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CHAPTER 13

Functional Units of Human Behavior and Their Integration: A Dispositional Analysis

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If "Physics is experience arranged in economical order" as Ernst Mach suggested a century ago, then by comparison Psychology could be characterized as experience in profligate disarray. We find ourselves in the waning years of the 20th century unable to even agree on the fundamental subject matter of the discipline. The internecine quarreling becomes even more strident when the domain of discourse shifts from the behavior of laboratory animals to the actions of *Homo sapiens* in its natural habitat. The issues that puzzle even the most optimistic observer are basically these: (a) What are the natural units of a virtually continuous, uninterrupted stream of a person's activities, one blending smoothly into the next, with no obvious beginning or endpoints?; (b) Even if it were possible to identify units of analysis, how could one begin to understand their integration to form the elegantly articulated kinetic structures we call human behavior? Some have asserted there are no natural units for analysis of human behavior (Loevinger, 1957), while others have imposed units on the flux of human behavior a priori based on assumptions about the presumed underlying mental apparatus (Chomsky, 1965, 1968).

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We suggest in this paper that the problem of identifying fundamental units and then coming to an understanding of their integration to form larger units, the features of which are not at variance with our understanding of the complexities of human behavior in the natural environment, requires two sets of concepts. We first explore *fundamental behavioral units* in terms of their proximal controlling variables. Our second concern has to do with the *integration of clusters* of behavioral units to form larger classes, which we relate to the familiar dispositional trait concept. Finally, we suggest that the force responsible for integrating members of successive response classes derives from their relative response probabilities and their temporal distances.

FUNCTIONAL BEHAVIORAL COMPONENTS

Functional behavioral components of human behavior can be identified at four levels: *fundamental response classes*, i.e., elicited, emitted, and evoked responses (Branch, 1977; Zeiler, 1977), *behavioral combinations*, composites of two or more fundamental units (Thompson, 1969; Thompson & Grabowski, 1972), *traits*, or *response families* consisting of clusters of fundamental units and behavioral combinations, and *trait-clusters,* two or more traits that covary intra-individually. Behavioral components isolated at these various levels are *dispositional response class entities* (Carnap, 1956; MacCorquodale, & Meehl, 1954; Pap, 1958; Sellers, 1958; and Tellegen, 1981), i.e., a class of behavioral components which covary as a function of a class of stimulus events that regulate their probability of occurrence. We argue that all behavioral complexes are composed of fundamental units integrated temporally and/or collaterally. The extent to which complex systems of behavioral flux may be analyzed into their rudimentary constituents (or reduced to the next lowest level), varies across behavioral components (both within and between the proposed levels).

Fundamental Units

Branch (1977) has proposed that behavioral "units can be defined as such only by demonstration of functional relations between the supposed units and certain environmental events or arrangements, and the functional relations must bear a resemblance to those described for other proposed units" (p. 176). Though limited to units defined by their relation to a controlling consequence, Zeiler (1977) has used a similar approach to defining behavioral units. We have proposed elsewhere that behavior is composed of three types of such functional units (elicited, emitted and evoked responses), which can be identified by their relation to environmental controlling variables (Thompson & Lubinski, 1985). Such behavioral units refer to the functional response classes originally identified by Bechterev (1928), Pavlov (1927), Skinner (1938), and Thorndike (1911), and the derived response class first described by Falk (1961). Elicited responses include removing one's hand from a hot surface, increased heart rate when unexpectedly being asked to speak at a meeting, and tears generated by viewing an emotionally engaging art form; while opening a locked door, solving an algebra problem, and saying "Good morning" to a coworker exemplify emitted (or, operant) responses.

Laboratory research with rats, monkeys and pigeons has revealed a third functional response class, the strength of which is determined by the interval between successive stimulus events, as well as the nature of the stimulus event. Falk (1961) originally described excessive drinking by rats induced by a concurrent schedule of food reinforcement. It was subsequently found that schedule-induced polydipsia was a member of a far broader class of schedule-induced events including aggressive behavior (Cherek, Thompson & Heistad, 1973), pica (Villarreal, 1967) and wheel running (Levitsky & Collier, 1968). Though nearly all of the early research involved laboratory animals in highly controlled settings (Falk, 1971, 1977; Staddon, 1977), it has been recently discovered that such evoked behaviors occur in humans as well, including schedule-induced eating (Cantor, Smith, & Bryan, 1982), smoking (Cherek, 1982; Wallace & Singer, 1976), alcohol consumption (Lindman, 1982), aggression (Frederiksen & Peterson, 1974) and repetitive motor movements (Wieseler, Hanson, Chamberlain & Thompson, 1985). Such responses are not elicited on the first or second presentation of the evoking stimulus, but gradually emerge on repeated presentation of a given stimulus presented at a specific interstimulus interval. Moreover, rather than occurring in a circumscribed form immediately following the stimulus (as is true of elicited responses), evoked responses tend to be more diverse and are distributed over an extended interval following presentation of the evocative stimulus.

Behavioral Combinations

Whether a unit is judged basic has to do with the degree to which it is reducible with respect to a given level of analysis (Marr, 1981). We take it as given that human behavior is constructed of fundamental functional components combined in various patterns of complexity. Sometimes two concurrently strengthened responses alternate if they are topographically incompatible. We may laugh and cry in rapid alternation at a time of crisis. At other times, the concurrent strengthening of two responses creates a new emergent response class. The artist who has worked in oils and water colors suddenly finds herself confronted with acrylics, which simultaneously sets the occasion for elements of both prior responses. Suddenly a new set of behaviors seems to inexplicably emerge. These behavioral phenomena are the products of behavioral combinations (i.e., a composite response class composed of two or more minimal units integrated sequentially and/or in parallel). Such behavioral complexes may be classified into two subsets based on the nature of their constituents.

Homogeneous combinations consist of behavioral units of the same type (e.g., elicited or emitted), whereas *heterogeneous combinations* are composed of different types of units (e.g., elicited and emitted). Extended segments of human behavior

(or the behavior of any adult organism, for that matter) rarely, if ever, consist of pure homogeneous constituents (Thompson & Lubinski, 1985). Ongoing streams of behavior are typically composed of several homogeneous and heterogeneous response classes operating collectively. Nevertheless, for analytical purposes, it is useful to conceptualize highly integrated behavioral complexes in terms of their rudimentary components in the same sense that chemists investigate individual elements though they rarely occur in isolation.

Response chains seen in many vocational settings and in carrying out daily routines in the home exemplify homogeneous combinations (e.g., meal preparation, replacing a washer in a faucet). These performances are composed of several sequenced operants (one occurring after the other), controlled by discriminative stimuli and natural consequences arranged by our environments. Often, imbedded in the flow of human behavior are reflexive responses elicited by specific antecedent events. The orientation response (Hinde, 1970) is a heterogeneous combination: A mother's voice not only sets the occasion for the three month old infant's head to turn in the direction of the sound (an operant), but elicits heart rate changes as well through classical conditioning. Such elicited responses often involve smooth muscles and glands and are associated with characteristic interoceptive stimulus events contemporaneous with familiar affective states that we label as "pleasure," "anxiety," or "anger."

