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Foreword

Meaning and Symbolism was in part an attempt to present a comprehensive summary of thinking and research in Descriptive Psychology some five years after its overt beginning with the writing of "Persons" in 1964. In addition, it contained the first systematic Descriptive treatment of linguistic behavior. To date, it is the only such treatment (an abridgement of this material appears in "State of Affairs Systems") as well as the only occasion for a survey of Descriptive research.

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MEANING AND SYMBOLISM

It is a trivial and important fact in logic that for any statement, F(x), there is a corresponding statement, ~F(x), which is the negation of the first. This is particularly relevant in connection with empirical research and empirical hypotheses, for empirical fact-finding consists of identifying one of two such statements as true, or factual, and the other as untrue, or non-factual. Empirical findings represent a selection from a set of already distinguishable possibilities.

It follows that any fact which an investigator is capable of discovering empirically is one of a set of possible facts which that investigator is capable of stating in advance. It follows further that if the empirical study of a given subject matter consists of selecting facts from merely possible facts on the basis of observation, then a systematic articulation of that subject matter can be given. Moreover, it can be given in advance of empirical investigation, and it will be given by a specification of the range of possible facts from which an empirical selection is to be made.

If the subject matter is either extensive or complex it will not, in general, be possible to specify that range of possible facts by simple enumeration. In these cases a calculational approach is required. This involves a systematic classification and analysis of conceptual units in such a way that the required range of facts can be generated by a systematic procedure which thus replaces simple enumeration.

Parametric representations are implicitly calculational. Consider, for example, the parametric representation of a physical phenomenon, P= <L, M, T,e >. (Set theoretical bracket notation is used here and elsewhere for notational economy and heuristic value.) If a physical phenomenon is defined by the parameters of length, mass, time, and charge, and each parameter has a set of admissible values (which may be given by reference to yet another set of parameters), then the range of possible facts concerning physical objects will be given by generating all the admissible combinations of admissible values, taking each parameter independently and in conjunction with cross-parametric restrictions, if any. The presentation, below, of a system for representing possible behavioral facts will require a combination of parametric and explicitly calculational resources.

The proposal to systematize <u>possible</u> behavioral facts in advance of investigation contrasts with our current predilection for systematizing <u>facts</u>, either before investigation (hypothesis testing) or after investigation (the "nomological net"). The methodological disadvantage of systematizing facts without a more inclusive systematization of possible facts is that the range of facts which are excluded by the facts which are stated remains implicit and is usually quite unclear.

Because of this, the information value of the facts which are stated is also unclear.

In systematizing a subject matter one of the primary and initial issues is whether to attempt a conservative specification or a polemic one. A conservative specification is one which does not exclude in advance any apparent possibilities. A polemic specification is one which does exclude some apparent possibilities in advance. I say "attempt" because in the popular literature we do not find any conservative specifications of "behavior", and many psychologists would argue that such a result is in principle impossible to achieve because we all have our biases. As Murphy (1964) comments in connection with a related problem of "subjectivity",

> "It is one of the ironies of contemporary thought that those who in their political and moral attitudes are most vehement against'bias' are often also those who, in their theories, attempt to show that there is nothing else but bias for a moral judgment to express."

Existing polemic specifications with respect to "behavior" are direct descendents of historical controversies in which contrasting positions were staked out with slogans in which the locutions "nothing but" and "must be" figured prominently. "Behavior is nothing but a conditioned response to an occurrent stimulus;" "Behavior must be an expression of the organisms awareness;" "Behavior must be a function of the whole organism;" "Behavior is nothing but the product of the balance of urging and restraining forces; "stimulus-response contingencies must be stated explicitly in quantitative form before rigorous empirical investigation is possible." These are a sample of the polemic positions with which we are well acquainted.

Polemic specifications of behavior have the same consequence as a systematization of facts a priori, and may be so regarded. To take the position, for example, that the facts of behavior are S-R facts is to rule out the possibility of discovering that they are not--or that they are. We should have to question how any one who was willing to give up that possibility so easily could take the position that there is a point in making that 'claim'. Taking a position of this sort is flying in the fact of the fact that some behaviors (including those which each of us calls "mine") seem not to be of this sort. Thus, to carry off the assertion that all behavioral facts are S-R facts (or organismic, or experiential, or whatever) requires that we have, in advance of experimentation, some way of discounting apparently negative cases as merely

apparently negative cases. To accomplish this is one of the primary functions of the polemics, slogans, and programs associated with each restricted position. When the millenium comes it will be demonstrable, though today it is only "in principle", that all behavior is S-R, organismic,psychodynamic, existential, or whatever.

Whatever may be the case when the millenium comes, it seems clear that the a priori restriction of the domain of possible behavioral facts is a procedure which puts a severe strain on our ability to increase our knowledge concerning behavior and our ability to decide whether we have done so on a given occasion. It renders our findings ambiguous, since we are then unable to specify even approximately in conceptual terms what range of facts contrasts with, and therefore is excluded by, the facts we established. In that case, neither do we know what facts we established.

More and more often we are coming to hear disclaimers in this sort of connection. "S-R", we are told, doesn't really mean anything, and there is no more an S-R psychology than there were clothes on the back of the Emperor. "S-R" is simply an honorific language we have for introducing technical terms into psychological accounts of behavior, and in this each investigator runs his own shop without restriction. With this conclusion we need not argue. It does, however, leave us with the original problem of specifying the range of possible facts from which an empirical selection is to be made and merely reminds us of the additional problem that idiosyncratic technical terminology is better suited to conceal what the investigator does and thinks than to reveal it, so that perhaps we might speak more descriptively of "Q-T" psychology.

As we shall see, reservations of this sort concerning our procedures and accomplishments in the empirical investigation of behavior are particularly apropos when it is verbal behavior that is in question. It is doubtless not an accident that coming to grips with the general problem of the experimental study of verbal behavior should have prompted reflections of the foregoing sort. Indeed, such reflection suggests that to achieve an experimental study of verbal behavior which is both conceptually adequate and methodologically apropos, essentially all of our currently accepted ways of thinking about matter must, because they are all highly subjective, dogmatic, and polemic, be laid aside until such time as they can be reconstructed critically from a more general, systematic, behavioral standpoint.

Such a resolution has some respectable historical precedents. For example, F.P. Ramsey (1931) commented similarly in connection

with an inconclusive dispute between Bertrand Russell and W.E. Johnson:

> "Evidently, however, none of these arguments are really decisive, and the position is extremely unsatisfactory to anyone with a real curiosity about such a fundamental question. In such cases it is a heuristic maxim that the truth lies not in one of the two disputed views, but in some third possibility which has not yet been thought of and which we can only discover by rejecting something assumed as obvious by both the disputants."

As an essential preliminary to an examination of the empirical study of verbal behavior, I shall present a system designed to provide a conservative representation of the range of possible behavioral facts. If it were merely a matter of rejecting some one thing, we should have no problem about it, and it probably would have been accomplished long ago. What we shall find, however, is the rejection of many things assumed as obvious by various psychological disputants and their philosophical teachers. Implicitly or explicitly, the presentation will apparently violate many scientific readers' strongly held and emotionally defended convictions about behavior, verbal behavior, explanation, measurement, objectivity, empiricism, observation, truth, reality, science, and experimentation. Et al.

I say "apparently", because I should also want to suggest that it is only the polemicism expressed by "nothing but" and "must be" slogans which is violated, whereas substantive findings, logical consistency, and methodological proprieties are preserved. Little headway could be expected from such assurances, however, since it is precisely as statements concerning methodological propriety that our slogans have traditionally been promulgated. The counterpoint to our civilized posture of handsome tolerance with respect to 'different' theoretical viewpoints has consisted of an engagingly primitive dogmatism with respect to 'methodological standards'.

The presentation below does have some clear historical antecedents (e.g., Wittgenstein, 1954; Anscombe, 1957) and even a contemporary first cousin (Harré,1969) written in the tradition of analytic philosophy and couched in that idiom. Nevertheless, the present formulation is essentially sui generis and cannot be meaningfully understood as a species under any substantive or methodological genus of "psychological theory" or even "scientific theory", or, indeed, "theory". Only confusion and question-begging could be expected to result from appraising or trying to understand it by reference to current scientific custom and popular

scientific ideology. Only standards of objectivity, coherence, and universality are going to be relevant here. Thus, if a common basis for communication exists, it will have to be the supra-scientific basis provided by ordinary language. The development of a further basis for psychologically relevant communication is the primary aim of an uncommonly long, tendentious, and 'philosophical' introduction to the empirical enterprise which is our common business.

"Why all this obfuscation? Why can't he come right out and say what he means?" This reaction is sufficiently predictable to warrent a preliminary answer. Toward this end, let it be noted that the formulation of the system of behavior is not a thesis of any sort, so it will not be just the taking of another polemic position. Instead, it is an effort to delineate and articulate a complex concept and its constituent concepts and their logical interrelationships. It is not a description of anything at all, not even behavior. Being a concept, it is necessarily non-propositional in nature, and so from the very beginning it differs fundamentally from any existing theory, psychological or otherwise. (That scientific theories consist of general propositions having a factual reference is something that our psychological disputants have not merely accepted as obvious, but very likely they would have said that there is no conceivable alternative.) Being non-propositional, it is logically impossible for the concept to be founded on assumptions of any sort. (Part of the reason why a conservative specification of behavior has seemed impossible is the folk wisdom embodied in the familiar "Well, you have to make some assumptions, don't you?") Being non-propositional, the concept could not possibly be either true or false. Accordingly, neither could it be supported by arguments, and nor could it be believed or doubted by anyone. A concept is a resource to be acquired by mastering its use(including, in the present case, its verbal use), not something to be believed or doubted or argued for or against. A forteriori, it is not something upon which empirical evidence can be brought to bear. (Where does that leave us as empirical scientists? Not, at any rate, where we have so commonly supposed.)

The heart of the present difficulty is that a concept cannot be told, either, though it can be taught, explained, illustrated, used, and compared. Simply saying what one means is a viable approach when terminology, concepts, and local and background presuppositions are already shared. If these could be assumed in the present case, there would be little to present except the quantitative results given in the final section below.

The task is complicated by the fact that the concept in

question is one whose use we have, by and large, mastered and engage in constantly. We have not, however, been able to be explicit about this, and psychological training and practice of the classic sort is a serious handicap in this regard. Thus, presenting this concept is not a matter of starting from scratch, which would be hopeless, or of defining a new domain of discourse, which could be done with definitions, but rather, as Cavell (1965) has put it, a task of "getting someone to see". This task may involve illustration, argumentation, explanation, and comparison no less than does fact-stating or straightforward exposition, and is therefore likely to be confused with these.

In short, I take it to be simply the case that there is no easy way out at either end of this effort at communication. Presenting a concept is a peculiar course of action which we sometimes carry off successfully even though there is not a standard way of doing it to which one could turn for the practical assurance of success.

1.0 The Problem of Universality and Representational Adequacy

The psychological study of verbal behavior, like the psychological study of behavior, is extraordinarily variegated. We have studied verbal behavior from the perspective of historical development, biographical regularity, environmental contingency, physiological contingency, statistical regularity, quasi-physiological mediating process or operational mechanism, pathology, and formal theories of logic, semantics, grammar, and signal detection. Among others.

Amid the catholicism of explanatory and manipulatory perspectives which have been brought to bear on verbal behavior, one area of neglect stands out more and more prominently with the passage of time, namely, verbal behavior itself. In the effort to develop explanatory power by reference to models of those various sorts, we have neglected almost completely the task of developing descriptive, or representational, power with respect to the phenomenon itself.

The neglect of the descriptive task reflects certain sociological features of the practice of experimental pscyhology. By common consent, terms of ordinary discourse (e.g. "speaks" or "says")are dismissed by us as imprecise and "merely commonsense" locutions which do not necessarily stand for anything determinate and are therefore to be refined or replaced by technical language which is more precise and operational. Thus, it is customary for the psycho-

logical investigator to give a vague, nominal characterization of his subject matter (e.g., "complex behavior," "symbolic processes", "problem solving", "verbal behavior") and then move to an experimental paradigm as a way of "discovering what the central features of the phenomenon are." Almost inevitably, the experimental paradigm itself becomes the primary description of the phenomenon, and the major product of experimentation is the refinement of explanatory detail, leaving the original descriptive task unchanged. But we should have to question how one could discover empirically what the central features of a phenomenon were without knowing already what features would so qualify if they were ascertained. And if one knew that in advance, it would have to be possible to give, in advance, more than a nominal description of the subject matter under investigation.

We are not, after all, constantly experimenting in the hope that we might discover something. Generally speaking, we conduct experiments because we know in advance what they are capable of telling us, and we decide in advnace that we have a use for that kind of information. If we knew so little about the phenomenon that we could only give it a vague name, how would we know whether a given finding was a finding about that phenomenon? The most likely outcome for the know-nothing style of experimentation would be the invention, out of whole experimental cloth, of a new subject matter altogether rather than an investigation of the kind originally announced. The question of whether one is studying verbal behavior is not one that is settled merely by asserting that one is doing so.

The problem of representational power, or descriptive adequacy, is a relatively unrecognized aspect of the standard of adequacy for a behavior theory which specifies that the theory must apply to all behavior. It is to this standard that the present discussion is primarily responsive.

In this familiar standard, however, "applies to all behavior" has turned out to be resoundingly ambiguous. We may inroduce the problem by noting that the laws of economics, physics, visual perspective, chemistry, theology, phsysiology, logic, and ethics, and indeed, the laws of almost anything at all, "apply to" all behavior, yet we are not on that account strongly tempted to call them laws of behavior or to include them within the scope of psychological theorizing. Psychoanalytic theories, certain S-R theories, and certain expectancy theories also "apply to" all behavior, including verbal behavior. On what basis could we say that they were any more relevant to the study of behavior than those other theories? Could we discover, by doing an experiment, that in fact they were not? Could we discover, by doing an experiment,

whether an experiment would give us an answer? If we cannot, is it because its relevance to the study of behavior is not one of the central features of such theorizing?

It would seem that the question to ask is, what is the range of different behaviors which must be covered by a theory if that theory is to quality as one which "applies to" all behavior? What is the principle of individuation by reference to which we certify that behavior B is a different behavior from behavior R? The common answer is that two behaviors are different if they are differently space-time-locatable. This answer is reasonable enough when it comes to individuating objects, for there at most we have difficulty with arbitrary divisions or fuzzy boundaries. With respect to behaviors, which are not objects, but processes, the same difficulties are found, but we shall see that there is a radical ambiguity which cannot be resolved by specifying location.

1.1 Intention, Description, and Space-Time Locatability

Let us remember the classic example of the hunter, H, who is out for elk and shoots a bear with his rifle thinking it is an elk. Where was that behavior located? Where H was? Where the bear was? Where they both were? Would it have been a different behavior if the bear or the man had been two inches north, or if the bullet had followed a slightly different path? If so, is it sheer equivocation to give the same description of the behavior in both cases, "H shot a bear?" Was it one behavior, i.e., shooting a bear, or two behaviors, i.e., raising the rifle to his shoulder and then shooting the bear? The latter two behaviors are differently space-time-locatable. But then we can divide each of them into an indefinitely large number of constituent behaviors, every one of which is differently space-time-locatable. Evidently the space-time-location approach is a question-begging one, since to use it to any good effect here requires that we already be able to distinguish behaviors. If we can do that, then we can give a post hoc S-T-L description, but not vice versa.

The radical ambiguities are brought out by asking, not where the behavior was, but what the behavior was. Was it shooting the bear, as suggested above? Perhaps it was shooting the rifle. Or again, it might have been defying the law, if it were not the hunting season. But then again, it might have been pulling the trigger, or curling his index finger, or contracting certain muscles of his index finger. These latter occur at the same place at the same time, and defying the law overlaps in space and time with each of the

others.

Many cases of space-time "stacking" of behaviors and possible behaviors are provided by verbal behavior. Suppose that the warden, whom H passed ten miles back shows up and asks, "What have you been doing?" What is the warden's behavior? Is he checking up on H? Is he showing H that he suspects him? Is he warning H to be careful? Is he accusing H of having shot a bear? Is he trying to frighten H, be friendly, improve public relations, maintain discipline in the national parks, ... leading up to another question, just passing the time of day, . . . or what? All of these are descriptions of behaviors occurring at the same time and place. And there is no question of their being different behaviors, as shown by the fact that for any two such behaviors, W could correctly (not merely sincerely) deny one and affirm the other, and he could do this even when an observer, O, would be equally inclined to endorse either.

In these examples we encounter some of the phenomena which would come under the heading of "meaning" in behavior. The applicability of a description of W's behavior is decided by W on the basis of what W meant (intended) to do. In contrast, the applicability of the same descriptions may be decided by O on the basis of what the descriptions mean in the language, and so this application is not a matter of W's intentions. Likewise, W accomplishes his warning of H (if that is what it was) as well as his acceptance or denial of O's descriptions by virtue of what his locutions mean in the language, and the latter is not a matter of what he intends, either, although his warning and his acceptance or denial are a matter of what he intends.

The upshot of such considerations is that what was obvious at the outset remains obvious upon examination. Behavior is not a species of movement because (a) what distinguishes one behavior from another is not what distinguishes one movement from another, and (b) what makes one behavior the same as another is not what makes one movement the same as another.

What distinguishes one behavior from another is the applicability of different descriptions of the relevant sort (behavioral descriptions, of course). There is a parallel here--what distinguishes one movement from another is the applicability of different descriptions of the relevant sort (movement descriptions). The latter sort of description is observable and conceptually different from the former sort (see the discussion of homonymy, below, in this connection).

One of the easy routes to such conclusions would be simply to note that some behaviors, e.g., resting in bed or listening to a lecture, need not involve any movement at all. That would be less informative, however, and the absence of movement would still leave the space-time-locatable suggestion untouched.

One of the further conclusions of interest is that verbal behavior is not merely a subclass of behavior, for if what distinguishes one behavior from another generally is the applicability of an individuating behavior description, then in some sense, which we shall be concerned with below, verbal behavior and the phenomenon of "meaning" stand in a one-to-one relation to behavior per se.

Such a relation has only one major precedent. That is that in an infinite series a part of the series may have a one-to-one relation to the whole series, so that, for example, there are as 'many' odd numbers as there are numbers. As we shall see, this parallel is not accidental. A feature of this sort has enough logical consequences to qualify as one of the central features of the phenomenon of verbal behavior. It would hardly be surprising, therefore, if experimental-theoretical approaches which overlooked this feature were to qualify eventually only as the study of something other than verbal behavior.

