properties appear to offer some promise at this time. Methodologically, factor analysis, particularly three-mode factor analysis, and multidimensional scaling are potentially useful techniques for gaining some insight into possible structural representations of the variables of interest. However, these techniques can be useful only in relation to data based on careful observations of a broad range of stimuli, situations, or environments, preferably in as naturalistic a form as possible.

A third implication of work in other fields is that we be tolerant of, and interested in, problems in whatever classificatory scheme we may utilize. Even in advanced classificatory schemes in other fields there remain disagreements concerning membership. In zoology classification still varies to a certain extent among authorities. There is not always agreement concerning lines of descent or the optimum number of subgroups. Furthermore, there is acceptance of variability among members of a group. Classification is based on common characteristics shared by all members of the group, but this does not mean that all members of the group are identical or even that any one member is typical. It may be, therefore, that we want to focus our attention on groups of stimuli, situations, or environments that have the most in common – either in their apparent structural qualities or in the behavior associated with them (e.g., approach, flight, or attack behavior). Exceptions in terms of structural characteristics of apparent members of groups or in terms of behaviors associated with apparent members of groups would be considered significant, and potentially enlightening, but not necessarily as destructive to the study of the common properties of the remaining members. While by no means the only model to follow, Barker's line of research would appear to be one important model in this regard.

A final point may be noted concerning implications from taxonomies in other fields. In most cases these classifications are hierarchical.Yet, in psychology, minimal consideration appears to have been given to the possibility of hierarchical classifications. One implication of this is that in considering similarities and differences among potential members of a group we may want to consider the possibility that one or more of the stimuli, situations, or environments under consideration might lie at a different point in the hierarchy. A second implication is that it may be possible some day to develop a hierarchical classification which allows us to move from stimuli to situations to environments in the way that it is now possible to move from species to genus to class in biology or from elements to compounds in chemistry. Brunswik's emphasis on representative design in research and the observational methods of the ethologists would appear to have important implications for further efforts toward definition, measurement, and classification.

SUMMARY

Definitions of stimuli, situations, and environments have tended to be missing or inadequate, with distinctions among the three concepts blurred. Major issues relevant to their conceptualization and definition include: (1) whether analysis should be at the molar or molecular level; (2) whether definitions should be in terms of objective or perceived characteristics; (3) their relationship to behavior.

The nature of the structural units basic to our understanding of stimuli, situations, and environments appears to be a key question with implications for measurement and taxonomy. It is suggested that efforts be made to define these concepts independent of observers, responses, or perceived characteristics. The work of the ethologists may serve as a model here. Such an effort does not imply that perceived characteristics are unimportant or that behavior is purely a function of the stimulus, situation, or environment. It is accepted that organisms are always engaged in a transactional relationship with their environment or with parts of the environment. As Piaget notes, individuals are always interacting with the environment in terms of assimilating phenomena into their cognitive structures or accommodating their structures in response to environmental phenomena. And, as the ethologists observe, the meaning of a stimulus for an organism always depends upon the state of the organism and the surrounding context of the stimulus. In terms of understanding this transactional relationship, however, it would appear useful to have definitions of the concepts that are independent of the responding organisms. Brunswik's distinction among distal stimuli, proximal stimuli, and central mediating processes would appear to be useful in this regard.

Discussion of the issue of measurement has made it clear that many modes of presentation and measures of response exist. At times the method of measurement chosen follows clearly from the definition of the concept but frequently is a matter of convenience. One problem is that measures which depend upon the cooperation of subjects are open to the sources of error and bias common to all reactive measures. A second problem concerns the confusion that often exists between measurement of the concept *per se* and measurement of its effects upon the responding organism. Two further problems concern the possible lack of agreement among data obtained from different modes of presentation and different measures of response. To the extent that there has been a limited sampling of the phenomena of interest, with a mode of presentation variant from the natural engagement of the organism with the variable of interest (e.g., written descriptions of situations as opposed to real-life situations), and a reactive measure of response, the results of a research effort may, in Brunswik's terms, have limited ecological generalizability. It is therefore suggested that wherever possible stimuli, situations, and environments be measured independent of the responding organism and that their effects be studied in the natural

setting with unobtrusive measures. It is also suggested that the multitrait-multimethod approach in personality may have important implications for the ways in which we study stimuli, situations, and environments and their effects upon behaving organisms.

In our efforts toward classification we return to basic conceptual and methodological questions. Taxonomies have been suggested which are based on objective characteristics, perceived characteristics, and behavior consequences of stimuli, situations, and environments, Study of the development of taxonomies in other sciences suggests a line of progress from taxonomies based on convenience to taxonomies based on structure to taxonomies based on theory. It is suggested that attention be given to the definition of units by which stimuli, situations, and environments can be measured objectively and that there be considerable naturalistic observation of many organisms responding to a range of relevant phenomena. Such conceptual and observational pursuits provide the best hope for the future development of taxonomies that are useful in integrating existing knowledge and advancing further research.

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