It is one thing to show that certain aspects of behavior under controlled circumstances consist of discrete functional components (i.e., minimal functional units or behavioral combinations), but quite another to identify their contribution to human behavior in the natural environment. Consider the following behavioral events: The setting is an academic departmental colloquium reception. Jones is approached by fellow faculty member Smith, who says, "Not a bad turnout, considering the topic" (the topic of the preceding colloquium lecture having been in Jones' area of expertise). Jones frowns discernibly and replies in an irritable tone, "At least we heard something relevant for a change, instead of more pie-in-the-sky hogwash!" Smith smiles slightly, turns away and approaches the reception table where he fills a glass with wine. Smith turns to a female graduate student standing nearby and says, "Managed to tear yourself away from Greg for a few minutes, I see," as he takes a sip of his wine and studies her facial expression over the rim of his glass. (Greg is a male student friend of the young woman.) "Greg and I haven't been seeing much of each other lately," the young woman replies, awkwardly. "Well, it's good to see you on your own for a change," Smith replies with a warm smile, establishing prolonged eye contact. The young woman uncomfortably returns Smith's smile.

Such a hypothetical series of events are often said to be difficult, if not impossible for scientists operating within a behavior-analytic framework to deal with. We have no access to the histories of any of the speakers, nor are we cognizant of any of the multitude of other stimulus events which may be exercising control. What we do know is that two of Smith's remarks seemed to be aggressive (i.e., the consequence of two responses was to cause harm or discomfort to another person), though the topographies of the verbal responses were quite different, and the controlling consequences for Smith's remark to his male colleague and to the female graduate student may have been different to some degree (part of one of the controlling consequences may have been, at least in part, sexual).

Traits

We believe that response components within such episodes can be identified and functionally analyzed. To do so, however, requires adopting a broader meaning of response classes and a more molar level of analysis. As Marr (1981) has suggested, there are similarities in the conceptual problems faced by modern physics (e.g., Bohr, Heisenberg, Dirac) and those of behaviorism. Dirac (1958) argued that concepts drawn from classical mechanics were adequate to deal with interference and diffraction of light, but other phenomena, such as photoelectric emission and scattering by free electrons, indicated that light

must be composed of small particles, hence a corpuscular account was also required. In the behavioral sciences, one set of concepts is already well developed to understand the moment-to-moment structure of small units of behavioral phenomena (i.e., fundamental units and behavioral combinations). Such units can be identified by their relation to proximal environmental controlling variables (Thompson & Lubinski, 1985). However, a second set of concepts is required to account for the composition and kinetics of larger, more diverse response classes.

The terms "small" and "large," when referring to response units have a disturbingly relativistic quality which may not seem rooted in objectively quantifiable reality. However, this need not be the case. Small functional response units are those whose probabilities of occurrence are controlled by a given temporally proximal class of environmental events, but a large cluster of responses making up a response class may not necessarily vary as a function of the same operation. That is, small and large functional units appear to be regulated by different mechanisms. Such response units exist in states of strength which are themselves not always observable. Such states are measured by sampling observable properties of the states (i.e., response frequency). At a broader level of analysis, classes of fundamental units and behavioral combinations are known to covary; that is, they are integrated collaterally. We argue that these aggregates of more basic response units can be analyzed as functional entities in their own right, and are similar to what psychologists have called traits. Traits are often referred to as "dispositional clusters" or "response families" because their response components often involve diverse topographical properties, but are nevertheless controlled by similar classes of variables. The collateral integrity of traits is analogous to the verbal behavior generated by word associations. When someone is confronted with a verbal discriminative stimulus, for example, "cat" (and instructed to say the first word that comes to mind) several responses concurrently rise to high strength (e.g., "rat," "mouse," "dog," etc.). But only one is emitted. The emitted response is, of course, viewed as having the highest probability, whereas those responses which collaterally increase in strength but don't reach the level of the emitted operant are characterized as *incipient responses* (MacCorquodale, 1969).

The number of constituent response classes defining a particular trait can only be determined by observing an individual over time; the breadth of the aggregate consists of the range of behavioral components that increase in probability in situations relevant to the trait in question. Since we cannot definitively determine (i.e., analyze) its strength without manipulating a controlling variable which alters its probability, it can be said that the momentary strength of each component response unit is *indeterminate* (i.e., the Heisenberg Principle) (cf. Davies, 1979). That is, although we may be able to predict the aggregate or a homogeneous subset of the aggregate's constituents (following the presentation of a relevant controlling variable), in all likelihood, we will never be able to make refined topographical predictions of particular individual components. One can only estimate the strength of individual components in a probabilistic sense, expressed as a measure of its average strength on many occasions. While we refer loosely to such individual components in terms of their "momentary probabilities," by which we mean a current response tendency (e.g., "He seems very anxious"), more often, however, we are interested in the aggregate's average level of strength over longer time intervals (e.g., "He tends to be very anxious").

The diversity of the interrelated individual functional response classes comprising a response family implies that the probabilities of individual members may not be equal. As a result, on any given observation (in the presence of relevant controlling variables) one or another response class may be observed. However, the various individual response classes would be observed according to their relative probabilities in the functional response cluster over many occasions. The intermediate character of the functional response family formed by the numerous individual constituent response classes expresses itself through the probability that a particular result for an observation is intermediate between the corresponding

probabilities for the original response classes.

We indicated earlier that two sets of concepts are necessary to understand local behavioral integration. The structuring of local response probabilities are understood in terms of the arrangement of stimulus events in time (eliciting, evocative, discriminative, and reinforcing) relative to the temporal distribution of behavioral events. Collateral clustering of response classes, independent of time, is characteristic of traits. That is, clusters of responses tend to belong to the same class by virtue of their shared stimulus equivalence or response induction. These behavioral properties stem from genetic and/or historical sources, such that manipulation of the probability of one member of a given functional class (often called a trait) tends to be associated with changes in probability of other members of that class.

Assessing Diverse Response Classes

In practice, the task of assessing the nature and strength of a person's major response tendencies is formidable but, in principle, possible. If one could combine the skills and training of an especially brilliant ethnologist, with those of a behavior analyst and an ethologist, the job might take on more manageable dimensions. Suppose one were faced with the assignment of identifying the major response classes within the behavior of an adult human subject, freely moving in his/her natural environment. Let's simplify matters by assuming the subject is from a cultural background very much like our own. To begin, we might choose to observe our subject during all waking hours, 7 days a week, for a period of 2-3 months. Using a coded partial-interval time sampling procedure (Sulzer-Azaroff & Mayer, 1977), it might be possible to track up to 10 different behaviors and stimulus situations at a time with reasonable reliability. Over a quarter of a year's daily observations, one could probably construct a reasonably complete inventory of the major types of responses exhibited by the individual, the stimulus circumstances antecedent to those responses and any typical consequences that seemed to regulate their probability of recurrence. Some behaviors would be more difficult to track adequately than others; for example, sexual behavior is less accessible to observation. Other responses occur relatively infrequently, but when they occur, may be very significant (e.g., violent responses). However, given enough skill (drawing on ethnological tactics) one ought to be able to construct a reasonably valid picture of the functional response classes comprising the behavior of our single subject.

Having enumerated a vast number of responses, and drawn tentative conclusions about response class membership based on putative controlling variables (i.e., a functional classification), one could then begin to cluster responses sharing common controlling factors. For example, all operants, the probability of which are controlled by approval from other people, might be tentatively combined into one class (regardless of topographical differences). It might prove useful to begin to aggregate groups of functional responses which commonly covary, as cases of naturally integrated response classes. Certain operants (regardless of differences in form) are often controlled by avoidance or onset of an aversive stimulus, and covary with conditioned elicited responses, which are frequently associated with characteristic interoceptive stimulus conditions (e.g., described by the person exposed to those conditions as "being anxious"). These integrated operant-elicited response combinations may comprise a functional heterogeneous response class. As this exercise is played out, the result would be an extensive enumeration of single and composite covarying response clusters controlled by the same variables. By recording enough instances of each functional behavior class over a 2-3 month period, the observers could translate their observations into a family of relative probability estimates. By arranging such probabilities ordinally, one would arrive at an hierarchy of relative response probabilities (Figure 1).