1.2 The Differential Scope of Verbal Behavior and Psychological Theorizing

As practicing psychologists we are well equipped by training to deal with the presentation, usually by a certain kind of philosopher or a certain kind of student, of the kind of consideration brought out above. "All that sort of talk is pre-scientific. Of course you can put different verbal labels on it if you like, but what behavior is is movement or the inhibition of movement, and it conforms to the principles given by my theory 'X' which applies to all behavior." If the philosopher or student points out that theory "X" looks like just another verbal label having no apparent mark of special merit or truth, except a verbal mark, we will normally dismiss this as philosophizing and go on about our business. To be able to do this in good conscience is part of being well equipped in the way that we are.

It is instructive, however, to examine carefully the behavioral phenomenon of a hypothetical investigator, H, who, being well equipped in that way, asserts that (for example) behavior is movement and that our job as scientific practitioners is to

discover the laws of its direction, intensity, and persistence or inhibition. What we find is that that behavioral phenomenon is not merely some happening at a particular spatiotemporal locus and that the central features of that phenomenon have nothing to do with direction, intensity, persistence, or inhibition. Rather, to carry off the assertion that behavior is movement, in the contexts in which that assertion typically can be carried off, requires the interlocking of no less than four types of phenomenon, individuated by four conceptual systems. Interestingly enough, three of these systems carry the requirement that verbal behavior, at least, is not merely a matter of sound or movement. In the fourth, the type "X" psychological theory, the concept of behavior does not appear at all, though the word"behavior"sometimes might. Let us examine these conceptual systems briefly.

a) System A is the system of ordinary discourse. Within this system what is required by H's assertion is that we are able to represent the fact that person K is operating as a philosopher and person Q is operating as a scientist. There must be such statuses as "philosopher" and "scientist", and there must be verbal behavior of "asserting", for it is H's status which gives his assertions the significance that they have, as contrasted, for example, with the same 'assertions' made by a five-year-old child or a well-trained parrot. It is H's assertions which have significance, not the sounds or movements that might be found at roughly the time and place of his making his assertions. To 'assert' in this context that verbal behavior is sound or movement or that its occurrence is merely a symptom of a preceding environmental contingency is to generate the same kind of paradox as is produced by the classic "I'm lying to you right now." (Wick, 1964; Ewin, 1968) The conclusion is, therefore, that there is no such assertion to be made in this context. To make the sounds of "behavior is movement" here is not to say anything at all, but at most to pronounce some familiar words. For our present purposes, one System A phenomenon is the relevant one, namely the one which is individuated by the description "K says 'B'." The elements of this phenomenon are (1)the person K, (2) his verbal behavior of saying something, and (3)the verbal content, "B", which identifies what K says.

b) System B is the philosophy of science which is the content of what K, the positivistic philosopher, says. Note that there could not be the fact of there being this content if there were not the fact of there being a System A content consisting of "K says 'B'," and that the latter involves at least two elements which fall outside the scope of "B" and are therefore presupposed by "B". For our purposes, the content of B may be summarized in the statement,

"Q does Y and uses X to explain M." (The psychologist does experiments and uses a theory, X, which must have characteristics X in order to qualify as a scientific theory, to explain behavior.) Here, qualifying as X is only one of the four elements of B, which, collectively, comprise only one of the three elements of part of System A. System B resembles System A in that it includes in a straightforward way persons, scientists, and what they say and what they do. Thus, in this system, too, "behavior is movement" is a non-starter. There must be such phenomena as the person, Q, saying "X" and saying that "X" explains behavior. It is only the logical embeddedness of "X" in System B and ultimately in System A which makes the uttering of "X" an assertion rather than, e.g., a series of movements or sounds. (Movements and sounds are System A phenomena, too, and as such are different from asserting.)

c) System X is a behavior theory of the sort that is referred to in B. For our purposes, System X may be summarized as "R = f(L,D,C,N,r)." (Response is a function of some drive, D, at a level of intensity, L, and a cue, C, having a degree,N, of association with that response, which results in some degree, r, of positive or negative reinforcement. This is a simple formulation, and no doubt it has a somewhat old-fashioned ring, but then, general behavior theories do have an old-fashioned ring.) Note that although X is capable of representing certain kinds of patterns of C,D-R connections (actually, representation of patterning is ordinarily not part of X at all, but part of its use by Q) it is not capable of representing different kinds of cue, or of drive, or of response, except by the ad hoc addition of a list of each kind. This list is ad hoc because there is no conceptual relation between the elements on the list and the parameter (C,D, or R) to which that element is associated. On a given occasion, Q may say of a blinking light that it is a "cue", but equally, on a given occasion, he may say of a blinking light that it is not a "cue". "Blinking light" is not a case of "cue" in the way that "blue" is an instance of "color". Rather,on some occasions, but not others, when something is describable as a case of "blinking light" something is describable as a case of "cue". The coordination of the two descriptions, "blinking light" and "cue" is not accomplished in a general or systematic way by "X". Rather, it must be done on each separate occasion by Q and on an ad hoc basis.

What holds for"blinking light" and "cue" also holds for

"says" and "response". "Says" is not an instance of "response". But Q may say on a given occasion that what is describable as "(the subject) says ('. . .')" is also describable as "response". Since "says" is an instance of "behavior" as a System A or System B phenomenon (note that "behavior", as the subject matter of psychological science is a System A and System B phenomenon), it follows that the concept of "response" is different from the concept of "behavior." And if the locution "behavior" were to reappear in system X as a technical term, that term would not mean "behavior," either, but a good deal of confusion would result. In this sense, as noted above, the concept of behavior falls outside the scope of a type X "behavior theory".

d) The final system, G, is the "observation language" by which Q identifies and describes the range of phenomena which constitutes his subject matter. It is by reference to G that Q selects the ad hoc descriptions associated with "X". Note that it is not in "X" that the relationship is stated, but in "B". G, however, is a portion of A, i.e., a part of the system of ordinary discourse which is assigned to a particular status (is described in a particular way), i.e., "observation language", by K, our positivist philosopher of science who has so well equipped our hypothetical investigator, H. Since G is part of A, the same conclusions regarding the impossibility of behavior equalling movement will hold.

1.3 The Dilemma of the Experimental Study of Verbal Behavior

Having gone through this tedious,though sketchy, exercise, we are in a better position to see the kind of difficulty which could be expected to result from approaching the study of behavior and meaningful verbal behavior within the framework of a type X theory of the familiar sort. The sense in which a type X theory "applies to" all behavior is that it can be used, ad hoc, by a person to give a behavioral description of something. Since System X does not individuate responses in the way that Systems A,B, and G individuate behaviors, it is not clear that anything could be said by uttering the words "and it's the same thing which is described in one way in System A and in the other way in System X." This is also the sense in which economics, physics, theology, and physiology "apply to" all behavior. The sense in which a type X theory does not apply to all behavior is that all behavior, including behaviors which the existence of theory X as a theory presupposes, lie outside

the conceptual scope of the theory. This is also the sense in which physics and physiology certainly and universally do not apply to behavior, and economics and theology at least partly do not apply.

It is not merely behavior as a System A phenomenon, but meaningful verbal behavior which is presupposed by a type X theory. Moreover, it is not merely presupposed "somewhere" or "in the background" or "In some sense". It must literally be exemplified by a type X theory if there is to be such a thing as a type X theory. Thus, for a type X theory to have even the putative force that it does, meaningful verbal behavior must already be known in all its essential features and must really be that and not possibly something else. To propose the empirical study of verbal behavior begins to resemble the proposal to undertake the empirical study of mathematics (to put it on a sound, quantitative basis). If the psychological investigator is constrained by his prescribed role in System B to approach this task by saying, in type X fashion, that meaningful verbal behavior is really something else (of a type X sort) then indeed it has the look of impossibility, and it will not be surprising if his own announced behavior of "studying meaning empirically" turns out to be really something else. As we shall see, there is a way of conceptualizing the task as non-hopeless and approaching it empirically and without making any sacrifices. It does involve giving up type X theorizing and the familiar philosophy of physics which it presupposes.

Adopting a social-historical perspective may help to clarify the issue by concretizing it. From this perspective what we see primarily is persons participating in distinguishable forms of activity, or social practices. Each such practice is distinguished by there being a way of doing it (i.e., a range of optional ways) and by its being done that way by its practitioners. Baseball is a case in point. Baseball is one of the done things, and there is a way that it is done. Science, and specifically the scientific study of behavior, is also one of the done things, and currently there is a way that it is done. If we turn again to baseball and ask, how is it done, one of the things we notice is that to do it the way it is done requires the use of certain locutions such as "Strike one," "Ball two," "Play ball!", "Out!" "Safe!" and others. And if we ask how the practice of experimental psychology is carried out, one of the things we notice is that to do it in the done way also requires the use of certain locutions. The range here is wider than it is for baseball, but certainly a good part of it may be summarized as "type X theorizing". In both baseball and experimental psychology the locutions we identified are part of the verbal technology whereby that kind of behavior is accomplished. This is essentially the

account of the matter given by the positivist philosopher of science also. The contrast to be drawn now is between doing it and describing or studying it. The accomplishment of a certain kind of behavior, whether by verbal means or otherwise, is quite a different task from the adequate description or representation or empirical investigation of that kind of behavior, and so there is no reason whatever to expect generally that what it takes to accomplish the first of these tasks is what it takes to accomplish the others. The type X investigator is well equipped to accomplish the kind of behavior that type X investigators do accomplish, and to do it in the way that it is done. To recognize that gives us no reason yet to suppose that he is adequately equipped to study that kind of behavior, or to study or describe behavior generally.

We might, by way of comparison, consider the situation of the baseball player who takes on the position of radio commentator, where his job is to give play-by-play descriptions and to explain the internal logic and strategic possibilities of the game to an audience of various degrees of sophistication--and only then discovers that in this endeavor he is restricted to the use of those forms of expression that are used in playing baseball and to those behaviors that are part of baseball. The plight of the type X investigator of meaningful verbal behavior is less catastrophic only because there is less of a check on what he accomplishes and less of a penalty for failure, but it is the same plight. The verbal part of baseball cannot, by itself, be used to describe any part of baseball, not even its verbal part, for all of baseball is beyond its conceptual scope, just as all behavior is beyond the conceptual scope of a type X theory.

We may agree that as type X investigators what we do is to study verbal behavior experimentally. In the same sense, we would agree with H that what he did was to shoot an elk, i.e, that was what he meant,(intended) to do. We may go further as type X investigators and agree that we have studied verbal behavior experimentally in the way that it is done, i.e., in the way that people do when that is what they mean to do. But just as we may question whether H shot an elk in the sense that "shot an elk" is a correct description of his behavior, as opposed to his intention, we may also question whether "studies verbal behavior experimentally" is a correct description of our scientific behavior as users of type X theories.[1]

If the standard of universality as a requirement for the adequacy of behavior theory is taken seriously, and if that requirement is seen to include a requirement of representational adequacy, then it seems clear that in order to meet it we shall require a conceptualization

which differs fundamentally from type X theorizing in both its logical characteristics and its methodological status.

Equally clearly, our closest present approximation to the required conceptualization is System A, the system which includes natural language. This is, for example, the only one of the four systems discussed above which is not methodologically incomplete in the sense of presupposing some other system. Indeed, it would appear directly that System A was the conceptualization we required, except that certain difficulties have traditionally been raised. It has been said of System A, for example, (a) that it is imprecise and ambiguous, (b) that it is pre-scientific, not scientific, and (c) that it is not a system at all but is, rather, a set of conventional verbal labels for a pre-linguistically given reality (the 'referent' of "observation language"), or that it is at most, and only in part, "proto-theoretical" or "quasi-theoretical" (Hempel, 1968).

The conceptualization presented below in section 2, 3, 4, and 5 is responsive to these objections. It retains the general characteristics of System A but performs the functions of Systems B, X, and G as well. In toto it is a conservative specification of the range of possible behavioral facts and it leads directly to a substantially novel conceptualization of meaningful verbal behavior and symbolic behavior and their empirical investigation.

2.0 The Concept of a Public Domain of Behavior

People act in light of their circumstances. What they know about their circumstances is, "ultimately", acquired by observation. If we ask what, most generally described, do we observe, the answer will be (a) objects, (b) processes, (c) events, and (d) states of affairs. To say that we observe such things is to say at least that there are exemplars of each sort which we come to know about on occasion without on that occasion having to find out something else first ("observation" contrasts with "inference").

For example, (a) I observe an object when I see a table, hear an automobile, taste an apple, touch a person's hand, or see a cloud, a mountain, or a lake. (b) I observe a process when I feel the water warm up, see the sugar dissolve, or hear the fly come buzzing in this window and out that one or see the automobile come around the corner. (c) I observe an event when I see the automobile stop, see him break out into laughter, feel the wire begin to vibrate, or see the window shatter. (d) I observe a state of affairs when I see that there is a chair in the room, when I hear

that the motor is out of tune, when I see that he is angry or hear that he has made a promise, or when I notice that I am no longer cold or that they are being tactful, or that the water on the lake has a bluish cast, or that the rate of bar pressing is 132 per hour.

The connection between observation and knowledge here is logical, not epistemological. There is no implication, for example, that observation is the starting point for knowledge because the things we observe in the real world are "out there" and observation consists of "reading off the features of what is actually there." Rather, the fact is that knowledge starts somewhere, since we do not and could not go through an infinite regress of cognitive operations, though it need not start in the same place for different persons or for the same person at different times or with respect to different facts. "Observation" marks that boundary, wherever it may lie for a given person at a given time, and the fact of there being observation is no more than the fact of there being such a boundary condition.

Which is to say that, as with all the other concepts with which we shall have major concern, "observation" is defined by its place in the system of possible behavioral facts and not by reference to any external (to the system) circumstance or intrinsic character by virtue of which it has that place.

The four concepts of "object", "process", "event", and "state of affairs" are by no means unrelated for we have ways of moving from a description of (or reference to) exemplars of one of the four kinds to a description of (or reference to) exemplars of the other three kinds. The transitions are made in accordance with the following rules, which do not necessarily represent a minimum set, though they are reasonably parsimonious. Because these transition rules may be applied successively and some are recursive, an unlimited number of transitions is possible.

2.1 Basic Transitions

1. A state of affairs is a totality of related objects and/or processes and/or events and/or states of affairs.

2. An event is a change from one state of affairs to another.

3. An object is a state of affairs having smaller objects as constituents.(An object divides into related smaller objects.)

4. A process is a sequential change from one state of affairs to another.

5. A process is a state of affairs having smaller processes as constituents. (A process divides into related smaller processes.)

6. The occurrence of an event is a state of affairs having at least two states of affairs ("before" and "after") as constituents.

7. The initiating or terminating of a process is an event.

8. That a state of affairs has a relation to a second state of affairs. (The relation may be, e.g., succession, similarity, difference, logical incompatibility.)

2.2 Some Limiting Cases

1. The state of affairs which includes all other states of affairs. ("the world") .

2. A set of objects which are not states of affairs ("ultimate constituents;" "basic building blocks").

3. A process in which nothing changes (part of the history of an unchanging object or state of affairs).

4. A process which is not a state of affairs (i.e., does not divide into processes and therefore is like a unit class of events).

2.3 Some Characteristic Features of the System

1. Objects have histories and are embedded in states of affairs along with other objects.

2. Certain states of affairs are temporal cross-sections (i.e., their constituents do not differ temporally), and are designated as "temporal"states of affairs. Others include constituents which are temporally distributed. If the distribution is finite, so that we can identify an earliest and latest constituent, this is designated as a "cross-temporal"

state of affairs. If not, it is an "atemporal" state of affairs. "The world" and logical relations are of the latter sort.

3. A process has an outcome which represents the difference the process makes in the cross-temporal state of affairs which includes the process.

4. Rule 1 (basic transition #1) states that a state of affairs is a totality of related objects and/or processes etc. The nature of these relationships may be, e.g., geometric, economic, emotional, kinetic, or any others which are appropriate to the type of object involved. Here again it is a logical relation that is involved. Types of object are distinguished by reference to the types of relationship in which they might, logically, be found. Conversely, whenever any two or more objects are related in any of the ways in which they can be related, that they are so related is a state of affairs.

Since the concept of "state of affairs", including its constituent-correlative concepts of "object", "process", and "event" is only the first major conceptual element of the domain of behavior to be presented, its systematic significance cannot be exhibited as yet. Informally, we may say that the state of affairs concept provides a representation of the public "real world" within which persons and their behavior necessarily have a place and with respect to which persons necessarily behave. Persons are a type of object within the state of affairs system, and their behavior is a type of process within that system.

2.4 Comments on the SA System

Certain additional comments regarding the state of affairs concept may be apropos in connection with its later use.

1. Because the basic transition rules can be applied successively and some of them recursively, so that an infinite set of infinite sets (at least) of distinctions and descriptions is generated, the state of affairs concept does have the general characteristics of a calculus and is therefore referred to hereafter as the SA System. The transition rules exhibit the four reality concepts as being mutually defined in terms of one another by virtue of their respective positions in the system.

2. "Object", "process", "event", and "state of affairs" are therefore formal, categorical concepts rather than names or descriptive concepts. For example, it is not that "an event" is a descriptive term (not even a "topic-neutral" one") which we use to characterize the occurrence of something. Rather, to see something as having occurred is to take something to have been an event. Parenthetically, in the present formulation, states of affairs do not occur, and indeed, in most respects "fact" and "state of affairs" may be used interchangeably for our purpose (it is primarily the relation of "fact" to "truth" that separates the two concepts).

3. A consequence of the categorical character of the SA System concepts is that using them is not a case of applying them to anything. SA System concepts could no more have referents than colors could have colors. (But isn't the referent of 'object' actual objects?" "What is the referent of "actual object?" "This!" "What is the referent of 'This?' " "This object" "Q.E.D.") In this way we avoid the pragmatically question-begging "show and tell" paradigms of semantic theories of meaning and reference and instead, move directly to a pragmatic conceptualization of language and meaning.

   There is a parallel problem of boundary conditions in the two cases. For semantic theory the boundary condition is an interface between language and the rest of the real world, and we, who as users of the language are conversant with both sides of that interface, can formulate that state of affairs in a description of the relation between what is "shown" and and what is "told". In a pragmatic context, we can only identify a boundary condition, not an interface, for we are not the transcendental spectators of a transcendental, or really real, world which is divided in just those ways that our SA concepts "stand for". What we can tell is that there is nothing here to show. The boundary condition in both cases is expressed by conceptual tautologies. Thus, "to see something as having occurred is to take something to have been an event" is the pragmatic analogue of the semantic classics, "The referent of 'snow' is snow" and "The sentence 'snow is white' is true if, and only if, snow is white."