Upon scrutinizing the response tendencies derived from this exercise, we would probably find that many of these entities correspond closely to traditional trait-labels and may be

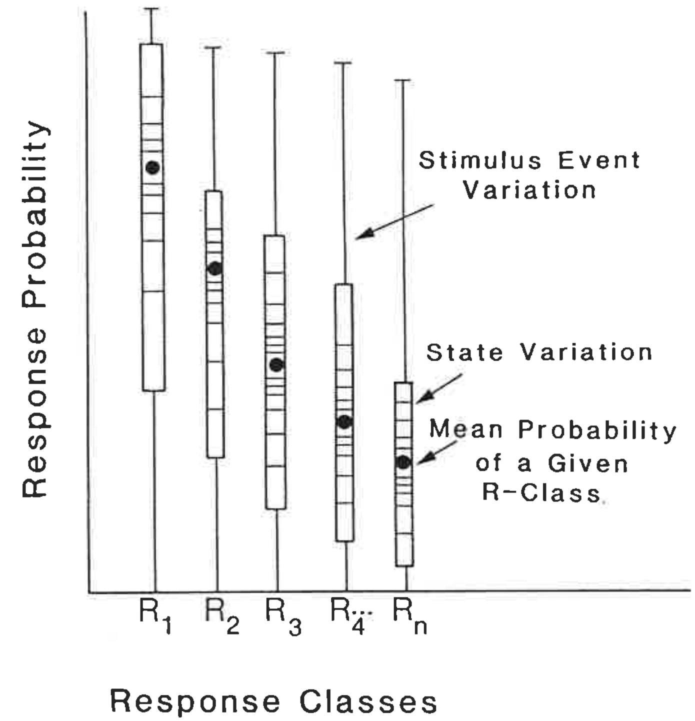

Fig. 1. The hierarchy of an individual's relative response probabilities. R_1, R_2, . . . R_n - the individual's dispositional profile (each "R" represents a specific disposition, the average strength of which is illustrated by a black circle). The short horizontal lines extending from each circle illustrate short-term fluctuations due to state variables (i.e., nonstructural organismic conditions that enhance or attenuate the strength of response classes, for example, fatigue, deprivation, drug, and hormonal states, etc.). Dispositions vary in the extent to which state fluctuations moderate their strength, which is highlighted by the larger variance of R_1, compared to R_n. Strength modulations due to variations in the intensity, configuration and temporal structure of exteroceptive stimulus events are shown by the narrow vertical lines extending from the bars marking variations due to state fluctuations.

classified into several functional domains. Some response classes are distinguished by their common consequences. For example, response tendencies controlled and maintained by social events might be labeled "extroverted" and the dimension along which the strength of such tendencies are measured has conventionally been called *social introversion-extroversion*. Those controlled by aversive stimuli and punishment have traditionally been called "avoidance" (or, in Freudian nomenclature, "defense mechanisms"), and the dimension along which such dispositions have been scaled has been called *neuroticism*. The maintaining events for response classes which involve pain or discomfort to others are called *aggressive*. And response tendencies directed toward inducing others to mediate reinforcers for us has been called *dominance*. These labels are descriptive devices used to characterize functional molar units, nothing more. The strength of such *preference dispositions* refers to the degree to which their respective controlling variables will function as maintaining events for instrumental responding.

A second domain of human response classes includes *response capacities*: An individual's level of strength on these dimensions refers to the ease with which certain instrumental responses can be performed. This domain consists mostly of response tendencies involving discriminative performances and generalizations to symbolic material. Examples of this class include *verbal skill* (responding discriminatively to the meaning of words and using them effectively), *spatial skill* (responding discriminatively to relationships resulting from the movement of objects in space), *clerical skill* (the tendency to respond selectively to pertinent detail in verbal or tabular material), and *finger dexterity* (facility at manipulating small objects rapidly and accurately). We refer to this domain as "response capacities" because in addition to representing an individual's response strength with respect to a normative class of controlling variables (i.e., a skill) the level of these dispositions also measures an individual's readiness to acquire subsequent response tendencies (i.e., an individual's aptitude).

A third class of response tendencies pertains to a small segment of the human population and may roughly be labeled "psychopathological" traits. We mention this class for the sake of completeness, although a thorough behavioral account of the nature of these response tendencies is difficult to characterize.

Whether the entities embraced by this class stem from systematic sources of individual differences at extreme levels or actually represent real "taxa" (Meehl, 1986) remains to be seen. Perhaps both views are correct. For example, most cases of mental retardation represent the low end of polygenetic inheritance for intelligence. However, mental retardation can also result from Mendelian inheritance (e.g., PKU and Down's syndrome) and, hence, stem from taxonic entities. The same could be true for major psychopathological disorders. For our purposes, we have chosen to place these response tendencies in a separate class.

The most salient members of this class are the psychotic response tendencies (e.g., those associated with manic-depressive disorders and schizophrenia). These traits stem from endogenous dispositions which predispose an individual toward developing abnormal (psychotic) behaviors. Individuals suffering from these disorders typically display delusions, hallucinations, and incoherent speech patterns. Often these tendencies become so debilitating that effective functioning of preference and response capacity dispositions are drastically impaired.

Like behavioral combinations, traits may be analyzed into two subsets. *Homogeneous traits* are response families composed of multiple emitted responses (e.g., response capacities). *Heterogeneous traits* consist of emitted behaviors covarying with characteristic elicited internal states (preferences and psychopathologies).

The momentary strength of heterogeneous traits can be modulated by variables controlling either the emitted or elicited components of these aggregate entities. However, the degree to which manipulating a variable controlling the probability of an elicited or emitted component will be effective in altering the strength of a heterogeneous trait depends on the response class under consideration. If, for example, the objective is to decrease the probability of psychotic behavior of a person suffering from a major affective disorder or schizophrenia, administration of a pharmacological agent (i.e., lithium or a phenothiazine derivative, respectively) would likely be the most effective. Often the internal states of people suffering from psychoses must be modulated before the contingencies of punishment and/or reinforcement are capable of making contact with behavior (Thompson, Golden & Heston, 1979).

Trait Clusters

Trait-clusters are defined as two or more traits that covary intra-individually. Like the confluence of behavioral components at more basic levels, products of these interactions may consist of brief expressions of both response tendencies in rapid alternation, a blending of response tendencies collaterally, synergistic behavior unlike either constituent response tendency when functioning in isolation, or behavior may stop. A common trait-cluster which may involve all of these integrative forms follows: Children raised in punitive households are often severely punished for engaging in sexual behavior and discussions of sexual matters. As adults, these children may develop "dysfunctional" avoidance behaviors when sexually aroused because of their past history of punishment following sexual arousal or interest. Even when these individuals are able to engage in sexual activity, they oftentimes report "feeling anxious" throughout the episode (Masters & Johnson, 1966).

In the above example, the trait plus trait covariation is due to historical factors. The *environmental mould* (Cattell, 1950) has produced a trait cluster "sexual arousal" plus "neurotic-avoidance responding" which covaries with stimuli that typically only control the former trait. Other trait clusters are composed of constituents having common biological antecedents. The cluster of traits jointly defining general intelligence (g) is, perhaps, the best known example. In complex problem solving tasks, several cognitive (numerical, spatial, verbal) skills often rise to high strength, collectively. No doubt there are specific biological antecedents for each of these traits, but their tendency to jointly covary both intra- and inter-individually probably stems from antecedents common to all of them.

Refining Time Sampling Estimates

Response tendency (including trait) estimates generated from observers' recordings over long intervals are most accurate for stimulus situations frequently encountered (e.g., work settings) and least accurate for rarely encountered situations (e.g., violent or hysterical episodes). The phrase "I've never seen that side of him before" refers to instances of the second kind; infrequent response tendencies may nevertheless be at high strength, but rarely observed because the circumstances necessary for their manifestation are infrequent. Ideally, estimates of relative response probabilities established by observing an individual over long time intervals should be complemented by observing the subject in low probability situations - to estimate the strength of infrequently observed response tendencies. Both methods estimate the strength of a particular disposition but the latter measures the strength of response tendencies that rarely have the *opportunity* to occur.

Finally, for a comprehensive account of an individual's response tendencies, behavioral data should be collected in compound stimulus situations composed of stimuli relevant to two or more response tendencies. In such circumstances, if responses are incompatible, behavior may cease or become bizarre "superstitious rituals" (Falk, 1986), responses may be integrated in a novel manner "emergent verbalizations" (Sidman, 1986), or one response tendency may emerge as temporarily dominant "regnant need" (Murray, 1938). To be sure, an adequate assessment of all possible hybrid situations can only be approximated, but to the extent that such compound situations are adequately sampled, our capacity to predict an individual's behavior in natural settings becomes more precise.

The above program, if thoroughly carried out, would generate an idiographic (intra-individual) profile of an individual's major response tendencies. However, collecting behavioral data over 3-month intervals is a formidable task, as is exposing subjects to a comprehensive array of low probability situations (and hybrid situations) such that a reasonably valid picture of an individual's response tendencies could be drawn. The opportunity to observe subjects over such long intervals is rare and inefficient. When observations are limited to more manageable intervals, the validity of our estimates of response tendencies may become suspect, because similar response forms may cut across several response classes and, conversely, disparate topographical components can be members of the same class. It is essential that a genuine functional covariation is established before a particular behavior is assigned to a specific response class.

For example, if we observe a couple dining at a fashionable restaurant and, after finishing their meal, the male diner administers a large gratuity to the waiter, we may be inclined to interpret the tipping response as a member of a larger class, say, generosity. In reality, however, someone who knows the diner well might point out that he is typically penurious, but in certain instances where the impression made on his female companion is the controlling variable, his "generosity knows no limits!" On the other hand, responses, some of which appear to have very different forms, may be controlled by the same variables and, belong to the same functional class. As a case in point, part of what it means to exhibit "authoritarian tendencies" is the manner in which superiors and subordinates function as discriminative and reinforcing stimuli for the authoritarian individual. Subordinates are addressed in a "Now hear this" tone, whereas the authoritarian responds obediently in response to orders from superiors. Some critics refer to military promotion policies as ludicrous, because officers are promoted to leadership roles based on their ability to follow orders. Although this may appear otiose, for the authoritarian the transition is often made smoothly. The apparently conflicting features of the authoritarian's behavior in work settings suggest inconsistency, however, bearing in mind that social interactions operate as conditional discriminations based on superior/subordinate social discriminative stimuli, lawful regularities emerge.

One way to circumvent the arduous task of time sampling involves exposing the subject to a variety of situations in a more

efficient and standarized manner using verbal symbolic, rather than concrete discriminative stimuli - namely, psychological tests. Psychological tests are not designed to provide precise estimates of the nature and strength of specific idiographic response tendencies, but they estimate an individual's response strength relative to normative classes of controlling variables. Just as time sampling techniques generate estimates of idiographic response tendencies by abstracting commonalities across behavioral instances *within* an individual, psychological tests estimate normative response tendencies by abstracting behavioral commonalities (via an indirect medium) *across* individuals.

Both methods are concerned with assessing the strength of lawful covariations between classes of stimulus events and classes of responses, but at different levels of abstraction. To the extent that we comprehensively measure the strengths of an individual's response classes on an array of these normative response class dimensions, psychological tests can be employed to generate estimates of an individual's idiographic response tendencies.

Psychological Tests

Historically, the objectives of psychological testing have been either technological or theoretical. The technological goal is concerned with distinguishing individuals of a certain type from the general population (e.g., children likely to have difficulty learning in school, accountants, schizophrenics). This was the main purpose of the first psychometric devices.

Thus, Binet (Binet & Simon, 1905) was assigned the task (by the French Ministry of Schools) to construct an instrument to differentiate retarded children from children in general. The Strong Vocational Interest Blank (SVIB) (Strong, 1927) was constructed to identify individuals well-suited for various occupations. And, it was the success of the SVIB that set the occasion for Hathaway and McKinley (1940) to build the Minnesota Multiphasic Personality Inventory (MMPI), an instrument designed to differentiate individuals suffering from psychopathology from people in general.

These instruments are composed of verbal stimuli which provide the subject with the opportunity to tact symbolic relationships ("2 + 2 = _"), and to estimate ("autoclitically") reinforcer preferences ("I prefer to work alone") or frequent interoceptive states ("My mind isn't working right").[1] The pattern of responses to these verbal discriminative stimuli by members of a representative criterion group (e.g., retarded children, accountants, schizophrenics, etc.) are used to determine *empirically* the items that differentiate the responses of the criterion group in contrast to the general population. This method of item selection is referred to as "empirical keying" (i.e., items are selected based on their *external structure,* or their capacity to generate contrasting response patterns between certain groups of people, and nothing else).

Although patterns of response to specific textual stimuli (test items) may distinguish groups of individuals (e.g., retarded children from children who are not, accountants from physicians, schizophrenics from people with affective disorders), they may not cast much light on the functional response classes which distinguish one criterion group from another. In later test development greater emphasis has been placed on selection of verbal stimuli based on theoretical concerns (Cronbach & Meehl, 1955; Loevinger, 1957; Messick, 1981). Verbal cues (items) are selected based on their (a) specific content, (b) internal structure (or, inter-item correlation), *and* (c) external structure in various degrees

[1]There is a fundamental difference between the psychometric assessment of *response capacities* (e.g., clerical, spatial, and verbal skills) and *preference* and *psychopathological* dispositions (e.g., attitudes, interests, needs, and noncognitive personality traits). In the assessment of cognitive skills, the strength of an individual's response class is estimated directly and objectively; the verbal responses emitted in this context are tacts. In the assessment of preference and psychopathology, however, individuals are asked to estimate "subjectively" the strength of certain dispositions (i.e., we ask subjects to tact the strength of certain response classes); hence, the verbal operants emitted in this context are autoclitics. This distinction may be related to the finding that the assessment of response capacities is much more reliable than the assessment of preference and psychopathological dispositions.

depending on the purpose of assessment. These additional considerations of item content and internal structure help focus scale construction toward indexing unitary response tendencies, rather than lightly tapping a variety of response tendencies which is what empirically keyed scales often do. Scales constructed in this manner may be construed as measures of reinforcer preferences (i.e., the activities and stimuli which will function as maintaining events for instrumental responding) or response capacities (i.e., the tendency to emit certain responses or the readiness to acquire certain responses). An individual's standing on these dimensions represents the strength of a given class of responses in relation to a set of controlling variables.