4. A consequence of the formal character of the SA System concepts is that they are content-free. For example, an object is not, per se, any particular type of object, such as a psychological object, a chemical object, an observational object, an artistic object, or a physical object. Objects

are not "really" physical objects, and we will not here find any reason to call observations "physicalistic" rather than "observations". Instead, we may use this formal system as part of the basis for moving directly to the study of the domain of behavior which includes physicists, semanticists, "unity of science" polemicists, ourselves, and the professional practices of science and sloganeering, and more.

5. Because the SA System is a conceptual, calculational system, an entire cosmology is the more or less implicit accompaniment of every single observation independently. The transition rules will reproduce a universe in the abstract from a single observation along the lines of "the house that Jack built". Consider the potentialities reflected in "X is the object that partook of the process that terminated in the event that signalled the change to the state of affairs that succeeded the state that included the behavior that Jack observed." The SA System provides descriptive formulas ranging in scope and complexity from "Here is an X" to an entire past and future history. We shall not have occasion to single out a particular type of formula, e.g., the continuous temporal succession type, as having any special ontological validity or intrinsically scientific character. Consideration of the conceptual richness of the system is used to clarify the notion of "surplus meaning" in psychological explanations, most of which are SA Systems redescriptions of "the behavior that Jack observed."

6. Because the SA System is a formal system, it is not a picture or description of reality, though the products of its use may serve pictorial or descriptive ends. In the present formulation, the world is determined by the facts, and by these not being all the facts. Instead, we leave open the issue of the extent to which various observations can be and are reconciled in a single 'picture' through the use of the SA System. In short, the SA System is a conceptual fragment whose completions requires an articulation of what is invovled in "using" it, a task to which we now turn.

3.0 The Concept of Behaving Individuals and Behavior Processes

Among the concepts which may be distinguished within the system are the concepts of type H objects and IA processes. Basically, these are the concepts of persons and behavior (mnemonically, Human objects, and Intentional Action processes). Because the de-

lineation of these concepts is formal and systematic, reference will be made primarily to type H objects (or H-objects) and IA processes, even at the risk of seeming to burlesque the manner in which technical terms are commonly used. In this way, perhaps we may initially bypass a variety of conflicting emotions elicited by the ordinary language descriptions and also preserve the distinction between delineating concepts and making factual statements about their exemplars. The delineation of the concepts of "person" and "behavior" is not a description of persons or behavior, either individually or collectively.

The following informal commentary may serve as an aid in preserving the sense of the direction of the more systematic presentation which follows.

A person is to be thought of not simply as an object, but as a life history, i.e., as an object embedded in a historical sequence of states of affairs which involve other objects, processes, events, and states of affairs in addition. That historical sequence is a process of a certain kind, and it is divisible into a certain kind of smaller processes. Each of the latter is an intentional action, which is the logical and psychological unit of behavior (episodes such as sleep states are dealt with by ID functions, which are discussed below).

A person as a type of object is defined by the fact that its history is, paradigmatically, a history of intentional action. In turn, intentional action as a kind of process is defined by seven paramaters which are discussed briefly in turn (in Section 4). Types of intentional action can be defined by introducing some constraints on the values of the defining parameters. Let "type X action" represent any particular, distinguishable type of action. Then the possible occurrence patterns of type X action within the life history of the individual serve to define several interrelated functions, each of which is categorized as an "ID" function (for "individual difference"). Heuristically, a moderately good analogy for understanding the ID functions is the case of sine, cosine, tangent, arosine, cotangent, etc. The trigonometric functions are ratio functions derived from a common paradigm, the right triangle. Because of the common paradigm these ratio functions are logically interrelated. The ID functions are, ultimately, part-whole functions based on a common paradigm, i.e., the sequence of actions comprising the life history of an individual. Because of the common paradigm, these part-whole functions are logically interrelated.

The three major conceptual elements, i.e., the SA System, the concept of a person, and the concept of intentional action are delineated sequentially, beginning with the SA System, above, then going to persons as the one type of object that is indispensible in the SA

System, then to intentional action as a type of process intrinsically associated with persons. In the latter development the SA System is shown to be one of the parameters of intentional action. In this way we obtain a "three-system system" which is conceptually balanced and therefore neither needs nor could have a 'foundation' external to it. This is the domain of behavior, which, being maximal in scope and logically complete, maximizes the range of empirical possibilities.

3.1 Type H Objects and IA Processes

Within the conceptual system of objects, processes, events, and states of affairs, we select for special attention the concept of a certain sort of object, designated as a type H object, or H-object, and the concept of a certain sort of process, designated as an IA process, or, simply, IA. In this section we shall deal primarily with the concept of a type H object.

3.2 Essential Characteristics of H-Objects

(a) A type H object exhibits sequential changes which can be divided (transition rule 5) into smaller process units of the kind designated as IA processes.

(b) For a given H-object the pattern of occurrences of a given type of IA process can be expressed by reference to the total sequence of such processes exhibited by that H-object.

(c) Each such pattern gives rise to a function which expresses the membership of a historically particular IA of a given IA type in that pattern.

(d) Kinds of type H objects are essentially (as contrasted with accidentally)distinguished by reference to the values of such functions, which are collectively designated as ID (individual difference) functions.

3.3 ID Functions of Type X Behaviors

In order to explain the concept of ID functions, the concept of behavior as an IA process must be anticipated slightly. We shall need here the concept of a type of IA, as contrasted with a historically particular IA. A distinguishable type of behavior is what we normally

mention in giving behavior descriptions in ordinary language. For example, "He is talking to a friend on the telephone," "He is buying a ticket to the theater," "He is having supper," "He shot an elk," "He studied verbal behavior experimentally," "He apologized for being absent-minded" are all of this sort. Likewise, emotionally motivated behaviors such as angry, fearful, greedy, loving, and guilty behaviors will each comprise a type of IA. In the explication of the ID functions, "type X action" will be surrogate for any type of IA process.

There are two major kinds of individual idfference functions. The first kind involves distinctive occurrence patterns of type X actions and may be generally characterized as "propensities" or "dispositions". The second kind involves concepts of behavior potential, and may be generally characterized as "powers" or "abilities". A third kind involves comparisons and differences of the first two kinds and may be generally characterized as "state" or "status"functions.

Trait functions. The trait function reflects one of the simplest occurrence patterns of the type X actions, namely, a pattern of excessive frequency over a substantial period of time. The reference point for "excessive" is normative and circumstantial, so that an excess of occurrences also implies some degree of inappropriatness of some occurrences. If we take angry behavior as an example of type X behavior, then the corresponding trait function is the trait of hostility, and the corresponding individual difference characterization is that here is a hostile person.

(a) The example of hostility may help to make clear why the ID functions are referred to as functions at all. Not every angry behavior is a member of a trait pattern of occurrences. For example, a particular angry behavior might merely reflect a momentary irritation rather than an enduring trait of hostility. The difference is neither trivial nor academic, for the difference between the two has a great deal to do with the appropriateness and effectiveness of various alternative responses to that behavior. Indeed, the difference between the two is the difference between one behavior and another. Yet we do not have two additional descriptive terms, one for "angry behavior which is an expression of the trait of hostility" and another one for "angry behavior which is the expression of a momentary irritation." Instead, we have these rather cumbersome locutions which, nevertheless, are logically adequate for differentiating the two kinds of behavior.

A heuristic analogy here is the square root function. "The square root of of two" is a cumbersome locution compared with "two", just as the trait description was cumbersome compared with "acted angrily". Yet the square root of two is a number just as is two and just as is

the logarithm of two. These are three different numbers, though two of them have to be identified indirectly by reference to a directly identified number. Thus, on the model of " N," the locution "type X behavior which is the expression of trait X" serves to identify a new behavior indirectly by reference to an already identified behavior. ID functions thus serve to extend the range of behavioral concepts (as compared with simple action descriptions), just as the real numbers represent an extension over the range of natural numbers.

With reference to the SA System, we may note that trait descriptions of behavior and other ID descriptions make use of cross-temporal descriptive formulas rather than temporal succession formulas. If the former seem peculiar, the four-dimensional space-time model of physical phenomena may provide a hueristic analogy. In this model there are configurations which are identified by physical laws, but in that four-space nothing ever happens.

(b) The use of terminology such as "excessive" and "inappropriate" will frequently be the occasion for some scholarly eyebrow-raising. How much is too much? And what is the objective criterion for "appropriate?" The eyebrow raising, one might say, substitutes for the verbal comment that the two locutions are excessively vague and inappropriately subjective. This is to say that these terms are precisely what are needed here. As we shall see, the so-called 'vagueness' and 'subjectivity' of these terms is essential to their use, since they thereby have an intelligible public use which does not require prior agreement. In delineating the concept of "trait" in a precise, though schematic, way, therefore, it is essential to articulate this 'vagueness' and 'subjectivity' rather than commanding it to go away.

(c) Just as there is nothing which is merely "a color" without being a particular color, there is nothing which is merely "a trait" or " a type X behavior" without being some particular trait, e.g., hostility, or a particular type X behavior, e.g., angry behavior. The number of possible traits is the number of distinguishable kinds of behavior, i.e., indefinitely large and a historically open set, Thus, "trait" is not a descriptive concept but a categorical one. Since posession of a given trait or set of traits is a way in which one H-object may differ from others, "trait" qualifies as a parameter of H-objects. Similar considerations hold for the other ID functions, and this is why the ID functions collectively are designated as the conceptual parameters of type H objects and are characterized as "individual difference" concepts

Since, with one exception (ability) the details of the other ID functions are not directly relevant to the aims of this presentation, the remainder will be given only in sufficient detail to indicate their

relevant logical characteristics.

Interest Functions. Some type X behaviors are the expression of an interest (e.g., an interest in chess, in art, in Jane, in politics, in making money, in blondes). The occurrence pattern of type X behavior for an interest is formally the same as that for a trait. However, in this case 'type X behavior' does not refer to a set of behaviors which, like "angry behaviors" simply resemble one another in the usual sense. Instead, type X behavior is defined by the two conditions:

(a) It is behavior directed toward a given object or class of objects. (In this connection, see the discussion below of the K parameter of IA processes.)

(b) The behavior directed toward the object of interest is behavior engaged in without a further end in view. (In this connection see the discussion, below, of the W parameter of IA processes.)

Attitude Functions. Given the prior explication of "trait" and "interest", the concept of "attitude" may be given relatively briefly: the occurrence pattern for the type X behavior is one of excessive frequency, with the implication of some degree of inappropriateness. However, the reference class for counting occurrences of type X behaviors is restricted to behaviors which are directed toward an object or class of objects. Thus, for example, a person who has a hostile attitude toward Jane or toward Frenchmen would exhibit that attitude in showing an excess of hostile behaviors among those directed toward Jane or toward Frenchmen, but would not necessarily show unusual hostility in any other circumstances.

Ability Functions. "Ability" is one of the primary codifications of behavior potential. What is referred to by this locution is not a specific pattern of occurrences of type X behavior, but rather the occurrence or non-occurrence of type X behavior. For ability functions, type X behavior is identified by reference to results or achievements, since an ability is always the ability to accomplish a certain kind of result. Thus, a specific type X behavior of this sort is identified by reference to an identifiable class of achievements, for example, "doing sums," "speaking English", "kicking a ball", "driving an automobile", "showing affection" or "studying verbal behavior experimentally".

Thus, a person who has the ability to do X is one who may be expected to achieve successfully and at a comparable level of success across a range of distinguishable cases of doing X. For example, a person who has the ability to drive an automobile may be expected to

operate successfully with automobiles with various transmission and braking arrangements, in traffic and on country roads, on curves and corners, etc. To say of a driver that his getting from A to B is a manifestation of his driving ability is to say that his present success is unremarkable in that it is a member of a whole class of successes which could be expected from him.

(a) Abilities are, of course, relative to circumstances, and when an ability description is given without qualification, the standard qualification, "under normal circumstances" is "understood". If we are to speak of competence at all, then there must be paradigm circumstances in which success is expected and failure calls for an explanation.

(b) To speak of a range of achievements which a person might be expected to accomplish is to say nothing about how it came about that he acquired this behavior potential. In particular, there is no implication that the entire range of potential (e.g., the ability to drive an automobile) was acquired at once or that the acquisition of various portions of that potential are in any way related. The primary limitation on the independence of what is acquired and how it is acquired is that since many abilities imply an indefinitely large number of distinguishable achievements, whereas learning episodes are finite in number, we may in such cases have some confidence that the component behavior potentials were not acquired in an entirely discrete way.

(c) Neither is there any implication that two individuals who accomplish the same results do so by virtue of behaving in the same way in any respect other than accomplishing the same results. Ability descriptions have no logical implications as to the manner in which results are obtained.

(d) A family of related behavior potential concepts may be generated from the concept of ability. For example, the fact that abilities are acquired but need not be (and are not) acquired in the same way by everyone leads to the concept of capacity. Capacity plus history (learning episodes) equals ability. Or again, if there is <u>any</u> circumstance in which the relevant success is unremarkable (in the sense of not being a matter of luck, chance, accident, coincidence, etc.) then the individual <u>is able to</u> do X even though he lacks the ability to do X. The development of capacity into ability to do X frequently depends on the identification and achievement of circumstances under which the learner is (merely) able to do X. Clearly, also, any ability, capacity, or personal characteristic may be expressed as the manifestation of an original, hence "innate" capacity.

(e) It should be clear that ability descriptions are logical correlatives of achievement descriptions. For every distinguishable achievement, there is (logically, not actually) a corresponding ability.

Knowledge and Value Functions. Two other behavior potential concepts are Knowledge and Value. The first refers to the set of conceptual discriminations (including SA) which the individual has the ability to act on. The second is the set of motivational priorities which the individual has the ability to act on. (The concept of acting on a discrimination or acting on a given motivation is elaborated in the discussion, below, of IA processes.)

State and Status Functions. To say that a type H individual is in a particular state at a given time is to say that during that time there is a systematic difference in his behavior dispositions or behavior potential or both. The difference is relative to a norm, usually the classic one of "under normal conditions". Type X behavior in this case is behavior which reflects that difference. The pattern of occurrences for type X behavior is the pre-emption of a finite interval of time, so that during this time every behavior is an expression of the change in potential or disposition. Being tired, depressed, sick, drunk, overjoyed, asleep, and cold are commonplace examples of states of various kinds.

(a) Certain types of states,e.g., being asleep or unconscious, correspond to extensive and "across the board" limitations on behavior potential. It is by virtue of the descriptive resources provided by reference to such states that paradigm case methodology permits us to say that a type H individual is paradigmatically an individual whose history is a history of IA processes, even though there are times when such an individual is not exhibiting IA processes. Note here that "asleep" and "unconscious" are behavioral concepts, not, e.g., physiological concepts, and as such they are logically parasitical on the positive behavioral concepts such as telephoning a friend, conducting a psychological experiment, etc. Individuals who never slept and were never otherwise unconscious could still telephone friends, conduct experiments, etc.,but individuals who were logically incapable of being in a normal waking state could not be asleep or unconscious, either.

(b) The concept of "status" shares the basic logic of state concepts but represents certain additional discriminations. First, state refers to temporary, or in principle temporary, changes in an individual relative to his own characteristics as a reference point. Certain status concepts are distinguished by being irreversible or presumably permanent. The reference point for the difference in what is to be expected from such an individual is therefore a contrasting individual or, usually, a contrasting class of individuals. In this

sense, "blind","male", "female", "child", "mentally retarded", "foreigner", would normally fall under the category of statuses.

Second, there is a strong tradition in English usage such that certain differences associated with social relationships are designated as status differences even though they are in principle temporary. Thus, "mayor of X', "one of the Joneses", "policeman","prisoner of war", would normally fall under this category also.

(c) One of the consequences of having available the concepts of state and status is that any individual or kind of individual within the state of affairs system may be represented as a kind of type H individual. This is because type H individuals are logically the most complex kind of individual in that any characteristic logically attributable to any object can, logically, be attributed to a type H object. Because of this, any other type of object can be represented as a defective case of a type H obejct, i.e., as one which is lacking some of the possibilities exhibited by the paradigm case H-object. The assignment to a particular status codifies the deficiency just as "blind" and "mentally retarded" do within the present soical range of human statuses. Thus, for example, a physical particle might be represented as an object with a particular disability, namely being incapable of being asleep or awake, but which behaved in ways that an object having that limitation was capable of. For example, instead of acting on a discrimination, which it could not, since it could not be awake, it is nevertheless capable of acting under certain conditons, which paradigmatic H-objects can discriminate.

Style Functions. We shall have little to say about these here. Style functions are defined by the fact that type X behavior is defined by performance characteristics (see the P parameter of IA processes, discussed below) and the pattern of occurrence is preemptive, as in the state functions. (For example, speaking with a southern accent would be expected to occur not merely with excessive frequency, but essentially, on every opportunity.)

3.4 Recapitulation of ID Functions

We have noted the following classes of ID functions: trait, interest, attitude, ability, knowledge, value, state, status, and style. These represent dispositions and behavior potentials and what may be called "displacements" of dispositions and behavior potentials. The basic conceptual framework which the ID functions serve to articulate is that of a type H object as an object whose history is a history of IA processes. ID functions represent patterns of occurrence or possible

occurrence of types of IA processes within the history of an H-object.

It may not be an excess of caution to repeat that the delineation of the concepts of ID functions as parameters of type H objects as such is not a general description of persons or a theory about persons or personality. It is, rather, a calculational representation of the logical possibilities from which an empirically informative description or theory of behavior must make a selection. We shall therefore turn next to the representation of behavior as such.

4.0 Behavior as IA Process

In this section we examine a parametric formula for representing the general case of behavior as an IA process. Each of the parameters is delineated briefly. For this formula and others to follow, a common set theoretical bracket notation is used both for notational efficiency and its heuristic value in reminding us that what we are dealing with is something which has some resemblance to set theory. There is no order relationship among these parameters.

(1) $IA = \langle I, W, K, KH, P, A, ID \rangle$

Briefly, these expressions have the following significance:

IA Intentional action, the generic term for the paradigm case of the behavior of persons.

I The identity of the person of whose history the behavior in question is a part.

K (for Know) The cognitive parameter.

W (for Want) The motivational parameter.

KH (for Know How) The competence parameter.

P (for Performance) The procedural parameter.

A (for Achievement) The outcome, or result, parameter

ID The ID functions to which the simple IA is assimilated.

4.1 Individual Identity

Every behavior is someone's behavior. Two individuals may engage in "the same" behavior, in which case there is still an important respect in which the two behaviors are different. The identity parameter is a resource for representing such a difference.