Numerical estimates of preference dispositions provide estimates of the reinforcing efficacy of various classes of stimuli, whereas response-capacity estimates measure the individual's capacity for gaining access to these high probability behaviors. For example, Dawis and Lofquist (1984) analyzed work adjustment by parsing the individual's work behavior and the occupational environment into two broad (and mutually corresponsive) sub-domains. An individual's work behavior is defined by their repertoire of specific *skills* and *preferences* for certain reinforcers; whereas occupations are defined in terms of their *response requirements* (skills necessary for satisfactory performance) and *reinforcer systems* (types of reinforcers typical of a given occupation). The system calls for two levels of correspondence to predict adequate work adjustment: "satisfactoriness" (i.e., correspondence between an employee's skills and the response requirements of a particular occupation) and "satisfaction" (correspondence between the employee's preferences and the reinforcer system). To the extent that these two pairs of variables correspond, the likelihood of job tenure is increased (Dawis & Lofquist, 1984). Individuals who are "satisfactory" and "satisfied" in their occupations are able to emit the required responses because of the response-capacity/skill-requirement correspondence, and stay in the occupation because of the reinforcer-preference/reinforcer-system correspondence, respectively.

Our understanding of individuals' response tendencies can often be enhanced by increasing the comprehensiveness of our assessment program. For example, we once saw a client for vocational assessment whose response capacity estimates exceeded the minimum requirements on all occupations listed in the *Dictionary of Occupational Titles* (DOT, 1977). His assessed preferences pointed toward managerial occupations (which also corresponded to his expressed interests in-session). However, he also reported having "a hard time getting going on tasks" and spending "alot of time ruminating"; in addition, he appeared depressed. His responses to MMPI items revealed that some psychopathological dispositions were at high strength, which dramatically attenuated his instrumental effectiveness in a variety of work settings. This example serves to illustrate how estimates of an individual's hierarchy of relative response tendencies can be refined by increasing the scope of our assessment program not only in terms of indexing other classes of response tendencies, but also by adjusting other estimates. However, psychological testing is not designed to assess the way response tendencies will function in a particular setting to structure local sequences of behavioral events in time.

TEMPORAL STRUCTURE OF LOCAL RESPONSE PROBABILITIES

Stimulus events, either by elicitation, evocation or operation of the Law of Effect, structure local response probabilities. The local temporal structure of behavioral sequences depends on the relative response probabilities of successive response classes and their temporal distance. Biological state variables (qualitatively different from behavioral dispositions) modulate the degree to which a given stimulus event may exercise its effects on the probability of the response class with which it is related (i.e., either amplifying or attenuating response probability). For example, the probability that a man addicted to heroin will seek out an opiate injection will vary with time since his previous heroin self-administration and the probability of an individual's extroverted behaviors will vary as a function of fatigue. However, having been

determined, the role of such a local response probability is, in all likelihood, independent of its functional class (i.e., to the extent that a behavior is highly probable it will function as a reinforcing event, regardless of whether it is elicited, emitted, evoked, or a constituent of a trait or trait cluster). Premack has shown persuasively that relative response probability relationships are at the root of the Law of Effect (Premack, 1959, 1965, 1971). The relative magnitudes of response probabilities ordered in time by stimulus events determine which response class events can serve as maintaining events for other preceding response classes. Stated more precisely, relative response probabilities can determine the access to which events can maintain other response class events.

It may initially appear that this analysis is tautological (i.e., if one response probability is higher than another, that will determine the response sequence). However, consider the situation shown in Figure 2. A given stimulus event may have discriminative, evocative and eliciting functions which regulate the probabilities of three contemporaneously overlapping response classes. At any one moment in time (e.g., t_1), only one response class will be observable, *though the probability of all three may be relatively high.* On repeated presentation of the stimulus, one might find that R_1 would be followed by R_2. On yet another occasion, R_3 would follow R_1. The casual observer would conclude they are confronted by randomness or a tangled farrago of behavioral events. In fact, which response class appeared would be determined by their relative probabilities in response to the stimulus event, though on any given occasion, the order of response instances will be unpredictable. Given enough samples of S_1R_n, the actual distributions of the relative probabilities of the three response classes would be approximated. Similarly, whether access to members of a given class (e.g., R_3) could serve as a reinforcer for a member of another response class (R_1), would be determined by their relative probabilities and temporal distance between them.

The probability of occurrence of each response class waxes

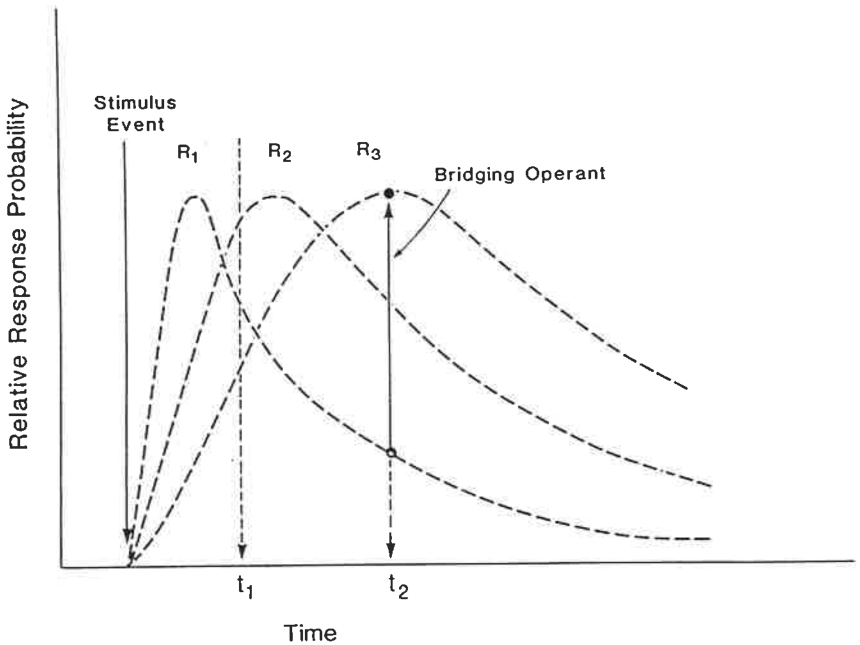

Fig. 2. R_1, R_2, and R_3 represent emitted, elicited, and evoked responses, respectively. The presentation of a stimulus event increases the probability of all three responses simultaneously, but their maximum likelihood gradients peak at different points in time. At time t_1, all three response classes are highly probable (although R_3 is least likely). The vertical line connecting R_3 with R_1 at time t_1 is intended to illustrate a "bridging operant" (i.e., a response emitted to temporally link a high probability behavior "R_3" with a low probability behavior "R_1").

and wanes in a fashion characteristic of a given class. Given the nature of those functions, and the particular points in time that controlling stimulus events occur, the times between peak probabilities of successive response classes will vary. The exact nature of the decay function characterizing the reinforcing strength of a given response class relative to a second response class is unclear, however, it is likely an exponential function describes the relationship, as is true of many biological functions. One can think of the probability relations of temporally sequenced response classes as creating a reinforcement force gradient akin to that across a

semipermeable membrane separating solutions of two concentrations (Thompson & Lubinski, 1985) or two plates of a capacitor, separated by a dielectric medium. The degree to which access to members of one response class can serve as a maintaining event for members of another response class can be expressed:

$$Pr_2 \cdot s^r \cdot r_1 = f\left[\frac{1}{(t_2-t_1)\cdot(p_2-p_1)}\right]^x$$

where $Pr_2 \cdot s^r \cdot r_1$ refers to the probability access to Response 2 will reinforce emission of Response 1, t_1 and t_2 refer to modal times of Response 1 and Response 2, p_1 and p_2 refer to the relative probabilities of the two response classes (assuming $p_2 > p_1$), and x is an exponential variable.