4.2 The Cognitive Parameter, K

The values of this parameter range over possible states of affairs. As noted previously, the SA conceptual system is a system for representing the public world within which behavior takes place and with respect to which behavior takes place. The particular state of affairs with respect to which a particular behavior takes place is the value of the K parameter for that behavior. Since states of affairs are individuated by concepts (concepts of objects, processes, events, and states of affairs, and concepts of particular objects or classes of object, particular processes or types of process, etc.), acting with respect to a particular state of affairs may be expressed as acting on a (corresponding) distinction or as using a (corresponding) concept or set of concepts.

The fact that the cognitive aspect of behavior may be represented as a case of using concepts may help to clarify why the present formulation of the domain of possible behavioral facts is a case of presenting a concept rather than asserting any propositions. Presenting a concept and acting on that concept are what is going on here (see also the discussion, below, of verbal behavior) and in these goings on there is no required place for any proposition. Of course there is a connection between propositions and states of affairs. The connection is given by the correspondence theory of truth: a proposition is true if it designates a state of affairs and not a merely possible state of affairs. This only shows that whatever can be represented by reference to propositions can be equally represented by reference to concepts and states of affairs. The two methods of representation should not be conflated however. For example, it is not that H acts as he does because he believes that "Z" is true or believes Z. Rather, his behaving in the way he does is his way of taking it that the state of affairs is Z. Actions, as we say, speak louder than words, and what a person is prepared to act on is what he takes to be the case. That is part of the concept of behavior and persons, not an empirical truth.

4.3 The Competence Parameter, KH

"His behaving in the way he does is his way of taking it that the

state of affairs is Z. More directly put, behavior consists of treating a state of affairs as being a case of Z. In the language of the laboratory, we cannot establish that an individual discriminates Z_1 from Z_2 unless he responds differentially with B_1 to Z_1 and B_2 to Z_2. The connection between differentiated circumstances and differentiated behavior is a logical one, and so we do not try to subject it to an experimental test--nor could we.

There is a difference between (a) treating something as a case of Z by doing B and (b) doing B on the occasion of Z, and (c) doing B whenever Z. The paradigm case is that of treating something as a case of Z, where the issue of what qualifies as treating something as a case of Z is settled by reference to norms of conceptual appropriateness (intelligibility). For example, in the face of a threat (=Z) the other individual, H, may on one occasion smile blandly, on another occasion turn pale and stammer, on another occasion speak out angrily and on yet another occasion leave the scene suddenly. Each of these, and many more, is a way of treating something as a threat, and it is that because there are existing social practices which provide a range of alternatives in dealing with threats of various kinds. There is, however, no description of a type of behavior, B_1, such that all the ways of treating something as a threat are cases of B_1. The only legitimate candidate for B_1 is precisely "treating something as a threat". Thus, an observer who had not mastered the norms of intelligibility of ways of dealing with threats would be unable to discover that H had done "the same thing" on those several occasions; very likely, such an observer would also be unable to discover that those several occasions were similar in that respect.

The concept of competence in IA is required to distinguish the paradigm case (a) from the defective case (c) and especially from the case of (b), i.e., doing B on the occasion of Z. The relation of behavior to circumstances is not coincidence. If B merely occurs on the occasion of Z, then Z is not the circumstance with respect to which H acted, and B is not a case of treating something as a Z. The only adequate guarantee that the correspondence of B and Z is not coincidence, accident, luck, chance, etc. is that it is the product of H's learning to discriminate Z from other circumstances and to engage in B in those circumstances. This will hold for case (c) as well as case (a). If neither B nor the discrimination of Z depends in any way upon H's learning history, then the occurrence of B is something that happens to H and is not the behavior of H. A paradigm case would be that whenever H is cut, blood flows out of the wound. Blood flowing from the wound is H's circumstances, not his behavior. "Instinctive" behavior is the most likely dubious case, and the requirement of competence provides the criterion for adjudicating it. If (which is extremely doubtful) any instinctive behavior is in no

way whatever dependent on the individual's learning history, then we are dealing with a physiological movement for all that it may bear a phenotypic resemblance to behavior.

4.4 The Motivational Parameter, W

Classically, motivation has been considered to be the instigation to behavior and the removal of the motivating condition to be the cause of the cessation of the behavior thus instigated. Knowledge of these two characteristics of motivation considerably antedates psychological behavior theory. In the present formulation the corresponding logical features are retained without the usual causal, S-R, deterministic, physiological, phenomenological, or empirical accompaniments.

First, the values taken by the Want parameter are states of affairs. That is, what is wanted is a state of affairs,Zw, and the achievement of that state of affairs marks the successful behavior. It follows that the individual, H, who acts on this motivation not merely can distinguish Zw from other states of affairs, but in fact does on the occasion when he acts on that motivation. Thus, the content of W is included in the content of K for a given behavior. Treating a state of affairs as a case of Z is therefore a case of treating a state of affairs as being the absence of Zw.

"His behaving in the way he does is his way of taking it that the state of affairs is Z." His way of taking it that the state of affairs is Z is to do B, which is an expression of his competence. In the present context, we may add a further refinement to this formulation. His way of taking it that the state of affairs is, among other things, the absence of Zw, is to engage in behavior B, which is behavior designed to bring about Zw. Here "designed to bring about Zw" is an implicit reference to his competence and not a phenomenological or teleological commitment (though it is not a denial of these, either).

Since the behavior, B, is behavior which is designed to bring about Zw, that behavior will be ended when Zw is brought about. Formally, the behavior B is a process whereby a type H object transforms one state of affairs, Z, into another state of affairs, Z'. However, it is the specification of Zw which determines the unit of behavior. For in the transformation from Z to Z', some number of intermediate transformations may occur, and it is only by reference to Zw that the distinction between arbitrary units and behavioral units is maintained. The transformation from Z to Zw is, for the individual whose behavior it is, the behaviorally relevant transformation. Intermediate trans-

formations are dealt with below insofar as they are part of the behavior in question and not merely an observer's distinctions.

4.5 The Performance Parameter, P

Briefly, the Performance parameter codifies the procedural aspect of behavior. Procedural aspects are individuated by process descriptions or by simple descriptive locutions (e.g., "raised his arm" or "walked") which can be approximated or replaced by process descriptions. The principle features of process concepts and process descriptions are given by the basic transition rules of the SA System.

4. A process is a sequential change in a state of affairs.

5. A process is a state of affairs having smaller processes as constituents. (A process divides into smaller processes).

Rule 4 guarantees that, unlike an event, a process has a duration. Since no limits are set on the recursive application of these rules, Rule 5 provides for as fine-grained a description of a process as may be required, with a continuous process being the limiting case (since between any two points there will be an infinity of points).

In general, a process description is a device for specifying later states of affairs as a function of descriptions of earlier states of affairs. This may be accomplished by a sequence description or by a calculational formula. Two examples of each may be given as follows.

(a) He reached out, grasped the cup, raised it to his lips, tilted it, and drank.

(b) He assembled the food, prepared it, ate it, and cleaned up afterwards.

(c) $S_{K+t} = S_K + \frac{1}{2} at^2$

(d) growing larger

In this connection, two points are worth making explicitly. First, the paradigm case of a process is the finite sequence exemplified by (a) and (b) above. Second, process concepts do not, per se, have anything to do with causality, determinism, or "dynamics". As shown by Rule 4, a process is a spatio-temporal pattern which either is or is not exemplified in some part(s) of a larger spatio-temporal pattern.

(And the "is" is the "is" of predication, not identity, since states of affairs are not reducible to spatio-temporal patterns.) There is no question, therefore, of its being produced by anything any more than there is a question of the real world being produced by anything. A forteriori, there is no question of its being necessarily produced by anything. I mention this because current psychological behavior theories are process-event theories which in actual use if not in explicit affirmation are modeled on the notion that "the moving finger writes, and having writ, moves on..." The polemics of determinism and a reductive "unity of science" 'hypothesis' have become so familiar that it is easy to take it simply that that is the way the world is.

Rule 4 and Rule 5 thus permit us to articulate the relevant temporal structure of the behavioral transition from an initial state of affairs, represented above as z, to a terminal state of affairs, z_w. Note, however, that intermediate transitions are historically tied and might never be repeated in other occurrences of the transition from z to z_w. The lawfulness of behavior as a phenomenon and the coherence of behavior as a conceptual system in no way depend on purely historical facts about intermediate transitions.

There is, however, a case where intermediate transitions are relevant. This is the case where either (a) certain specific intermediate transitions are essential, e.g., as in a ritual, or (b) certain intermediate transitions are essential, but there are specifiable options and possibly specifiable contingencies restricting or opening later options as a function of the choice among earlier options. The example of dining, (Example (b), above) shows these characteristics. As we shall note later, grammatical specifications of verbal performances have these characteristics also.

4.6 The Achievement Parameter, A

As noted informally in connection with the SA System, a process has an outcome which represents the difference the process makes in the state of affairs which includes the process. Thus, the values of the Achievement parameter are given by states of affairs. Secondarily, the attainment of that state of affairs will be expressible as an event (by Rule 2). The paradigm case of the achievement is a state of affairs which includes Zw. This is the case of successful behavior, the achievement of what was wanted.

The occurrence of the behavior, itself will be an achievement (Rule 6, Rule 2). Making use of the notion of achievement, we may summarize part of the discussion of Performance by saying that the

behavior in question is accomplished by engaging in the performance. This result also shows us that any intermediate transition, Z', between Z and Zw may itself be a behavior and not merely part of the transition form Z to Zw. For Z' may have the motivational characteristics represented as Zw and if the performance whereby the change from Z to Z' is accomplished is itself an expression of the individual's competence, then indeed, the transition from Z to Z' is a complete behavioral unit. In this case, we have one behavior (Z to Zw) accomplished not merely by a performance, but by other behavior (Z to Z' and also Z' to Zw). These notions will make a significant contribution to the analysis of symbolic behavior in Section 7.

4.7 The ID Parameter

The five parameters, W, K, KH, P, and A serve to distinguish what was described earlier as a simple type X action of the sort that is logically transformed by the ID functions. It was noted that the transformation has as its product an IA process which cannot in general be identified in any other way. Thus, the possible values of the ID parameter of behavior are simply the ID functions discussed previously.

4.8 Recapitulation of the Characteristics of Behavior

Every actual behavior is someone's behavior. In every case of behavior by H, H has distinguished his circumstances as being of a certain sort, i.e., of a sort which calls for a change to a certain different sort of circumstance. In the paradigm case, successful behavior, the change is accomplished, and it is accomplished by a performance or procedure which is an expression of H's competence. The significance of a given behavior will vary with the relevant personal characteristics of H.

5.0 SA, ID,and IA: A Three-System System

When the logical structure of the domain of possible behavioral facts is articulated in terms of the SA, ID, and IA conceptual systems and their interrelationships, the gross paradoxes of subjectivity and objectivity in behavior and the tension between phenomonological and 'behavioristic' approaches to the study of behavior are resolved.

Behavior is public and objective because it appears within the SA System which defines "the real world". Behavior appears within the system as one type of process among many and as a type of process having an indefinitely large set of exemplars. It would be as impossible to have a single behavior or behaver in logical isolation from other behaviors and behavers as it would be to have number 5 in logical isolation from the rest of the number system.

Conversely, the real world is an "inner" world because the SA System is not itself either an object or a process or an event or state of affairs. Because the SA System is not any of these, it is not simply a part of the real world. Rather, its place in the real world is given by the fact that the SA concepts individuate values of the K parameter of the particular behaviors of particular individuals. Briefly, every conception of the real world is someone's conception.

In turn, that every conception of the real world is someone's conception is a part of the public domain, for there being a K parameter of IA processes is a state of affairs which is within the representational scope of the SA System. Thus, every (paradigmatic) person's conception of the real world includes other persons having their conceptions. The systematization of this public state of affairs is provided by the ID system, which is the locus of reconciliation of differences among persons with respect to conceptions of the world or parts of it. We shall return to this phenomenon after an examination of some important characteristics of IA processes and the consequences of these characteristics.

5.1 Recursive Aspects of IA

Formula (1) which defines the IA process, is recursive and reflexive.

(2) IA = <I, W, <IA>, KH, P, A, ID>

(3) IA = <I, <IA>, <IA>, KH, P, A, ID>

(4) IA = <I , W, K, KH, P, <IA>, ID>

Formula (2) represents the case of an IA process which involves the use of the concept of an IA process. Formula (3) represents the case where the individual is motivated to engage in an IA process (e.g., as a way of accomplishing some other behavior). Formula (4) represents an IA process the outcome of which is an IA process. This might, for example, simply be a case of a person succeeding in engaging in an IA process which he was motivated to engage in. However, it might

instead be a case of one person getting another person to engage in some IA process (this includes what is described in some technical contexts as "manipulating the controlling variables."). Both these cases would require recursion in the K,W, and A parameters.

5.2 Some Forms of Behavior Description

Given that intentional action, defined by formula (1) is the general case of behavior, the recursive formulas (2), (3), and (4) permit us to derive three additional forms of behavior representation which will have some use in the discussions to follow.

5.2.1 Social Practices as the Basic Behavioral Phenomenon

A social practice may be represented as follows.

$$SP = \underset{L_i}{\langle IA \rangle} \quad \underset{L_2}{\langle IA \rangle} \quad \underset{L_3}{\langle IA \rangle} \quad \underset{L_4}{\langle IA \rangle} \; - - - - \; \underset{L_n}{\langle IA \rangle}$$

That is, a social practice is a pattern of actions engaged in by one or more persons. The actions of the different participants may be successive, simultaneous, or overlapping (thus, the diagram above is a simplified one showing only a linear succession). The structure of the practice is given in part by the pattern of actions and in part by the specification (L_1, L_2, etc.) of which of the participants is eligible to perform each of the actions in the pattern. The set of eligibilities for a given individual constitute a role definition relative to that social practice.

Social practices vary in extensiveness, and many of the shorter and simpler ones are components of larger, more extensive ones. The same practice, e.g., calculating sums, may be a component of various distinct practices. The basic practices are those which need not be part of any other practice but are intelligible in themselves. These will be referred to as "intrinsic practices". ("Upward" elaborations into social institutions and cultural organization are relevant but will not be dealt with here.) The most clearcut examples of such practices are games, recreational activities, avocations, and some vocations. For example, playing chess and playing politics are forms of behavior which a person can be understood to be engaging in without a further end in view. The person who claims to be doing one of these "because I just like to, that's all" need not be concealing an ulterior motive and nor do we need to invent a transcendental motive such as "pleasure", "reinforcement", "drive reduction", "satisfaction", or

"homeostasis" to make his behavior intelligible (cf Manser, 1961).

Since cooperative social behaviors require a dovetailing of the actions of particular individuals, social practices provide the paradigm of "getting someone to do X", i.e., formula (4).

5.2.2 Course of Action as a Derivative Case

The concept of "course of action" is the same as that of social practice except in regard to the adequacy of the participants' skills for the task at hand. (Additionally, "course of action" is in fact used mainly with respect to the behavior of a single individual.) Since a social practice is the done thing, there is a way of doing it, and so carrying it off in its paradigm instances has the characteristic of an action in that the success is attributable to what the participants know how to do rather than to luck, chance, coincidence, or accident. In a course of action there is at least one point in the sequence where the participants lack the practical assurance of success in advance which is normally provided by the KH of intentional action.

Because of this feature, much human learning and the paradigm cases of "problem solving", "strategy", and "motive" fall under the course of action representation.

The comparison between social practice and course of action, and the reason why the former is logically prior, may be illustrated by reference to most games. For example, playing chess is a social practice, and we all know how that is done. Checkmating, or gaining control of the center, can only be a course of action if it is any contest at all (otherwise, it's "not a real game"). It is the existing game which defines those uncertain achievements as desirable, hence renders intelligible a course of action directed outward such an achievement. And undertaking <u>that</u> course of action is an expression of the person's participation in <u>that</u> game. What one is <u>trying</u> to do is a derivative of what one <u>is</u> doing.

Thus, intrinsic social practices, as public, objective, repeatable patterns of social behavior are the logical boundary conditions for all behavior, though as we shall see in connection with verbal behavior, they are not generally simple and direct boundary conditions. The division of social processes into parallel and sequential components (by SA Rule 4 and Rule 5) generates logically just those smaller processes which we have designated as IA. In this way we have another balanced conceptualization (a "warp and woof" sort). Social behavior is defined by reference to what individual persons do, and individual behavior is defined by reference to what social patterns it is and could

be part of. Thus, the IA system, as given by formulas (1) and (4) is a culture-free 'grammar' of behavior. Cultural and group differences are represented as differences in regard to particular (institutions and) social practices, courses of action, intentional actions, and deliberate actions. Such differences have the same logical status as the individual difference concepts mentioned above, since we are dealing with patterns and pattern membership in both cases.

5.2 .3 Deliberate Action as a Special Case

In intentional action, the values of the parameter, K, are specified by means of conceptual distinctions of any sort within the SA format. Deliberate action is represented directly as a special case by formula (2). It is that special case of intentional action in which the conceptual distinction involved is the distinction between one kind of IA process and another.

Only an individual capable of deliberate action is capable of describing behavior, choosing behavior, intending behavior (formula (3)), thinking about behavior, and knowing what he is doing. (This is why formulas (2) to (4) are said to exhibit IA as reflexive as well as recursive. An account of "self" concepts can be given in these terms (Ossorio and Davis, 1968).)

It is deliberate action and not merely intentional action which defines the paradigm case type H object. And the study of behavior is a form of behavior which only such a type H individual is, logically, capable of.

5.3 IA as a Calculus of Descriptions

The brief reference to concepts of social practice, course of action, and deliberate action may serve to clarify the way in which complex behavior descriptions may be constructed using the simple IA concept as a conceptual building block (in diagrammatic form, it works very much like a benzene ring). Formally, it is the recursive character of IA, shown by formulas (2), (3), and (4), which has the consequence that there is no upper limit to the extensiveness or complexity of behaviors which a type H individual might, logically, conceive, describe, or act on. In fact there are personal limits and differences in regard to those limits, and these will be given by ability descriptions and other ID characterizations.

5.4 IA as a Calculus of Actions

Ordinarily, a calculus involves one set of elements for representation and a logically different set of elements for operations. For example, in arithmetic we have numbers for representation and operations consists of adding, subtracting, multiplying, and dividing. In a logical system we have sentential forms for representation and instantiation as the operation or we have well-formed formulas for representation and rules of inference for operations. In the domain of behavior, however, representation and operation are accomplished by means which are formally identical as cases of IA, though functionally distinct, as shown by the dual appearance of IA in the recursive formulas (2) and (3). Any way of operating the IA conceptual, or representational, system is a case of an IA process.

Comparisons may help here. (a) In a logical theory we have an unlimited number of elements and usually only one operation, e.g. instantiation or a simple rule of inference. (b) In arithmetic we have an unlimited number of elements and four operations. (c) In the IA system we have an unlimited number of elements and an unlimited number of operations, since the latter are formally identical to the former. It is that unlimited number of operations which is implicit in the innocuous-sounding pragmatic locution of "use", and it is the infinitely greater logical scope provided thereby which distinguishes an action-oriented pragmatic conceptualization from a truth-oriented semantic conceptualization.

For any one of our commonly recognized formal systems, the use of that system is a different thing from the system itself. So that, for example, the description of the use of the system requires concepts which are in addition to and different from the concepts which are required to describe or delineate the system itself. For example, the playing of baseball and the reporting of a baseball game must be described in IA terms, whereas baseball itself, is described in a well-known book of rules. Similarly, the system of English is used, e.g., to ask questions, to make requests, give orders, give descriptions, teach children, etc. The system of arithmetic is used to calculate acreage, make change, report one's income tax, predict the point of impact of a projectile, count the number of trials to criterion, teach children to do arithmetic, etc. Thus, all formal systems are logically embedded in the IA system because operating any other system is a way of operating the IA system, and it is the latter that gives point to the former.

Likewise, the representation vs. operation distinction may serve to clarify the logic of paradigm case methodology. A paradigm case

formulation for a particular type of phenomenon or subject matter consists of (a) a simple description or delineation of a paradigm case which leaves out some cases which are included in the subject matter, and (b) description or delineation of the other cases as transformations of, or functions of, the paradigm case. Such transformations can be broadly categorized as deletions, additions, substitutions, etc. When the transformations are deletions the result is designated as a "part-description" (Ossorio, 1966 a). We have seen an example of this in the relation of H-objects to other objects, which may be seen as incomplete or limited versions of H-objects.

The transformations of the paradigm case are the products of operations performed on representations. In a situation of the present sort where the operations are formally identical to the representations it is possible to articulate the subject matter with considerable conceptual economy. The logical rigor and conceptual precision attained thereby will not be different from the case of writing down the formula a + b = c and leaving the possible substitutions "understood", though we may expect to find less agreement (see below) in behavioral matters than in mathematical ones. Conversely, however, the conceptual scope of what is delineated must be understood not as what is explicitly represented (as I have noted, the IA and ID systems are not descriptions of behavior) but rather as the range of products generated by using what is explicitly represented in both logical roles (representation and operation) in all the sequences and combinations formalized in the recursive formulas.

Thus, frequent references are made to "the paradigm case" or "paradigmatically". For example, the paradigm case of an H-object is one who can engage in deliberate action (but perhaps a person in the status of "mentally retarded" can not); the history of an H-object is paradigmatically a history of IA processes (but if he is unconscious, he is not engaging in an IA process); the paradigm case of an IA process is one which is successful in attaining the desired result (but sometimes there is failure). Given our current penchant for simple description such formulations are not unlikely to appear to be ways of ignoring or evading the "difficult cases" or the "exceptions". In fact, they are reminders that with the representational power afforded by the IA system, such cases are not difficult to handle, but they must be handled differently, i.e., by recourse to paradigm case methodology.

5.5 Objectivity and Anthropomorphism

Because the system of behavior has a maximal degree of logical scope and complexity, and its organization includes other sorts of

organization, it may be regarded as the paradigm case of which other conceptual schemas are a partial or deficient copies. There are three such conceptual schemas which are of some interest for scientific investigation.

(a) The first such partial system is the simple SA system itself, considered merely as a calculus of objects, processes, events, and states of affairs. As we have seen, the SA system cannot stand on its own, since it is not directly part of the real world. We may note that any instance of behavior as represented in formula (2) will exhibit all four features. There is an object (of type H) given by the I parameter. There is a process, IA. There are at least two events, the initiating and the terminating of the process. And there are at least three states of affairs--two of temporal succession and the cross-temporal one which includes them. In just these brief considerations, all eight of the basic SA transition rules are exemplified except for Rule 3. The latter is accomplished as soon as performances are represented by differential reference to parts of H-objects such as hands, face, etc. Thus, for a type H object to conceive of the world as consisting of a system of objects, processes, events, and states of affairs is for him to see the world in his own image. To see the world as fundamentally composed of non-H-objects is for him to see the world as a defective copy of himself or to see himself as a defective type H object.

(b) We have already noted that the concept of behavior is not merely a calculus, but is the only complete calculus in that it is the only calculus which does not presuppose another one into which it fits, and it is the one which is presupposed by the use of other calculi. Thus, it serves as a paradigm for a variety of calculi which are incomplete in this respect,e.g., logical, grammatical, semantic, or mathematical systems.

(c) Finally, the concept of behavior serves as the paradigm for causal processes. The IA process is one which not only produces certain results, but produces them in a guaranteed non-accidental way (which is not, of course, to say that accidental results are not produced by behavior). Other processes can be said (which is an IA process) to produce results non-accidentally, but saying so does not make it so, and it remains always conjectural. Thus, causal process explanations perform their function of making occurrences intelligible only if they are conceived on the model of IA processes. Indeed, this is part of the ideology of experimentation. The only evidence that counts as prima facie evidence for A causing B is that we can produce B by causing

A. This is the classic "experimental method."

These three cases have a historical interest, because the history of our efforts to deal with behavior in a scientific, objective way has, in its major development, been an attempt to demonstrate effective manipulation of behavior based on the conception of it in terms of non-H objects and non-IA causal processes which define hypothetical "genotypic" states of affairs the transitions among which are, ideally, stated in 'rigorous quantitative form'. We have been taught by positivistic philosophers and their scientific pupils that holding to this program constitutes adherence to the standard of objectivity, and we have congratulated ourselves that thereby the science of behavior has "come of age" by finally outgrowing its pre-scientific, anthropomorphic origins. Under the present formulation, our recourse to these three defective cases may be seen as not merely anthropomorphic, but, so one could say, uproariously so.

This state of affairs may be summarized as the problem of "the ghost outside the machine". Any conceptually impoverished formulation of the domain of behavior will, in order to have the use that it does, require a user (an H-object) whose necessary characteristics are impossible to represent within that theory and who could, therefore, have only a ghostly existence relative to the restricted domain of facts delimited by the theory. Here again, the use of the theory would have to be described within a conceptual system that was different from the theory itself. In this respect, as noted previously, type X psychological theories resemble non-psychological and non-scientific theories. That such an individual could use such a description of behavior in the way that he does tells us a good deal about the capabilities and motivations of that individual as a type H object. In that way, perhaps we learn something about behavior. As to what his description tells us about behavior, the answer might well be "little or nothing". It is , one might say, a highly subjective description.

My behavior, which, as we noted earlier, does not seem to be simple (or even complex) Q-T matter, is represented by formula (2a).

(2a) IA = <I,W, <I,W,K, KH,P,A,ID> ,KH,P,A,ID>

And my circumstances are given by the single K in this formula.

Clearly, no type H individual of our sort is going to operate in an infinity of ways with an infinity of concepts. Social practices and ID characteristics bring us to a human level of operation. ("The world is determined by the facts . . .") Nevertheless, just as the grammatical and performative structure of our language permits us to make up nonsense sentences which stamp language as being something more than just what we can actually say, the conceptual richness of the IA-ID-SA

system give us an intimation of a reality which goes beyond what we happen now to be able to know and do. (". . . and by these not being all the facts.")

It is within this general human circumstance that a concern for establishing facts and being objective becomes intelligible, and thereby the contribution of meaningful verbal behavior, social practices, and ID functions in implementing that concern also become intelligible. That verbal behavior is intricately and inextricably part of the system of behavior was already suggested previously by the conclusion that there is a one-to-one relation between verbal behavior and behavior. By making use of a relatively formal representation of verbal behavior in section 6, we are able to make a conceptual survey of some of the most central features of the phenomenon. That conceptualization is implemented in empirical research designed to contribute to an objective study of behavior. Thus, the following discussion of objectivity serves both to introduce the concept which is to be implemented empirically and provides a preliminary, informal example of the phenomenon referred to above, i.e., that operating any other system, in this case the linguistic system of English, is a way of operating the IA system, and it is the latter which gives point to the former.

5.6 Objectivity and Agreement

If objectivity does not lie in giving impersonal, quantitative, causal descriptions, then what is it about a description that makes it objective? Let us consider a situation in which the question of objectivity could sensibly be raised. Let us introduce four persons, H, M, S, and R. Let H and M be observers and commentators on the behavior of S with respect to R. And let H begin by giving some description of S's behavior, e.g., "He's angry at R, but he's trying hard not to show it." To which M rejoins, "Now wait, you're not being objective!"

The rejoinder by M involves the claim that H's description embodies an error, that H has gone wrong somewhere. Fortunately, we can categorize broadly the three ways in which H might have gone wrong: (1) H may have ignored or failed to observe some relevant state of affairs. (2) H may have made use of some consideration which was irrelevant and therefore ought not to have been a consideration. (3) H might be overemphasizing or underemphasizing one or more of the relevant circumstances which he did consider.

So far, we have characterized H's original description as defeasible

in principle and as in fact being challenged by M. However, there is not a double standard here in favor of skepticism. M's challenge is also defeasible. The further conversation between H and M on the matter will have the form of appeals to shared standards, and so may be characterized as "negotiation". It looks to me like he was just a little bit drunk--after all, a little stutter isn't all that significant". "A little stutter, my foot! Didn't you hear what R said? And don't you know that R is his wife's favorite brother, who has 30 percent of the company he works for?" And so forth.

The end of negotiation will take one of two general forms. The first is eventual resolution of the disagreement, so that both would endorse the same description of S. This need not be the original description, since by virtue of reminders and appeals, both H and M may change to new positions. It should be noted, too, that in this kind of situation there is no such thing as demonstrative argument. There is neither a technical procedure the results of which are conclusive nor any non-question-begging premise from which it would follow that S was angry at R. Negotiations are conducted on the at least provisional presupposition that both individuals have the competence to make the judgment in question, and negotiating is a way of correcting such judgments, not of generating them.

The second possible outcome is the failure to agree. In this case, both H and M will resolve the disagreement unilaterally with an individual difference description. "H is biased by his dislike of R". "I guess M is just not very sensitive to unpleasant emotions. He just likes to be everybody's friend." These exemplify attitude and ability characterizations. Roughly speaking the failure of appeals to supposedly shared standards leads H and M to the conclusion that they do not in fact share all the relevant standards, or that although the standards are shared, the ability to apply them is not, etc.,(and the ID descriptions they give of each other codify these conclusions.)

What would it have been for H's description to have been objective? The description would have been objective if H had in fact not gone wrong in any of the ways in which he might possibly have gone wrong. Thus, the contrast between "objective" and "biassed" or "subjective" depends on there being the possibility of going wrong and on there being ways of judging whether one had gone wrong or not. Procedures of checking and negotiating are highly developed social practices. That is the substance of "there being ways of judging whether one had gone wrong or not." Which is to say that there was nothing about H's description that <u>made</u> it objective, any more than there was something about S's behavior that <u>made</u> it hostile. We do not arrive at correct conclusions because we have procedures and perspectives which are 'objective'. Rather, our ability to criticize

a judgment as "not objective" reflects our competence to decide what conclusion was the correct conclusion to draw.

Of course, the conversation between H and M could equally well have been a soliloquy by H. In this case, the appeals made by H (Didn't you hear. . . ?") would have a different methodological character, though the content and consequence might be the same. They would be precautions taken by H against certain ways of going wrong in his judgment. And if H made systematic observations, e.g., comparing S's behavior toward R as compared with others, making provoking comments to S and noting his reactions, etc., we might say that H was taking an empirical, experimental approach.

An experiment serves as a precaution for the experimenter against the possibility of a statement (or a projected course of action) going wrong in certain of the ways that it could go wrong. Precautions are not proofs, of course, and the decisions about which precautions are called for is a separate judgment which reflects the further competence of the investigator and is in principle defeasible. "Principles of experimental design" refers to a range of standard precautions of this sort. Taking irrelevant precautions may be just as subjective and detrimental to the empirical enterprise as the failure to take precautions that are called for. Clearly, the precautions that are called for depend on the further use to which the statement in question is to be put.

What about the eventual disagreement which resulted in the ID descriptions by H and M? The significance of the description of H by M is that M is thereby prepared to treat H as a case of z (z = "biased by his dislike of R"). That is, M is prepared to make certain allowances for H in regard to what he expects from him and he is prepared to treat H in the differential ways that that kind of individual calls for. What ways? The range of ways provided by social practices, restricted by M's own ID characteristics of ability, value, etc.

To be sure, M's judgment as to when to terminate the negotiations or whether to enter into negotiations at all is also subject to criticism. After all, M can use ID descriptions to dismiss the judgments of anyone who apparently disagrees with him as simply insensitive, wrongheaded, incompetent, biased, etc., and this procedure on M's part will be a paradigm case of judgment which is lacking in objectivity. Polemic stands of the sort mentioned earlier, share this feature.

However, if M's judgment is not at fault, i.e., cannot be successfully challenged, then what he has illustrated by his giving the ID description of H is a trans-personal calibration. If the situation is

as M sees it, then a person who differed form M in the way that he attributes to H would see and treat the same situation differently from M in just the way that H does differ from M. There is an indefinitely large number of actual and hypothetical individuals who, by virtue of differing from M in ways specifiable by ID descriptions would correspondingly differ from M, or fail to differ, in the way that they would see or treat this situation. Thus, "disagreement" in the usual sense does not contrast with "objectivity".

But what was the objective nature of the situation, and what is the objective description of it? Have we merely come back to our starting point here? No, for a certain kind of answer is now possible. The objective nature of the situation is categorically unlike any person's view of it. Because of this, it would be categorically impossible to ascertain or even approximate the objective nature of the situation by adopting some one view of it, e.g., a view which is shared by a set of "trained observers", or by a set of observers which includes that important special case of "me". Far from being a way of achieving objectivity, our standard requirement of observer agreement is a way of evading the problem by restricting our efforts in such a way that objectivity is not an issue between us. Methodologically, this shares most of the characteristics of a hypothetical procedure in which H and M would agree to de cide the question of S's hostility conclusively by flipping a coin. A question which is decidable in this way is no longer the question about S's hostility. And in general, the importation of a decision procedure for deciding a question for which no decision procedure exists only succeeds in changing the subject.

There are two heuristic analogies which may be exploited in connection with the notion of objectivity. The first is the contrast between the visual appearance of an object and the shape of an object. We know that an object like a beer mug or an automobile will have a different appearance, depending on the point of view. The object has only one shape, but an infinite set of appearances, not all of which need be unlike. Most importantly, none of its appearances approximates the shape, for there is a categorical difference between the shape it has and the way it appears. Yet we can only see the object from some viewpoint and when we do we do see the object directly. There is no special viewpoint form which the real shape is identical with its appearance. Nor is the shape a transcendental kind of appearance that would be visible to a hypothetical, transcendental, 'objective observer'.

Nevertheless, the shapes of objects have a comfortingly concrete character, and our competence with matters of visual perspective is such that we perceive shaped objects and do not calculate shapes from

their appearances. We have standard terminology for shapes and objects, not their appearances. Thus, the second heuristic analogy is more pointed, for here we lose this feature. This analogy is the case of relative motion. We cannot characterize the motion of an object except by reference to some other object or set of objects. The motion will be differently characterized depending on which set of objects we use as a frame of reference. What is the 'objective motion' of the object? That must be given by a set of correspondences among motion descriptions within particular frames of reference. This can be done, of course, but again, there is a categorical difference. The rule of correspondence is not itself a motion and the set of corresponding motions is neither a motion nor in motion. (Note the resemblance here to "reality is not a set of objects, processes, events, and states of affairs.")

From this viewpoint, the requirement of observer agreement as it has evolved to its present place in experimentation may be compared to the universal ether whose primary function was to provide the frame of reference for absolute motion. In each case we have a procedural principle based on the assumption that the nature of a phenomenon can be given by a simple description within a show and tell paradigm ("See the cat on the mat," "See motion X," "See behavior X") and that if it is an objective description there can be only one of it. And, in a historical perspective, we may say of each that if it had not been invented it need never have existed. The empirical work reported below, involving verbal behavior and symbolic behavior, employs the more complex notion of what an objective representation of a behavioral phenomenon consists of. Thus, our next task is a systematic conceptual examination of verbal behavior and symbolic behavior as phenomena within the domain of behavior.

6.0 Verbal Behavior

In this section the following topics are discussed:

(a) The problem of verbal behavior being both just behavior but also a very special kind of behavior.

(b) A formulation of verbal behavior

(c) The relation of verbal behavior to behavior

(d) Meaning and significance in verbal behavior

(e) A boundary condition problem for verbal behavior

(f) The relation of behavior and verbal behavior to grammatical theories

(g) The empirical study of verbal behavior

6.1 The Paradox of Verbal Behavior

It is a commonplace that verbal behavior is (a) behavior, no more and no less, but also (b) a very special kind of behavior which is much more unlike, say, running and throwing than those latter are unlike each other. This pair of facts about verbal behavior has provided a dilemma for the psychological investigator of verbal behavior. It is a dilemma which does not appear to have been resolved to date.

On the one hand, associative accounts, whether of the mediated S-R or operant conditioning genre, provide us with programmatic explanations of the occurrences of behaviors which are independently known to be verbal. However, the descriptions under such accounts are generally judged to be inadequate in principle by non-psychologists generally, and particularly so by those who are professionally concerned with the special character of verbal behavior, i.e., logicians, linguists, mathematicians, philosophers, and literary critics. From psychological accounts, they say, one would hardly know the difference between talking and running and throwing. Conversely, however, the special accounts by linguists, philosophers, et al of the special character of language appear to be at a certain remove from the scientific study of language.

One of the elements of the dilemma is that language (and its mathematical part by itself) is a system of some sort, so that in some sense every verbal behavior is connected to every verbal behavior. A further element is that the systems in question (natural language, theories of the syntax of natural language, and certain mathematical and 'mota'-mathematical theories, including the theory of recursive functions) are in principle infinite in both extent and structural complexity. Since no set of performance elements each of which is learned (hence finite) can be infinite either in structural complexity or simple extent, verbal behavior takes on the aspect of impossible behavior.