Hence, in the flow of a person's activities, r_2 will tend to follow r_1 depending on the relative differences between p_1 and p_2 and between t_1 and t_2. However, more importantly, access to r_2 will serve as a maintaining event for arbitrary operants leading from r_1 to r_2. The specific operants observed will depend on the individual's behavioral repertoire, the context and any unique response-reinforcer relations prepotent to the situation.

Consider the following exchange. A man has just emerged from a barbershop and his wife says, "What a smashing haircut!" The man's verbal acknowledgement will vary, of course, with his history, but might very well take the form, "Really, I thought it was a little short, but I'm glad you like it." After a predictable pause, the man might go on to say [unexpectedly to his spouse], "By the way, I was thinking it might be nice to go out for dinner tonight, what do you think?" In this example, the positive reinforcer (i.e., the compliment) served several purposes. It not only set the occasion for the acknowledgement, but it also increased the subsequent likelihood of another response class (approach), access to which was bridged by his verbal dinner invitation.

Punishing stimuli can have a comparable effect, and may temporally structure local response probabilities in a fashion that is often called "displaced aggression." Max (a senior faculty member) is approached in the corridor of the Psychology building by the department chair who says,"Max, you know I was expecting your report from the Executive Committee today, but I haven't received it yet . . . I thought you had understood the importance of getting it to me promptly so I can pass it on to the Dean . . . Perhaps I hadn't made myself clear." To which Max replies, "I'll see if I can get it to you first thing in the morning . . . I've really been tied up reviewing grants for the next study section." As Max walks down the corridor, he knocks on the door of Robin, a junior colleague (with whom he has frequent theoretical disagreements), and says, "Hi, how goes the battle?" Robin replies, "Not bad, how about you? . . . By the way, how's the budget report coming along?, to which Max replies, "Well, to tell you the truth, we are recommending some pretty stiff cutbacks in faculty positions . . . but I don't *think* you'll have anything to worry about." Max's increased probability of aggressing for an interval following the department chair's aversive remark is typical of the structuring of local response probabilities in time, and the tendency to seek out opportunities to emit high probability responses. His remark to Robin, designed as it was to cause discomfort over her job security, was displaced a minute or so in time from the evocative event.

In both instances, topographically arbitrary operants bridged lower and higher probability response classes. If the magnitude of the second response class had not been sufficiently high or the delay between the first and second had been too long (e.g., due to interruption or a competing response) access to the second response class would no longer reinforce the intervening operants (either verbal or motor). Hence we might observe that the spouse "failed to rise to the occasion," or that Max "dealt with his anger maturely [i.e., didn't lash out against Robin]." In such cases the expected response sequence would be interrupted. Indeed, much of what is referred to as "good timing" in interpersonal transactions (e.g., sales work, psychotherapy) and in humor, has to do with providing the opportunity for the listener to respond at exactly the most effective interval following a discriminative or evocative stimulus.

The role of such locally structured response probabilities, then, is to integrate successive higher and lower probability response classes by means of arbitrary operants that link them to one another. The foregoing proposed exponential relationship characterizes the conditions under which such linkages are likely to occur. It is this feature which gives the continuity to response sequences, providing the illusion of a continuous stream of uninterrupted activity. Groups of such concatenated response classes can be caused to covary collectively by providing major reinforcing events following entire sequences, as Findley has shown (see following discussion). The rules governing the size of units which can be organized this way are not known, nor are the algorithms by which hierarchies of response clusters become subsumed under larger and more diverse response classes.

Diverse Response Classes, Traits and Temporal Structure

That larger covarying groups of diverse response classes can be brought under the control of a maintaining event is well established. Perhaps the most persuasive example was Findley's demonstration that several complex human performances, each under the control of different stimulus and schedule events, could be regulated as a behavioral unit by the arrangement of a reinforcing event following the entire unit (Findley, 1966; Findley, Migler & Brady, 1963). Such complex responses as creating an oil painting, writing a section of a novel, and engaging in philosophical discussions with the experimenter comprised successive operant units in Findley's investigations.

In human discourse, the probability of successive response classes also waxes and wanes. For example, in psychotherapy, the antecedent stimulus event is either a discriminative stimulus provided by another person (e.g., the therapist's asking, "Hmm . . . I wonder why she reacted that way to your suggestion?"), a previous response-produced stimulus provided by the subject (e.g., the client's own remark, "I told my boss that I thought she should refer questions like that to me.") or often in the form of a conditional discrimination (e.g., the confluence of both the previous remark by the client, and the therapist's verbal probe). The emergence of a sudden high probability response class following a sequence of verbal exchanges (e.g., the client's insightful remark, "I see . . . she wasn't angry with me . . . she thought I didn't respect her judgment!") can serve as a maintaining event for a sequence of utterances that preceded the verbal remark. In Findley's experiments, no effort was made to characterize the distinctive features of these response classes for a given individual relative to a normative frame of reference. However, the nature of the response classes making up the behavioral repertoire of a given individual, and their enduring relative response probabilities are subject to a normative analysis. In the preceding example, the client's verbal responses are part of a therapeutic exchange concerning the client's belief that she was not liked by her employer. Further exploration may reveal that this woman exhibits a wide array of responses, the probabilities of which are regulated by anticipated loss of approval by significant people in her life (e.g., her supervisor, husband, father, mother). Indeed, when her responses to specific psychological test items are investigated (e.g., "Often I cross the street in order not to meet someone I see" [True], or "I have no dread of going into a room by myself where other people have already gathered and are talking" [False]) it becomes apparent that the client's verbal responses in the therapy session were members of a larger response class. In fact, relative to the general population, the client may score two standard deviations above the mean on the dimension of relative strength of this response class. Such a response class, as we have discussed earlier, is called a *trait*. (A trait is distinguished by its diversity and topographical complexity, but otherwise operates

like other response classes.) In the flow of events which set the occasion for the opportunity to engage in avoidance of loss of approval, the client in the preceding example exhibits a wide array of members of that class, given the right stimulus events. One ought not be surprised that the specific stimulus situations and particular avoidance responses are relatively content free. It is the functional controlling relation that defines members of the class, not the specific situation giving rise to a specific response form.

Moreover, the client will also display other behavior, the end product of which is the opportunity to engage in avoidance of loss of approval (i.e., a very high probability response class, or trait). If one samples the client's behavior in a narrow slice of time, it is impossible to make sense of a given motor or verbal response, since it is impossible to identify its class membership (e.g., the woman's verbally snapping at her children, when she realizes her husband is fifteen minutes later than usual). Similarly, *it is virtually impossible to predict the probability of a specific topography in time, though the probability of members of a given response class (trait) should be relatively predictable.* While there is a degree of indeterminacy vis a vis instances of a given response topography, the probability of the sequential arrangement of response classes is determined. One of the striking qualities of an astute psychotherapist is his/her ability to identify response class membership in the flow of a client's behavior with a high degree of accuracy.

Orders of Dispositions and Predispositions

In an earlier paper (Thompson & Lubinski, 1985), we argued that the minimal (i.e., elicited and/or emitted) units of several behavioral tendencies are so tightly integrated that an exhaustive analysis of many combinations may not be feasible. Thus questions naturally arise regarding the mechanisms involved in maintaining the internal consistency of such dispositional clusters.

One antecedent to formation of functional response clusters or traits is behavioral genetic endowment. An individual's genetic make-up is composed of dispositional entities (not behavioral dispositions but biological dispositions or behavioral predispositions to response tendencies). These biological antecedents integrate the elicited and emitted components of several traits (e.g., the collateral integrity of the elicited and emitted constituents of, say, extroversion and neuroticism). Moreover, these predispositions are inherited in various amounts which determine, in part, the wide range of individual differences (i.e., various quantitative levels of strength) observed across all traits. In addition, as the following discussion illustrates, the level and pattern of these biological antecedents is directly related to specific response tendencies that an individual acquires.