The traditional practical resolution of the problem of the 'impossibility' of verbal behavior has been accomplished by reference to the distinction between "performance" and "competence". The generative grammar of English (hypothetical, since it appears that no complete grammar of this sort now exists) and the theory of recursive functions represent the competence that is exercised by the English speaker and the mathema-

tician in their English and set theoretical performances.

Implementing the distinction bewteen performance and competence has, in turn, led to a variety of technical problems in giving systematic descriptions of the performances whereby the competence is exercised and acquired. In principle, it has appeared, the task is straightforward, and it is essentially the same as the task of specifying functionally the transformation of one piece of machinery into another. The acquisition process consists of the introduction of a set of logical constraints on a set of ingredient processes or mechanisms. Acquisition is complete when the operation of the ingredient processes or mechanisms under these constraints is just the required operational characteristics of the target machine. Differences in detail will be exhibited, for example depending on whether the constraints are identified by reference to environmental contingencies alone or by reference to environmental contingencies plus (internal) 'structures' or unlocated "probabilities of responding."

In any case, the relation of competence to performance is the relation of pattern to process, of initiation to process, of abstract to concrete. Performance is the stuff upon which the form of competence is impressed, if nothing else gets in the way. Conversely, once the performances which are the expressions of competence are adequately specified in a "performance model", the description of the operation of that machinery in terms of competence is superfluous, if not actively anthropomorphic or 'mentalistic', for it is the performance model which is keyed in to the causal texture of the world, and "competence" is a dispensible concept, behaviorally, though it may still be of some use in ordinary discourse or in providing a "reduction base" in behavior theory for some of the 'softer' social sciences and disciplines. The performance model is given by a process-event description which preserves a causal continuity. Thus, it may be thought of as a computer program which transforms inputs of some sort into outputs of the required sort. Of course, such a performance model requires a ghost outside the machine to make it work.

The behavior of persons, however, is different from the currently programmed behavior of computers. A computer program, for example, can produce a nested syntactic structure of any depth with little more program structure than a repeating loop and an external tally to determine when to stop the nesting. A person, however, loses track and becomes confused anywhere from the first nesting on. It is generally agreed on such evidence as this that a person, even in his purely linguistic performances, is not a piece of machinery which, upon selective inputs of a semantic and motivational sort, correspondingly produces, by a set of linear processes, an appropriate selection from the syntactic structures which are part of the natural language in which he is competent.

Since associative theories provide linear process-event accounts of behavior, whereas generative grammars provide a non-linear, recursive account of verbal behavior, a certain strain has developed between linguists and associative behavior theorists over the issue of whether S-R accounts of behavior are in principle inadequate to give an account of verbal behavior. Perhaps it is unfortunate that grammatical theories have been the central focus of this argument for the fact that we do not now have definitive, adequate grammatical theories leaves any such issue in doubt, since tomorrow's grammatical theory may differ from today's in fundamental respects.

It appears that mathematical theories offer no substantial problems of this sort, and neither are the acquisition problems in this regard confounded with the more general problems of early childhood development. Thus, instead of asking whether adequate process-event accounts can be given of a possibly recursive grammatical competence, it might be more to the point to ask whether an adequate process-event account can be given of the acquisition and exercise of competence in the known, existing theory of recursive functions. In answering this question, we have the help of the mathematicians themselves, and the answer is "No, linear process-event accounts are formalized in the theory of partially recursive functions."

"Performance" and "competence" are descriptive terms in ordinary language. The decision to exploit the contrast between the two as a practical way to avoid the dilemma of verbal behavior as both mere behavior and impossible behavior was perhaps inspired, but it was not sheer invention. It has been accepted as obvious by linguists, psychologists, and associative behavior theorists alike that the proper role of a behavior theory vis a vis language is to delineate the performance mechanisms whereby linguistic competence is acquired, exercised, or actualized.

It is this assumption which we are in a position to reject in favor of something very close to the converse, i.e., that the primary function of a theory of linguistic competence is to provide a performance model for that part of behavior theory which deals with verbal behavior. This relationship is made visible by the formulation of behavior as IA process. The latter, as we have seen, has a logical structure which is simply recursive, just as are the familiar formation rules of a logical calculus or a grammar, whereas a linear process such as is represented by a computer program or any cause-effect series can at most be partially recursive. The difficulty of process-event theories with respect to verbal behavior may be seen as simply a limited version of the difficulty of process-event theories with respect to behavior generally. If all behavior lies outside the conceptual scope of type X theories, so will verbal behavior. In this light, we may

proceed directly to an examination of verbal behavior.

6.2 Verbal Behavior

Recalling Morris' classic division of the study of language into three parts, i.e., syntactics, semantics, and pragmatics, it is clear that a systematic formulation of verbal behavior will fall under the heading of "pragmatic", as contrasted with "syntactic" or "semantic". Thus, for behavior theory, the paradigm phenomenon of verbal behavior, V, has, per se, nothing to do with syntactics or semantics, or theories of either kind, but rather, is found in the case where a person, H, says "c". How is such a phenomenon to be represented systematically?

(5) $V = < C,L,B >$

The conceptual unit for representing verbal behavior, V, comprises three elements. Formula (5) is itself schematic, as the explanation of these three elements will show; for our purposes, however, the notational simplification is advantageous.

(a) The first element represents a conceptual distinction, C vs C'. Any concept, C, is defined only within a system of concepts which determines its correlative alternatives. For example, if C is the concept, North, there are the other compass directions; if C is the concept, Red, there are the other colors; if C is the concept of distinguishing between A and A', there are other distinctions. Thus, for our purposes, C' is a surrogate (a) for each of the correlatives of C which stand in contrast to C and (b) for all of them collectively. It is because C represents a selection from a range of conceptual alternatives that verbal behavior is informative in a way in which running and throwing as such are not. We will elaborate this notion in the section on meaning. In the following presentation, "uses the concept of C' will be used interchangeably with " uses the distinction of C vs C'."

(b) The second element represents a locutionary distinction, with the locution L standing in one-to-one relation with C and a set of locutions, L', standing in one to one relation with the alternatives to C. (The nature of the one-to-one relationship is shown below to be compatible with the facts of synonymy and homonymy.)

(c) The third element represents two sets of behaviors, B_C and $B_{C'}$, characterized as follows.

(1) Any member of B_c will qualify as treating something as a case of c. The something in question may be an object, process, or event, but ultimately, as indicated previously, the something in question will be a state of affairs, and reference to objects, processes, or events will be a way of distinguishing that state of affairs from other states of affairs.

(2) Any member of $B_{c'}$ will qualify as treating something as a case of C', where the distinction between c and c' is obtained analogously to C and C'.

(3) In many cases, there will be no practical distinction between C and some c or between C' and some c' (see the "degenerate case" mentioned below). To anticipate a little, it should be recalled in this connection that any IA will qualify as treating something as a case of k, where K is the value of the parameter K for that IA. In the present case there is a conceptual connection carried by the notational correspondence of C with c and C' with c'. C will provide a partial specification of c and C' will provide a partial specification of c', where c = K for the IA in question.

Returning to formula (5), we note that the distinction between B_c and $B_{c'}$ is itself a conceptual distinction, and so also is the distinction between the locutions L and L'. Thus, both L and B are instances of C in V. This feature of V is similar to mathematical induction. That is, beginning with either L or B in formula (5) we generate a new instance by substituting the original instance under C. For example, if we substitute B under C, we generate a new locution, L_B, and a new set of behaviors, B_B. But now, each of the latter represents a new conceptual distinction, and so it may once more be substituted under C, thus generating another locution and set of behaviors. And so on. This feature of verbal behavior, V , is referred to by saying that V is "progressive" in L and B.

If we use subscripts in (5) to indicate initial values of C,L, and B, we may represent the nature of these progressions explicitly.

(5a) $V = \langle C_i, L_i, B_i \rangle$

(6) $V = \langle L_i, L_{i+1}, B_{i+1} \rangle$

(6a) $V = \langle L_{i+1}, L_{i+2}, B_{i+2} \rangle$
etc.

(7) $V = \langle B_i, L_{i+1}, B_{i+1} \rangle$

(7a) $V = \langle B_{i+1}, L_{i+2}, B_{i+2} \rangle$
etc.

The question of a possible progression in C will not be dealt with here. Certain problems associated with the progressive character of B and L are dealt with below.

Returning once more to formula (5), we see that it is recursive in both C and B.

(8) $V = \langle\langle V \rangle, L, B \rangle$

(9) $V = \langle C, L, \langle V \rangle\rangle$

(10) $V = \langle\langle V \rangle, L, \langle V \rangle\rangle$

That is to say, the dinstinction represented as C vs C' may be the distinction between one verbal behavior and another; the concept in question may be the concept of a verbal behavior. This possibility is represented by formula (8). Conversely, a behavior B_c which is a case of treating something as a case of c may itself be verbal behavior other than saying L. For example, B_c might consist of saying "But will it bite?" or "Ok, I'll take a dozen,". This possibility is represented by formula (9). The combination of both C and B being verbal is represented by formula (10). This possibility would be illustrated by saying "nonsense!" or "I don't believe it." It is by virtue of these recursive relationships that all verbal behavior is connected to all verbal behavior and thereby verbal behavior is a certain kind of system. But verbal behavior and its connectedness is only a special case of behavior and its connectedness. The general case is given by formula (2) which represents a case of IA in which something is treated as a case of IA.

6.3 Verbal Behavior and Behavior

The relation between behavior and verbal behavior is indicated by the juxtaposition of formulas (1) and (5).

(1) IA = <I, W, K, KH, P, A, ID>

(5b) V = < C, L, B>

That is, the locution, L, provides a partial specification of the performance parameter of IA. To say that an individual said "checkmate!" or "there's a cat on the mat" is to say something about his performance. Of course, other features of his performance such as the tone of voice, pitch, rhythm, posture, and facial expression are not mentioned. Very often they are not relevant, either, except in the sense that the performance has not gone wrong in any of these ways sufficiently to prevent the accomplishment of saying "Checkmate" or "There's a cat on the mat."

Likewise, the concept to which the locution stands in one to one relation will inevitably provide only a partial specification of the state of affairs concept which comprises the value of K in formula (1). For example, the general circumstances in which the behavior occurs are usually "understood" and do not appear in verbalization, though they do appear in K. When the circumstances of the behavior do appear in verbalization they do so in a limited way through the use of special locutions such as "this", "here", "now", "me", etc.

The juxtaposition of the general formulas for behavior and verbal behavior may serve as a starting point for clarifying the way in which verbal behavior both is merely behavior and is a special kind of behavior. The latter is dealt with in the discussion of meaning, below.

What is illustrated visually here is that to characterize a behavior as "verbal behavior" does not uniquely specify (individuate) any behavior, not even when we specify completely which verbal behavior it was. Either characterization fails to individuate a behavior because it fails to provide information about several of the parameters of behavior and provides only a partial specification of those parameters to which it is relevant. Thus "verbal" in relation to "behavior" is a qualifying adjective rather than a categorical subdivision. That is, it is not the case that behavior is a genus comprising several species, of which verbal behavior is one. Rather, to say of a particular IA process that it is verbal is to say that it has the characteristics represented by formula (5). In this way, verbal behavior is merely behavior.

It follows that to say that a particular behavior is verbal is to give a description which is essentially incomplete rather than merely vague or abstract. (In this sense, "this behavior is verbal" resembles "this behavior is movement.") It follows further that any behavior which qualifies as a particular verbal behavior will also qualify independently under an IA description. Briefly, verbal behavior is a case of

an IA which is accomplished by means of a verbal performance (identified by L in (5)). H says C by uttering "C".

Of course, the adjectival character of "verbal" is sufficient to define a "type X behavior" analogous to the example of "angry behavior" used in the discussion of the ID functions. Accordingly, we may identify verbal traits, styles, abilities, etc.

6.3 Meaning and Significance in Verbal Behavior

"Meaning" does not refer to a peculiar property of locutions which enables speakers to use those locutions to say something. In particular, it is not the peculiar property of having been produced by internal happenings such as 'mediating' responses or neural states of affairs or by external happenings, which we may <u>speak</u> of as "controlling variables". Rather:

(a) A given locution has a meaning if it can be used to say something.

(b) A given locution is used in its meaning (or meaningfully) on a given occasion if on that occasion it has been used to say something.

(c) "C" means C.

(d) As noted above, H says C by uttering "C"; he uses "C" to say C.

These are pragmatic tautologies, along the lines of the referent of 'snow' is snow."

It follows from the difference between (a) and (b) that meaningful locutions can be used in non-meaningful ways. This includes the case of grammatically correct but semantically nonsensical expressions such as "colorless green ideas sleep furiously". It also includes the case of the "infelicitous" performative such as saying "I now pronounce you man and wife" in an inappropriate context, e.g., in the absence of other individuals. Logical paradoxes such as "What I am now saying is false" either fits this case also or, as is more commonly judged, cannot be used to say anything at all, except in the derivative case in which, by virtue of being embedded in a verbal performance which is not infelicitous, the paradoxical locution can, after all, 'be used to say something'. The preceding sentence illustrates such a case.

Of the three conceptual elements of V, only one, the uttering of

the locution L, is normally identified as verbal behavior. Of course, uttering the locution "C" is something that occurs at the time and place of the verbal behavior, V. C, being a concept, does not occur at all, and members of B will occur, if at all, at other times or places. As determined process-event theorists, we will naturally want to ask, why are C and B involved at all.

In general, the answer is that verbal behavior is a logical aspect of the domain of behavior, not a name for an acoustic production or physiological production, and so there is no reason why C and B should not be involved. More positively, we may say that without C, the locution L would have no meaning and uttering it would be merely vocal behavior, not verbal behavior. Without B the locution L would lack significance.

Saying "C" is a special case of B_C, since it is a case of treating something as a case of c. However, if saying "C" were merely a way of accomplishing a particular IA (so that V = C, L), verbal behavior would not have the special significance that it does have and that distinguishes it from, say, running and throwing. Saying "C" is the "degenerate case" of B_C in that if it were the only case of B_C the category of B_C would be dispensible. Let us examine this further.

The relation of C to L (or saying "C") and B (or B_C) follows a familiar methodological paradigm. It resembles, for example, the definition of a cardinal number, e.g., "five", as the class of all classes having the same cardinal number as an explicitly identified class which by definition has that cardinality. Likewise, it resembles the definition of a length of one meter as the length of anything having the same length as the length of an explicitly identified object which by definition has that length. Since concepts do not appear in nature except as they differentiate values of the K parameter of IA processes, we may say, in a similar vein, that the concept of C is the class of all behaviors (B_C) having in their K values the same concept as an explicitly identified behavior (saying "C") which by definition has that concept in its K value. A behavior has C in its K value when the distinction C vs C' is part of the distinction SA vs SA', where SA is that K value and SA' is any other possible value of K.

The utility of the methodological device of the introduction of standard units is hardly open to question. It appears to be the only solution available in the fundamental cases of elaborating primitive or"undefined"terms for descriptive use and it is the correlative of the parametric analysis of a domain of discourse. The parametric formulation is a way of representing how an individual case of one sort (identified by the domain of discourse) may be the same as or different from others of its kind. The major alternative is the so-called "real" definition and its variant, the "operational definition". The 'real'

definition, far from being a real definition is merely a paraphrase in another idiom, usually of a supposedly more ontologically secure sort. Thus, we shall not have occasion to ask the infelicitous "What is meaning?", but we shall be able to ask "Which meaning does this one have."

This analysis will be fairly directly reflected in the empirical approaches, presented later, which provide a factor analytic representation of ways in which various locutions may be similar or different in meaning. Given this form of representation of similarities and differences in meaning, we do not have to suppose that these differences and similarities come about because there are mediating responses in peoples' bodies that work exactly the same way and produce these similarities and differences. To do that is to move from a merely anthropomorphic to an actively homuncular approach.

The sense in which saying "C" is the degenerate case of B_C may be clarified by the "calibration" concept and examples. Where saying "C" is the only case of B_C, it is as though the definition of the standard meter was the only reference we ever made to length. In that case we would be dealing with a definition which never thereafter entered discourse and so did not function effectively even as a definition. And, for example, there would be no distinction to be drawn between treating something as a case of C and treating something as a case of C' (hence the category of B in V would be superfluous).

The conclusion that verbal behavior is not merely a subclass of behavior, but also stands in a one to one relation to behavior was reached informally and perhaps suprisingly in our preliminary survey. Formula (7) exhibits this result directly and in a systematic way.

$$(7) \quad V = \langle B_i, L_{i+1}, B_{i+1} \rangle$$

It should not at this point be surprising. If verbal behavior has the unique function of identifying concepts, the unique identification of behavioral concepts will be merely a special case. In virtue of this, since the recursiveness of IA guarantees that the domain of behavior is a complex system, it is indeed the case that verbal behavior, and specifically, meaningful verbal behavior, is "intricately and inextricably a part of the system of behavior."

The one-to-one relation between locutions and concepts will give the appearance of being incompatible with the known facts of synonymy and homonymy primarily if the present formulation is thought of as a description of verbal behavior rather than as a paradigm case presentation of the concept. Given the development, above, of using the locution "C" as the conventionally definitive way of making the dis-

tinction of C vs C', we may derive the possibility of there being other forms of behavior, including verbal behavior, which serves as well. The condition for this is that there be a convention which makes them equivalent to "C" in that respect. The nature of this convention is not at all mysterious. It is simply the existence of other behaviors, per formula (6) in which "C" and its equivalents are treated as e-quivalent. To say that "C" and other locutions are equivalent is a possibility given by formula (10). The behaviors in question are "conventional" because they appear as differentiated segments of social practices. They are the done thing. More generally, since it is the function of L_{i+1} in formula (7) to distinguish B form other behaviors, it is not a problem to represent partial identities between behaviors in the same general way.

The question of homonymy is the question of whether the concept identified by one use of a given locution, "C", is the same concept as that identified by another use of "the same" locution. If it is not, then in formula (5) the set of behaviors, B_C, which consist of treating something as a case of C will be divisible into two sets, B_Q and B_R, such that though "Q" is equivalent to "C" and "R" is equivalent to "C", "Q" is not equivalent to "R". Uses of "C" which are equivalent to different uses are not equivalent to each other.

Finally, the one-to-one relation of L to C in (5) is not restricted to verbal behavior in which the IA in question is a case of referring to or designating or describing a state of affairs. On the contrary, the basic case is none of these semantic relationships, but rather, the pragmatic case of treating something as a state of affairs which calls for IA as contrasted with IA'. The behavior in this case will not, in general, be verbal behavior, but as a special case it may. If it is verbal behavior it may be behavior of referring, describing, or designating, but in general, it will be other verbal behavior such as asking, supposing, ordering, exclaiming, pleading, announcing, etc. "Checkmate" is a paradigm case of verbal behavior which identifies a state of affairs without referring to that state of affairs. So is "please pass the salt".