Biological antecedents to behavioral tendencies and behavioral tendencies can be distinguished in terms of their order (Broad, 1949; Meehl, 1972). Dispositions which are necessary for the acquisition of further dispositions are viewed as higher-order dispositions. Hence, a disposition of order "K" represents the tendency to acquire a disposition of order "K-1". For example, a three component dispositional sequence may be the following: There is evidence that (second order) behavioral components encompassed by the trait "extroversion" have (third order) biological antecedents (Gottesman, 1966; Scarr, 1969). These second order extroverted behavioral tendencies may be prerequisite for acquiring a variety of first-order dispositions, say, specific skills as a "sales person," "executive," or "politician," etc.

Individuals begin life with a host of biological dispositions relevant to the acquisition of several homogeneous and heterogeneous response classes which are inherited in various amounts (i.e., dispositions of the order "K"). The uniqueness of human individuality begins with the level and pattern of these antecedents to functional response classes. Lower-order dispositions (i.e., K-2, K-3, etc.) are acquired from these higher-order antecedents to form a truly unique dispositional hierarchy of relative response probabilities.

Biological prerequisites to functional response classes are not conceptualized as members of functional classes. Rather we consider them biochemical and physiological antecedents, akin to body build and visual acuity; they determine the extent to which certain classes of stimuli may function as reinforcers ("preferences"), the ease with which instrumental responses are acquired ("response capacities"), and, for a small subset of the population, a greater likelihood to develop abnormal behavior ("psychopathologies"). Although these biological antecedents function to channel an individual's behavioral development, the specific content of an individual's behavioral repertoire is determined by his/her experience. For example, one's standing on the biological antecedents to neuroticism determines the degree to which one's behavior is predisposed toward quick and effective control by aversive contingencies, but it takes the environment to attach the specific content of these contingencies. Just as the strength of unconditioned (second-order) reflexes determines the capacity for acquiring conditioned (first-order) reflexes, the nature of the conditioned stimuli (CS's) may vary tremendously (quantitatively and qualitatively). As Skinner (1969) has stated:

> To say that intelligence is inherited is not to say that specific forms of behavior are inherited . . . What has been selected appears to be a susceptability to ontogenic contingencies, leading particularly to a greater speed of conditioning and the capacity to maintain a larger repertoire without confusion. (p. 183)

Historically, correlational psychologists (i.e., behavior genetics, differential, personality, psychometrics, etc.) have focused primarily on higher-order (K-1) dispositions (the first dispositional order above the biological substratum), whereas experimental psychologists have tended to study lower-order dispositions. Although ostensibly these two areas of interest may appear unrelated, in reality they represent a logical progression of dispositional orders.

Response Class Composition

The homogeneity of a response class is determined by several variables, including the genetically determined tendency for certain responses to covary inter- and/or intra-individually, the uniformity of the contingency history underlying the response class, and the degree to which the same or very similar topographies contribute to other functional response classes. While the former two factors are reasonably straight forward, the latter may be less obvious. In laboratory operant situations, we are well aware of response induction, in which operants sharing common motoric elements tend to substitute for one another (formerly called response generalization). The classic experiment by Antonitis (1951) illustrated some of the dimensions along which induction occurs. In humans, two verbal utterances emitted with different intonations, accompanied by different motor responses (e.g., "body language"), and under different discriminative circumstances may be members of two very different classes. "What a lovely evening," said by the British Ambassador to the American Ambassador, on the terrace of the U.S. Embassy in London over after-dinner cigars on conclusion of an agreement, would be quite a different operant from "What a lovely evening" said by a young woman to her date as she is standing with him outside her apartment at the end of an evening together. Though the literal content of the utterances are the same, the stimulus conditions leading to them are quite different, as are their controlling consequences.

A feature of such larger and more topographically diverse response classes is that the manipulation of a variable that influences one member of the class tends to alter the probability of other members. While this is widely known for simpler response classes (e.g., lever presses), we tend not to expect this will occur with larger response classes. Much of what has often been described as "symptom substitution" refers to the phenomenon of behavioral contrast (Reynolds, 1961) within a broader response class. An extinction or suppression procedure applied to one member of a larger class of closely related educational or social responses may be associated with a temporary increase in strength of other class members. On the contrary, reinforcing one member of a class will strengthen other class members, which is usually the desired therapeutic or

pedagogical outcome. For example, McConahey, Zimmerman and Thompson (1977) found that when aggressive and other disturbed behavior of retarded women was ignored (i.e., extinction) or lead to token loss in a token economy (i.e., punishment), the probability of behavior from the same or closely related classes increased during nontreatment periods (i.e., symptom substitution or behavioral contrast).

The more individual elements two response classes share, the more likely they will combine to form a larger trait cluster, though some of the members of the combined class will continue to be nonoverlapping. The response class often described as "sociopathy" includes two subresponse classes having in common very little control by aversive contingencies. Short term contingencies exercise far more control over the behavior of such people than for most of the rest of the population. In a choice situation between immediate positive reinforcement for themselves and significant aversive outcome for other people, the person whose sociopathic disposition has very high probability would reliably choose the immediate reinforcement for him or herself. The aversive consequence inflicted on others (which, for most people could carry a conditioned aversive quality) would have little suppressing effect, since sociopaths are less sensitive to conditioned aversive stimuli (cf., Lykken, 1968, pp. 157-158). People having the genetic endowment for Mania exhibit some of the same response topographies, though often under different circumstances. In addition, however, people with the Manic disposition also exhibit a variety of other behaviors, including very high rate of speech under poor social control, extremely high rate of motor activity, responding at a high rate leading to a wide variety of primary reinforcers, with limited control by conditioned negative reinforcers. Though members of the two response classes overlap, and may occur at times simultaneously in the same individual, they are in fact different response classes. The sociopathic-like person often exhibits a combination of both response classes, and generally has a very high score on both the 4(Pd) and 9(Ma) scales of the Minnesota Multiphasic Personality Inventory. However, many other individuals exhibit relatively

"S" the probability of response "R" is $\hat{P}$). Because of the vast number of behavioral dispositions that an individual may possess, coupled with the infinite number of configural patterns of strength a dispositional hierarchy could reflect, perhaps our task is hopeless. At first blush, it may appear so; however, for a given individual there tends to be only a finite number of high strength dispositions within their repertoire under a given set of circumstances. Moreover, individuals tend to spend much of their time in relatively few environmental ecologies (i.e., situations relevant to only a few of their response tendencies). So the task of analyzing human behavior on a moment-to-moment basis becomes more manageable than one would initally suppose. Probably the most fruitful place to begin looking for such lawful regularities in behavior patterns is in the more circumscribed environments, such as certain educational or work settings; since these environments often contain quasi-standardized response requirements and reoccurring stimulus events, they are also environments in which individuals spend a great deal of time.

In addition to devoting more time to predicting the temporal presentation of environmental events, behavioral scientists would be well advised to conceptualize point predictions in terms of response classes, rather than the specific topographical members of a larger response class. In the preceding sections we have argued that several human response classes consist of mega-topographical response components. In fact, the overwhelming complexity of human behavior is considerably reduced by realizing that some response classes take on many forms. Nonetheless, some of our colleagues in related fields have chided practitioners of behavior analysis for failing to make topographical predictions concerning important aspects of human behavior, especially in applied settings (e.g., whether an ex-psychiatric patient will commit a particular act of violence, which verbal utterance a child will emit when confronted with a novel stimulus). While our desire to be able to make quantitative predictions of specific actions of individual subjects is understandable, it is misguided.

Focusing our attention on predicting response classes (as

opposed to the constituent components of response classes) is consistent with the manner in which other sciences operate. A chemist, for example, is able to predict with great certainty the reaction produced by mixing various solutions, provided their respective volumes are known beforehand. If, however, a specific molecule in a solution was radioactively labeled before it was mixed, and if a chemist were asked if this particular (molecular) entity will be involved in the (molar) reaction, our chemist's reply would be much less precise (i.e., the molar phenomena is quite predictable but the specific molecular constituents are indeterminate).

We sometimes forget that the very nature of the phenomenon we wish to predict logically precludes its precise topographical prediction. A given response instance (e.g., a specific violent act) is assumed to be a member of a broader functional response class of related aggressive acts, much as lever presses, chain pulls, and hurdle jumps may all be instrumental responses maintained by the same reinforcer, hence may all be members of a larger functional response class. If we were to present a discriminative stimulus for a lever press, but no lever were present, only a hurdle and a chain, where is the behavior analyst who would tell us whether the rat would emit one of the two instrumental responses, and if so, which one? A rational response would be to state a given probability based on an estimate of the likelihood of induction within the broad class of food-maintained instrumental responses and an estimate of their relative probabilities. If one knew the colors of the several training stimulus lights, and the hours of food deprivation, the adequacy of our probability estimates would increase, but nonetheless, they would be probability estimates of a class of behavior.

The violent act of the ex-psychiatric patient is even less adequately predicted because the response class is far more diverse, incorporating both respondents and operants in a very complex heterogeneous trait. As we indicated earlier, what one observes on any given occasion with respect to a specific response topography is indeterminate, but it is predictable as a class on the average across many occasions. That means, high probability of the psychopathic disposition (Pd), or of the manic disposition (Ma), but not both.

Any aggregate response class must be viewed as the result of the confluence of two or more other response classes. The nature of their integration requires a mathematical formulation, and cannot be understood pictorially. As Dirac (1958) suggested in writing about the states of quanta,

> When a state is formed by the superposition of two other states, it will have properties that are in some vague way intermediate between those of the two original states and that approach more or less closely to those of either of them according to the greater or less "weight" attached to this state in the superposition process. The new (integrated) state is completely defined by the two original states when their relative weights in the superposition process are known, the exact meaning of weights and phases being provided in the general case by the mathematical theory. (p. 13)

However, the mathematics involved in specifying the manner in which response units and their weights and momentary fluctuating states of strength are combined to form larger response classes (i.e., traits and trait clusters) remain to be explicated. It is useful to bear in mind, however, that the indeterminate character of the response family expresses itself in a probabilistic fashion, and *it is the probability of observing a given behavioral component that is indeterminate, not the response class*. On a given occasion, one may very well sample one instance in which one of several integrated response classes is sampled, however, by repeating the observation on many occasions, the probability of each will be accurately assessed.

It should be clear that sampling a moment in time out of the ongoing flow of a person's behavior will not provide a basis for interpreting the class membership of a given response. Nor, for that matter, will it necessarily be possible to make such response class assignments by observing the individual over even a more extended period. It is necessary to assess the individual's responses to a wide sampling of situations to assess their relative response probabilities. While such measuring devices as personality and vocational assessment inventories are fallible

indicators of the strength of such response classes, they are little different from any other autoclitics. To the extent that an individual is well trained to tact the strength of his/her own response tendencies, such instruments have the possibility of providing useful measures of relative response strength.

Point Predictions of Kinetic Structure

Since response tendencies are dispositional entities, i.e., they have an if "S" (stimulus situation of a given kind) then "R" (response of a given type) character (Tellegen, 1981), to the extent that our knowledge of an individual's response class tendencies is reasonably complete, predicting behavior on a moment-to-moment basis reduces to understanding state variables and predicting the environment. The problem of predicting the temporal presentation of environmental stimuli (especially in natural settings) is a formidable task by any metric, but point predictions of the kinetic structure of an individual's behavior is essentially hopeless without this knowledge. It's as if one were asked to predict the behavior of a pigeon whose behavior was under elegant stimulus control under a seven ply multiple-schedule without knowing which exteroceptive stimulus light was currently illuminated. Point predictions of the bird's behavior (assuming all lights are illuminated for equal intervals) would only be correct one in seven times. Similarly, a therapist would be hard pressed if asked to predict the behavior patterns of a client between sessions, even though they may have a comprehensive inventory of their relative response tendencies. Predictions are difficult to generate because the therapist is ignorant of the environmental events (i.e., the configuration and intensity of exteroceptive stimuli) about to confront the client during the interval in question. If these environmental events (and their temporal structure) could somehow be estimated, point predictions of the client's kinetic structure would begin to become an answerable question.

This is why most behavioral predictions are framed in terms of conditional response probabilities (i.e., given stimulus necessarily, that whether any given member of a larger class occurs on a given occasion is unpredictable - only its class probability is predictable. In the case of the would-be violent act, the probability of specific individual violent acts (e.g., verbal abuse, beating, stabbing, or shooting), would lead to a composite estimate of a probability of a violent act. Why one would expect a science of behavior to be able to make more precise predictions than chemists tracking specific molecules, is unclear.

The accuracy of predictions, and the significance of our limited ability to make such predictions depends on the homogeneity and the social importance of the response classes in question. Whether an elementary school student chooses to solve her division or multiplication problems first is less important than whether the president of the United States presses the button to initiate a nuclear attack, or picks up the telephone and dials his/her counterpart in the Soviet Union. Our confidence in predicting the latter is considerably less than most complex operants because the exact nature of the response class isn't clear, and occurrence of members of that class seem, fortunately, to be very uncommon.

In examining more circumscribed response classes, such as those involved in operating a motor vehicle, in many vocational or educational settings, or in some structured one-to-one social situations, the less diverse the behavior classes, the more manageable are predictions of the moment-to-moment flow of activities for a given individual. While limited to the humble statement of successive response probabilities, such a kinetic analysis is a reasonable step for behavioral science to take, and is consistent with the strategies of sister disciplines in the other natural sciences.

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CHAPTER 14

Trait Language and Behaviorese

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Some twenty years ago a distinguished behavior geneticist visiting here told me at a cocktail party at Gardner Lindzey's, which my friend and research colleague MacCorquodale was unable to attend, how pleased he was at the receptiveness of Minnesota students to the idea that behavior traits were strongly influenced by genes. I told him that would be expected, since they hear a lot about the inheritance of the general intelligence factor from MacCorquodale in the big general psych section. Whereupon he said, with an expression of utter stupefaction on his face, "But, but, why, I thought MacCorquodale taught your Skinner Course," to which I replied, "Yes, and a damn good course it is, and quite orthodox Skinner." The visitor's amazement I learned was due to two firm notions based upon his previous experience with operant behaviorists responding to his lecture, that they don't like traits, and they don't like genes. This attitude has always rather amused me, since Skinner's closest academic friend at Minnesota was my mentor, the late Starke R. Hathaway, whose research career was mainly based upon assessing traits. Also, I had noticed that before accepting a graduate student as a degree candidate, Skinner always looked up his Miller Analogies score. Now the total score on the Miller Analogies Test cannot by any reasonable use of language be called a response strength; for that matter, the analysis of a correct response to a single item of that test would involve an extraordinarily complex chain of responses and discriminative stimuli, mostly covert. With these two anecdotes, and the