6.5 Progression as a Boundary Condition Problem

It was noted above that beginning with a given substitution instance of either L or B in formula (5) we generate new instances of both by substituting either original instance under C, and this feature was designated as a "progression" in L and B. This provides an apparent difficulty, since it appears to require that an unlimited number of behaviors be available if any behaviors are to be available in acting under the formula. In this way, verbal behavior once more threatens to

turn into impossible behavior. The difficulty is headed off by a trio of boundary conditions.

6.5.1 The "Division of Labor"

The first condition, which is not by itself decisive, is that formula (7) does not imply that B_i and B_{i+1} are accomplished by the same individual or even that they are in the behavior repertoire of the same individual. All that is required is that both behaviors be within the domain of behavior. In this way, for example, paradigmatic H-objects can describe the behavior of infants and other organisms meaningfully as IA processes. Thus, there is no paradox stemming from the fact that non-verbal individuals are correctly said to behave intentionally even though IA processes stand in one-to-one relation with descriptions. That such non-verbal individuals behave intentionally is, however, a fact for us, not for them, since they are our descriptions, not theirs, and so it is our behavior in which those SA conceptualizations have a place, not theirs.

6.5.2 Verbal Behavior as the Degenerate Case of B

The second boundary condition is that there need be no deficit in B_{i+1} behaviors available if we do not demand that B_{i+1}, be anything different from L_{i+1} in (7). It was noted earlier that calling a situation a case of C is a way of treating it as a case of C. In the more general form, treating a situation (state of affairs) as one which calls for the behavior of saying "C" is a way of treating that situation as a case of c. As is well known, an indefinitely large repertoire of distinct verbal performances is available to the speaker of a natural language.

At this point, however, there may be some question as to what it comes to say that a given behavior, B_{i+1} or L_{i+1}, is "available". The contrast between an individual's finite learning history and indefinitely large number of distinguishable verbal behaviors in his repertoire is one of the puzzling features of verbal behavior. The short answer here is that formulas (1) and (5b) are an adequate representation of the phenomenon and that there is no problem of the sort suggested here because there is nothing in the system of behavior, as formulated above, which implies or even suggests that every performance which is a manifestation of acquired competence was acquired separately or that each such performance stands in one-to-one relation with a distinct competence which was acquired separately.

It may be helpful, however, to examine directly the operation of some conceptual systems having a calculational nature. Such a system is one in which a finite set of initial elements and a finite set of operations "generates" an endless set of products which have the general characteristics of elements as contrasted with operations, even though they need not be of the same type as the initial elements. Generative grammars, arithmetic, algebra, set theory, physical theories, and many games such as chess and tennis are of this sort. It has been noted that all calculational systems have to be used by a person. In particular, each operation in the calculus corresponds to a unit of behavior (IA) on the part of an actual user and a kind of behavior on the part of a hypothetical or potential user. This aspect is relatively explicit when the operations are spoken of as rules (of procedure, of inference, etc.) for it is clearly a type H object who must (because he has the requisite ability) be the one to follow or apply the rules. (Our current computing systems might be described by a type H object as following the rules, e.g., of arithmetic, but they could equally well be described as usually producing the same results without following those rules as a type H object would produce by following the rules. With linear process mechanisms there is no difference.)

Adding, multiplying, subtracting, and dividing are arithmetic operations simply. However, addition is always of one number to another number, and with a resultant sum. Thus, a person who has the ability to add is one who may be expected to succeed in the use of the formula a + b = c. Adding 1 to 3 and getting 4, multiplying 3 by 5 and getting 15, and dividing 3 by 3 and getting 1 are cases of an arithmetic operation performed on the number 3. They are (arithmetic) ways of treating something as the number 3. (If numbers are refused the status of "somethings" because they are too 'abstract', we may go to the more general formula and say that they are ways of treating one's circumstances as a state of affairs which calls for operating with the number 3.)

We may note that, unlike the case of tennis, with arithmetic operations there are no (behavioral) performance standards for doing it correctly. There is no movement, no posture, no internal or external vocalization sequence which, if only it is properly done, will have the correct answer as its (even practically) automatic outome. The standard here is an achievement standard. It is producing the right answer which has the consequence that the operation was performed correctly, not vice versa. (Of course a single success in producing the right answer is no guarantee of the corresponding ability.)

How is the infinity of the system compatible with the finitude of human capabilities for learning and performance? The system is infinite

because it contains an infinite number of elements because elements are generated by operations which are repeatable without limit. Because elements are infinite in number, element-operation-element units (treating something as a case of C) are also infinite in the sense of not having a numerical limit. The ability of the competent user of the language could be called infinite only in the sense that there is an unlimited number of behavioral results each of which (but not all of which) he could be expected to try to achieve and succeed in achieving if the situation called for it. However, it would be less misleading to say that his ability is neither finite nor infinite, though it is limited. To say that he has the ability to do arithmetic is to identify a range of achievements, not the number of them, which fall within the limits of his behavior potential.

Thus, we return to the original conclusion, namely that the verbal repertoire of a speaker of a natural language will produce as many cases of L and B as required, since L will do duty for B as the limiting case and an unlimited number of cases of L are provided by the linguistic system. And even though we are not dealing here with the difference between verbal and non-verbal individuals, a division of labor is possible here also, so that what one individual is capable of doing as a case of L_n or B_n, only another individual is capable of identifying as an instance of L_{n+1}.

6.5.3 Deliberate Action as a Boundary Condition

In the discussion of the relation of verbal behavior to behavior it was noted that the concept to which the locution in (5b) stands in a one-to-one relation provides only a partial specification of the state of affairs concept which comprises the value of K in formula (1). Deliberate action, presented above, is the general form of B_{i+1}, namely an IA in which something is treated as a case of IA (formula (2)). Let B_{i+1} be a case of treating a state of affairs as one which calls for behavior B_i. In this case, one of the instances of B_{i+1} is B_i itself. That is, one of the major ways of treating a situation as calling for B_i is simply to do B_i. In this case, in spite of the progressive character of ^{V} in B, no new behavior, B_{i+1} as distinct from B_i is generated.

In general, then, neither the infinity of common formal systems nor the progressive character of verbal behavior nor the recursive character of IA processes is incompatible with the notion that all of these are brought together in an organization of a finite set of social practices carried out by a limited number of individuals, each one limited in his abilities in those ways with which we are familiar.

Ways of treating something as a case of C are simply ways of participating in social practices which hinge on the distinction between C and C'.

6.6 Behavior, Verbal Behavior, and Grammatical Theory

An English-speaker has the ability to speak English and a Swahili-speaker has the ability to speak Swahili. Since the question of what it is to speak English or Swahili, etc. is a scholarly discipline in its own right and since theories on this subject have recently been of particular interest to psycholinguists and learning theorists it will be of some interest to develop some of the relationships implicit in the statement that an English speaker has the ability (considered as an ID function) to speak English.

6.6.1 The Formulations of Behavior and Generative Grammars are Parallel

The task of a generative grammar of English is to delimit intelligibly what qualifies as an instance of English. (For "English", read "language X"). A generative grammar of English is a set of elements and operations for generating all and only English sentences. This is accomplished by a procedure which may be characterized as "instantiation". (Only in the most detailed portions of the grammar is there any ambiguity about the equivalence of "A may be rewritten as B" and "B is an instance of A". The latter form facilitates comparison). Paralleling the earlier formulation of the domain of behavior, we may describe a generative grammar of English as an articulation of the concept of "English sentence".

These rules have the general form of R1.

R1. $A = F_i\ (B_j)$ $\quad I = 1,k;\ \ J = 1,r$

A more restricted form is R2.

R2. $A = B_n \quad n = 1,m$

A still more restricted form is R3.

R3. $A = B_1.B_2.B_3\ \ldots.B_n$

Here, R1 merely specifies one of several functions of one of

several elements. In R2 the function is identity, and A simply is one of those elements. In R3, A is a particular element, which may be a compound (as is the case with R1 and R2). The sequence from R3 to R1 is a sequence of increasing representational power, hence increasingly fine-grained delineation. This is the order of top-to-bottom development of currently standard efforts at a generative grammar of English.

The initial articulation of S(Sentence) has the form of R3: "S may be rewritten as NP + VP." It may be read as "Every sentence is a case of a noun phrase followed by a verb phrase." The immediate further developments have the form of R2. For example, every case of a noun phrase is either a solitary noun or a noun preceded by an article, or . . . .Finally, the most detailed developments are likely to have the form of R1, where the elements B_i are the products of earlier development and the functions are such as deletion, addition, substitution, and permutation of the order of the elements. Eventually, the substitutions have English words as their instances and so, if we can distinguish one word from another, the grammar serves to identify which sequences of English words are English sentences.

Note that this general direction of development could be continued "downward" indefinitely in principle, with only practical limitations and, of course, uncertain success. That is, one could continue to specify which sets of sounds or acoustic patterns were cases of which words, which cases of physiological sequences were cases of producing particular sounds or acoustic patterns, which biochemical processes were which physiological sequences, etc. In this sequence, to be sure, there does not appear to be any gap which behavior theory might aspire to fill.

In the case of behavior, we have a similar logical structure compressed into formula (1) representing the concept of behavior (IA). Every instance of behavior is a case of I, W, K, KH, P, and A. Thus, we begin with the R3 form, as above. We continue with the R2 form, since I is instantiated by either John Jones, or Mary Smith or ...; and every case of W is either a case of wanting X or desiring Y or being anxious to avoid Z or being determined to get Q, or . . . And so on for each parameter of IA. Finally, every behavior is some ID function of the behaviors simply defined by the first six parameters, so that we end with the R1 form. Moreover, in both cases the R1 form is called into play in dealing with what may be broadly characterized as part-whole relationships in historical sequences (a life history; the production of a sentence).

One notable difference between S and IA is that the latter shows a much tighter set of internal constraints. Any case of NP can be

combined with any case of VP and the result is still S. In contrast, very few combinations of instances of W, K, KH, P, and A will be cases of IA. "The colorless green idea woke up feeling blue" is an instance of S, but the combination of wanting fame, knowing that Peking is the capital of China, knowing how to ride a bicycle, sucking one's thumb, and causing an explosion do not constitute a case of IA. The strong constraints reflect the fact that a case of IA is highly patterned, and this in turn reflects the derivation of IA as an element in the patterns of social practices. No doubt this difference between S and IA is relevant to the fact that it is fairly natural to think of composing sentences in terms of their elements whereas the most commonplace cases of IA are performed spontaneously and described globally (e.g. "telephone a friend" etc.).

Parallels, of course, can be overdone, and one might ask of any parallel, "Well, what of it?" The parallels are perhaps most important in setting the stage for an examination of continuities. We noted above that in pursuing the course of instantiation to more detailed and "concrete" levels, there seemed to be no place for behavior theory to make a contribution. The nearest thing to such a contribution was the level of physiological mechanisms, and, indeed, the emphasis of both grammarians and psycholinguists and S-R theorists generally is in an overtly or thinly-concealed physiological account of behavior and verbal behavior. In the present formulation; there is a clear continuity between S and IA, but it is obtained by developing the instantiation procedure upward from S.

6.6.2 The Formulation of S is Formally Embedded in that of IA

When a given IA is a case of a person doing something by uttering sentence s, specifying that it was that action is to specify, among other things, that he knew how to say something by engaging in a performance which is correctly described as "uttering S". If "S_1" is a grammatical description of s, then we could also say that the person had succeeded in uttering S_1 and that saying something by uttering S_1 was something that he had accomplished.

There would be an important difference in that achievement depending on whether it was a relatively isolated case or whether it was exemplary of his general level of success with S. To describe his achievement as the expression of a particular ability and to identify that ability by reference to the grammatical theory of S would be to provide the information that the second of these two alternatives was the case.

Thus, although formula (5b) directly represents a locution L (in the present context, this would be S_1) as a substitution under P, the logical structure of IA leads to three new substitutions. (a) Since KH codifies the fact of a learning history of which P is the expression, any substitution under P will necessarily be included also in the conceptual content of a description of the value of KH. (b) Since the completed execution of the performance, P is one of the states of affairs brought about by the performance, any substitution under P will generate a corresponding substitution under A. (c) Since any substitution under A is subject to redescription at a higher level of generality, it is also subject to an ability description which subsumes it.

Since the primary importance of verbal behavior lies in its systematic character and since, as we have seen, this depends on behavior potential, hence ability as contrasted with particular performances, the primary formal continuity between behavior as IA and language as S lies in the use of S as an ability function which gives one of the important possible values of the ID parameter of IA. In this respect, the theory of S is indeed a theory of competence. Since a description of this sort has the form of formula (7), it carries with it the possibility of the "division of labor" discussed above. Consequently the speaker need not be a grammarian and need know nothing of the theory of S in order for it to be the case that he has the ability to speak in accordance with the principles of S.

The possibility of still further substitutions may be derived. (d) Since the paradigm case of IA is the case where the content of W is identical with part of the content of A, and since S_1 can be part of the content of A, S_1 can be the content of W, or part of it. (e) Since the entire content of W is part of the content of K, S_1 can also be part of the content of K. For these substitutions, in contrast to the preceding ones, the person would have to know the theory of S in terms of which "uttered s" was redescribed as "uttered S_1." The substitutions under P and A do not require this.

The case with respect to KH is subject to some confusion which may be attributed to the fact that the two competence concepts, the IA concept of KH and the ID concept of Ability, are seldom distinguished. Starting with the observation that H has said something by saying "s" we have a performance and an achievement established. We may then make use of the SA transition rules to go from the performance of uttering "s" to the historically prior states of affairs which constitute the learning experience(s) which make the uttering of s in these circumstances an expression of competence. We may also redescribe "s" as "S_1" and assimilate the performance of "uttering S_1" to the ability to operate with the theory of S. From <u>this</u> performance, we may also

make use of transition rules to historically prior states of affairs which constitute the acquisition of that ability. The use of the transition rules, however, only provides descriptive formulas, not descriptions. We may speak of a hypothetical learning history which accounts for the ability to use S, and this will be a reconstruction of "the behavior that Jack observed", with Jack now being the grammarian. It is quite possible, however, that we shall not, unless we invent decision rules which 'permit' us to, be able to identify that history with any observable history. (This is not to say that it would then be completely idle to talk about that hypothetical history.) In contrast, we can specify, at least in a gross way, identifiable conditions under which the ability to say things in English (s, not S) will or will not be acquired or facilitated.

A conservative formulation here appears to be that the English speaker, considered as the general case, knows how (and learned how) to engage in intentional actions which are accomplished by saying something, and consequently has the ability to use S to the extent that using S is the same as using s. Since the theory of S is being constantly readjusted so as to achieve this correspondence, and can be changed if English changes, it will not be surprising if a substantial degree of correspondence is accomplished.

There are reasons for adopting a conservative position here. We have already seen, in the resolution of the "progression problem" in verbal behavior, that engaging in behavior and treating that behavior as being of a certain sort are such distinct phenomena that they need not involve the same individuals. We noted there that the fact of the behavior being of the kind described is a part of the behavior of the observer, not of the behavior observed. This reflects the contrast between ability and know how as behavioral concepts, with the latter representing a before the fact resource and the former representing an after the fact reconstruction. In part, therefore, it also reflects the problem of the "psychological reality" of the concepts of S.

However a resolution of the problem of the psychological reality of the concepts of S will not resolve the pre facto-post facto problem. Formula (2) and the concept of deliberate action represent the possibility of the actor and observer being the same individual. If it is a grammatical description of his verbal behavior that is in question in this case (under formula (10)), then indeed we may expect that grammatical concepts will have "psychological reality" for him. It is still possible, and not even unlikely for a large number of speakers, that he will use the grammatical concepts (or moral, esthetic, arithmetic, and other concepts) in the way that the observer does, i.e., in a critical, after the fact fashion, and that his mastery of these concepts does not enter appreciably into the production of his verbal behaviors. Very often, we learn how to do something before

we learn in any articulated way what it is we are doing. And, for example, children learn to say things by speaking in English, but they also learn to parse English sentences -- later. This is supposed to do something for their ability to speak English.

Of course, there are other possibilities. We have seen earlier that formula (5) generates both uniqueness as the basic case (the "standard meter" or "calibration" notion) and non-uniqueness as a derivative case of the role of verbal behavior in identifying concepts. Using that brief analysis as a model, we may think of an adequate grammar as a way of identifying uniquely a way of saying something. What verbal behavior is to behavior, we might say, grammatical theory is to the performative aspect (the locution) of verbal behavior. The accomplishment may be extended to the identification (a) of which different ways of saying something are ways of saying the same thing, and (b) of which ways of saying something are ways of saying one or another of two different things (the analogue of synonym and homonymy). Presenting a grammatical theory is thus an elaborate case of formula (10), i.e., a verbal way of treating something as verbal behavior.

As we now ask in what way a grammatical theory (or portions of it) could, if known to the speaker, play a part in his behavior other than (a) direct production and (b) post facto recognition, we do find intermediate possibilities.

For example, a speaker might have recourse to the grammar of S if he wanted to take precautions against his verbal performances going wrong. This possibility is grounded in formula (3) as well as formula (6). The notion of defeasibility, mentioned earlier in connection with individual difference descriptions and negotiations thereof is a special case of the more general notion that all of a person's behavior, and not merely his descriptions of others, are subject to criticism and demands for justification. Although criticism and demands for justification must, in the nature of the case, be derivative and exceptional rather than basic and commonplace, an individual will exercise more or less care to be prepared to deal with such demands. Putting one's verbal behavior into canonical form ('correct' grammar) is a way of taking precautions against that verbal performance failing to accomplish the desired end of saying what the person has to say. In a face to face interaction, where the common context and what it calls for in the way of behavior is frequently clearcut, the called-for IA can almost always be accomplished by means of an elliptical or otherwise grammatically degraded verbal performance or a nonverbal performance or some combination ("Why?", shaking one's head, grimacing, or pointing one's finger; "Go!", pointing or jerking one's head; "Mmm," nodding in an understanding way). In this case missteps and misunderstanding are ordinarily quickly recognized and negotiated and verbal behavior is, on the whole,

grammatically atrocious. In contrast, written verbal behavior, where these alternatives are not present, is where we find grammatical rectitude at its maximum.

Of course, taking precautions must be a derivative form and not the paradigm case of behavior, since there must be something to take precautions in regard to, and that will be a straight exercise of competence, as noted in the earlier discussion of ID negotiations. Just as it would be impossible to take it that X is the case only by virtue of having in fact ruled out every logical possibility of going wrong in acting on X, it would be equally impossible to accomplish anything successfully by seeing to it that the performance did not go wrong in any of the logically possible ways in which it could go wrong.

Thus, a simplified schema for representing the operation of grammatical knowledge as precaution would be as follows.

(a) The person learns to try to participate in existing social practices by engaging in the IA processes which the situation calls for. Initially, this is possible because he is (merely) able to do so, and other, more competent individuals provide the circumstances which permit him to succeed.

(b) He learns (or partly learns) not to do it wrong when he tries.

(c) He learns (or partly learns) to participate in existing social practices of taking precautions against his propensities for doing it wrong. For this, he must have the concept of what it is to do it right.

(d) He learns, or partly learns (as part of (c)), what states of affairs call for what precautions.

(e) He learns, or partly learns, not to do it wrong when he is trying to take precautions.

The theory of S would be straightforwardly part of the story of the production of an individual's verbal behavior only if he saw a situation as calling for behavior directly conceived in grammatical terms in regard to part of its execution and achievement. This possibility is represented by formulas (3) and (4).

The several possibilities of different ways in which the grammatical theory of S may be related to behavior will be matched by corresponding possibilities in regard to a semantic theory of S or any combination of the two.

Clearly, individual differences are to be expected among persons in regard to their characteristic emphases (traits, attitudes, interests, styles) and level of mastery (ability) and execution (value, status, state) of these various possibilities. Moreover, we may expect the person to operate differently in this respect at different times and that his differential status in these regards reflects the cumulative history of differential behaviors in the past.

There is little in the gross facts of behavior and verbal behavior to suggest that simple empirical regularities will be found or that if found they would contribute substantially to our understanding of verbal behavior. Likewise, any psycholinguistic account which is merely designed to exhibit in a parsimonious way a covert process whereby grammatical mistakes are avoided and thereby grammatically correct verbalization occurs will be correspondingly suspect. We might term such an account a theory of competence in taking grammatical precautions. That would leave us still with the task of accounting for the behavior which does occur, for it would amount to saying that this behavior went right, grammatically speaking, because it didn't go wrong in any of the theoretically possible ways that it could, grammatically, have gone wrong. This would be the case whether the covert process was characterized in the terminology of overt behavior ("editing", "composition", etc.) or in the idiom of computer programming (e.g., "Do" loops with test and exit). At the same time the notion of "taking precautions", which it would not be entirely whimsical to describe as part of the "Deep structure" of behavior, may help to make clear why such formulations make the sense that they do.

If verbal behavior is intentional action having certain performance characteristics, the grammatical theory of S is a theory which specifies performance characteristics of IA which would qualify as paradigmatic verbal performances. The top-to-bottom development from S to phonetic pattern is a way of specifying those performances in greater and greater detail. In this respect, the theory of S is a limited theory of performance (limited in scope to verbal performances) relative to the IA system. No doubt this reading of it is a post facto, third person reconstruction, under formula (7), of the grammarians' behaviors, for they have not intended such a use. However, as we have seen, the concept of S has many possible logical roles in the IA system.

6.7 Syntactics, Semantics, and Pragmatics Revisited

At this point we have surveyed the field of verbal behavior, covering pragmatic, semantic, and syntactic aspects. In the classic

tripartite division, syntactics was concerned with the relation of signs to signs, semantics with the relation of signs to referents, and pragmatics with the relations among users, signs, and referents. In pursuing the latter, without going into technical details of either of the former, we have found a significant network of relationships which are economically codified in formulas (1) through (10). Some of the major relationships are recapitulated as follows.

(a) Formal recursive systems such as grammatical, semantic, and mathematical systems are embedded in the recursive IA system of behavior and derive their formal properties therefrom.

(b) Behavior is an IA process and verbal behavior is a type of IA process.

(c) Behavior requires the use of concepts (the K parameter) and verbal behavior has the behavioral function of uniquely identifying concepts.

(d) By virtue of its concept-identifying function, verbal behavior "has meaning" in a way that other behaviors do not. The concept identified by a given locution is its "meaning".

(e) The concept-identifying function of verbal behavior is the basis of semantic theories. Where the concept in question is one of the SA concepts as contrasted with others, we speak of "referents" as contrasted with "meaning". The concept-identifying function of verbal behavior spans both the "theory of meaning" and "theory of reference" without overlooking the distinctions on which they are based.

(f) The pragmatic analysis of meaning as concept identification goes beyond the scope of traditional semantic theories in that it encompasses all meaningful discourse, not merely that small part consisting of statements. In this way the differential emphases of formal semantic theories and the "philosophy of ordinary language" are brought together.

(g) Just as verbal behavior has the function of uniquely identifying concepts, grammatical theory has the function of uniquely identifying verbal behaviors through the systematic representation of paradigm cases. Such a codification may serve a variety of roles in the IA system. In particular, it is not restricted to being either a "theory of competence" or a "theory of performance".

6.8 The Empirical Study of Verbal Behavior

The primary importance of verbal behavior lies in its concept-identifying (distinction-making) function. In turn, this is important because of the indispensible function of concepts in distinguishing among behaviors, not merely in the describing but in the doing. The general significance of verbal behavior as a topic of psychological study is given by formula (5). Subject to his personal limitations and motivations, whatever an individual, H, is prepared to say that something is is what he is prepared to treat that something as being. To learn something about the former is to learn something about the latter.

To learn something about what H is prepared to treat something as being is to be in a better position to say what behavior he engages in and possibly also to predict his behavior also. The former is primary in that if we do not have the resources for describing behavior adequately, to speak of predicting it or studying it empirically must appear as bravado, disingenuousness, blind faith, or worse.

Similar considerations hold for the second individual, P, who learns what H is prepared to say. For P to learn that kind of fact about H is for P to be prepared to describe H in a certain way, say"h", and that is for P to be prepared to treat H as being that way. Which is to say that if there were no alternative behaviors involving H open to P, the choice among which depended on whether P was prepared to describe H as "h" or otherwise, there would be no point in his having learned what H was prepared to say.

Of course, this is the paradigm case formulation. The role of P could be filled by separate individuals, P_a and P_p, one of whom, P_p, discovered what H was prepared to say and the other of whom, P_a, was prepared to treat H as being of that kind. In this case, we might want to say that P_a was prepared to describe P_p in a certain way (i.e., what he said about H) and act accordingly. Or, again, P might be engaging in Case 3 symbolic behavior (see next section) with H as a symbolic object, so that the issue for P would be how to treat some other individuals, H_o, on the basis of what H was prepared to say. This would be the case, for example, if the psychological investigator, P, was interested in what an experimental subject, H, was prepared to say only because P was interested in a population of individuals, H_o, of which he took H to be 'representative'. In the case where P takes himself to be included in H_o, a type X investigator will be prepared to accuse P of believing H instead of examining his 'verbal report', and for many, such an accusation will be nonnegotiable.

7.0 Symbolic Behavior

"Symbolic behavior" like "higher mental processes", "thinking", and "problem-solving", is a nominal characterization of an area of investigation. In general, any behavior which is described as a response to anything not then and there present may be described as "symbolic behavior". Thus, the term would cover such diverse phenomena as a rat running an alternation problem, a chimpanzee showing a reinforcement effect under token reward, a housewife crying out "But you forgot the onions!", a clinic patient reporting a dream of climbing a mountian, and a psychological investigator studying the physiological mechanisms underlying symbolic behavior. To be sure, any of the nominal descriptions mentioned above could be applied to each of these examples also.

In this section we shall examine three separate cases of symbolic behavior in an effort to do justice to the variety of the phenomenon. As we shall see, there is, nevertheless, a unitary conceptual formulation.

7.1 Case I. Human Behavior as Essentially Symbolic

There is relatively general agreement, at least among non-psychologists, that in some important sense, at least paradigmatically, all human behavior is symbolic. Classically, this fact was expressed by reference to "mind" or "soul". More recently, e.g., by Cassirer (1953), and by Langer (1964), symbolic behavior ("symbolic transformation") has been related in an essential way to language, consciousness, and self-awareness. What distinguishes human behavior from other, merely natural phenomena, say these authors, is its symbolic character.

Arguments of such wide scope and uncertain foundation are likely to be uncongenial, if not actively distressing, to data-oriented investigators. At present, however, we are in a favorable position to give an objective account of this notion of symbolism as part of human nature. Representation of the "universal" case of symbolic behavior is automatically given by the IA system, for in this sense, the IA process is symbolic behavior.

It has been argued elsewhere (Ossorio, 1967) that the concept of behavior as IA is the concept of mind. In an earlier paper (Ossorio and Davis, 1968) it was shown that intentional action provides a non-paradoxical account of self-awareness, self-concept and its relation to behavior, the problem of the knower and the known (the "transcendental ego" and the "empirical ego") and of the self as agent and subject.

For our present purposes, it will be sufficient to indicate how the problem raised by Cassirer and Langer is dealt with.

One way of exhibiting the mystery of symbolic behavior is to ask, "How can the movements which constitute human behavior have the significance that they do when other movements in nature do not?" Or conversely, "Other movements in nature occur in the presence of particular circumstances, whereas human behavior necessitates the transformation of circumstances into a meaningful situation." The answer is given in three parts.

(a) As indicated earlier, movements do not constitute behavior, so there is no such question as the first of the above to be asked or answered.

(b) The relevant contrast is between the performance parameter of the IA and the IA itself. How can the performance have the significance that it does? Its significance is that it is the performance of that IA. It has the significance that it does because it is the way that that IA is accomplished.

(c) The IA in question, as are IA generally, is a case of H treating something as a case of Q, not something that happens whenever Q or merely in the presence of Q. Here Q identifies the state of affairs concept which is the value of K in that IA. Since states of affairs include relationships among objects, processes, and events which may be found at different times and different places, and since states of affairs do not occur, and since the IA use of a state of affairs description is not the application of that description to anything, IA processes could not be (logically could not be, in the general case) simple, symptomatic consequences of immediately preceding here-now stimuli. States of affairs, it may be noted, are not physical sources of energies impinging on receptors, either.

Thus, the present formulation answers directly to the two "mysteries" of symbolic behavior, i.e., its significance and its requirement of meaningful situations. It also preserves the contrast between signs as symptoms of a present condition and symbols as somehow going beyond that limitation in achieving "time-binding" and "referential meaning" in addition to "space-binding". It preserves the notion that "level of symbolic functioning" is what distinguishes the normal person from one who is "concrete" and "stimulus bound". In an IA process the performance will always be more "concrete" than the IA per se.

7.2 Conventional Gesture, Burlesque, Ritual and Affirmation

Case II is probably best delimited by examples. Baptizing, saluting, "breaking bread together", thumbing one's nose, and voting the straight Conservative ticket provide a representative range of examples. H performs the baptismal rite by sprinkling water; he expresses respect by saluting; he expresses defiance by thumbing his nose; he exhibits solidarity by breaking bread together; and he affirms the traditional values by voting the straight Conservative ticket.

In examining these cases, we find once more the contrast between a concrete description of "what H did" and a more significant description of what he did. It is not, however, the Case I contrast between an IA and its P parameter. Rather, it is the contrast between two IA processes, B_1 and B_2. The relation between an IA and its Performance, i.e., B_1 is accomplished by accomplishing B_2.

Further, we may add verbal behavior to our list of Case II examples. We noted earlier that the conceptual-methodological anchoring point for the analysis of behavior is the existence of social practices which are intelligible as being engaged in without a further end in view, and, correspondingly, IA processes having the same feature. Other actions, we noted, are intelligible only as ways of achieving or as efforts to achieve one of these "intrinsic" actions. To describe one of these non-intrinsic actions as being <u>simply</u> what H did would be to give a necessarily incomplete description. The characterization of a behavior as verbal behavior, we noted previously, is a necessarily incomplete characterization which implies a further applicable IA description. Thus, verbal behavior, will always fit either Case I or Case II of symbolic behavior.

The contrast between a more concrete description and a more significant description provides the basis for certain kinds of humor, e.g., parody or burlesque. For an individual who is normally sensitive to differences in significance, nothing could be easier than to burlesque a given behavior or social practice by describing it at a more or less reduced level of significance. For example, playing golf, either as a social practice or as individual behavior, can be burlesqued as "tromping around on grass and knocking little white rubber pellets into a hole in the ground--and then doing it all over again!" A similar sort of move is customary for an experimental psychologist in attempting to give 'objective' descriptions of 'behavior'. The inability of type X psychological theories to deal with this vertical embeddedness as contrasted with left-to-right production was discussed initially as the problem of "applying to all behavior".

In any case, it is the contrast between the concrete description, B_2, and the more significant description, B_1, which generates the phenomenon of Case II symbolic behavior. B_1 is accomplished by accomplishing B_2 and B_1 is the symbolic significance of B_2.

7.3 Case III: Symbolic Behavior as Substitution

These are, no doubt, the most flamboyant cases, and they have been even more prominent since the advent of psychoanalysis. Some examples included sympathetic magic (e.g., sticking pins in dolls), executing bearers of ill tidings, the ceremony of holy communion, and the Old World decor of a restaurant. Psychoanalytic examples include a pencil symbolizing a penis, plowing a field symbolizing sexual intercourse, and the employee who is angry at his employer and comes home and kicks his dog.

The major difference between Case II and Case III is the degree to which a "substitution" formulation gets at the significant aspects of the behavior. The example of baptism given above might be considered to fall under Case III. Judgments of this sort are, of course, negotiable. We shall consider Case III in two stages, dealing first with the case of symbolic behavior and then deriving the case of symbolic objects.

For this purpose we shall need to refer to three logical roles played by three distinguishable IA processes. These roles are designated as IA_1, IA_2, and IA_3. IA_1 is a desired behavior which H is not simply in a position to engage in. This may, as in the case of sexual intercourse or wreaking anger on the employer, reflect the constraints of personal and social standards. Or, as in the case of communion, it may reflect a more general ability constraint. For example, there might not be anything that could be called literally being at one with God, or if there were, it might not be something that could be accomplished simply by engaging in a particular action at a particular time and place (compare: acquiring wisdom). In general, part of the conditions for Case III is that IA_1, though desirable, is not engaged in, either because H cannot (given by an ID ability function) or has a stronger motivation not to (given by an ID value function).

IA_2 is defined by the fact that it is an IA which resembles IA_1 in relevant respects. "Relevant" here will reflect what it is that is desirable or distinctive about IA_1. Thus, H engages in IA_2 <u>because</u> of the way that it resembles IA_1, and this is the basis for the notion that symbolic behavior is a case of substituting one thing for another.

If IA_2 resembles IA_1 in respect to significant desirability characteristics, then there exists a description which identifies a third behavior, IA_3, by referring directly to the desirable characteristics shared by IA_2 and IA_1. For example, if IA_2 is the behavior of executing the bearer of ill tidings, and IA_1 is the nullification of the state of affairs referred to in the ill tidings, IA_3 might be identified by such descriptions as "removing sources of unpleasantness," "denying unpleasant facts," or "affirming his defiance of fate." Or again, if IA_1 is sexual intercourse and IA_2 is climbing a mountain, IA_3 might be given by "successfully completed a strenuous, exhilarating activity that was worth engaging in." More venturesomely, we might try "demonstrated his manhood by succeeding at a strenuous, dangerous, exhilirating, satisfying activity," or, with a trace of an accent, "was driven to attempt a strenuous, dangerous, satisfying task as a way of demonstrating his manhood."

The delineation of the roles of IA_1, IA_2, and IA_3 now shows a familiar pattern. The relation of IA_1 and IA_2 to IA_3 is once more the relation of the more concrete to the more significant behavior. Either IA_1 or IA_2 is a way of accomplishing IA_3. Thus, when H behaves in this way, the observer, P, need not describe it as a case of substitution, for example, the substitution of fantasy satisfaction for real satisfaction or the substitution of IA_2 for IA_1.The way in which it makes sense to speak of IA_2 being a substitute for IA_1 is not one which requires the invention, by P, of a mechanism which operates in H to produce that substitution. Instead, he may regard it as a straight-forward case of H getting what satisfaction he can (IA_3)in that situation by doing what he can (IA_2) toward that end.

P will describe H's behavior as not merely symbolic but unconsciously so when several additional conditions are met.

(a) He denies (or, P judges, would deny) that his reason for doing IA_2 is the way that it resembles IA_1.

(b) H is (or, P judges, would be) unable to negotiate successfully his disagreement with P.

(c) P is able to give an acceptable (to P) account of H as refusing to admit to his symbolic behavior, even to himself, because H's motivational priorities (among other things) so limit H's behavior potential in his current circumstances that H is unable to treat his own behaviors and choices as being of that sort.

One of the ways in which IA_2 could resemble IA_1 is that both behaviors requires "props" which are essential to the performance.

The props might be objects (e.g., the case of the pencil) or settings (e.g., the Old World decor). If the prop, U_2, for IA_2 resembles the prop, U_1, for IA_1 in relevant respects (those respects by virtue of which U_1 is essential to IA_1) then treating something as a case of U_2 will resemble treating something as a case of U_1 in the relevant respects. Thus, this case will reduce to the previous Case III, and under these conditions U_2 is said to symbolize U_1.

Language may be implicated in Case III symbolic behavior in various ways. For example IA_2 may resemble IA_1 by virtue of involving similar verbal performances, or similar (or identical)sorts of locution (e.g., technical terminology).

We have noted that Case III differs from Case II to the extent that a "substitution" formulation gets at the significant aspects. We may develop this notion further by introducing for this purpose the notion of "the normal behavioral description," B_n. This is defined as the description given of H by an observer P who was normally versed in the social practices of his community and took H to be likewise. (Here we need think of P only as representing the modal response among the various P's in the community.) Recalling also the designation of B_1 as the more significant behavior and B_2 as the more concrete behavior in Case II, we may say that in Case II B_n is identical with B_1 whereas in Case III, B_n is identical with B_2. Thus relative to the baseline of the usual participation in familiar social practices, B_2 in Case II represents an impoverished description and B_1 in Case III represents an "enriched" description. Descriptions which directly reflect this baseline are the major starting points in the negotiations of behavior descriptions (that is a social practice also) since such descriptions are prima facie justified (if he acts and talks as though he is telephoning a friend, then any contradictory account of what is going on there carries a burden of proof).

However, B_1 in Case III reflects existing social practices and recognizable values no less than B_2 does--it is simply less obvious, and it is less obvious because B_2 is the "obvious" description. If, for example, there were in the community no concept of unpleasantness or misfortune and no contrast between intention and accident and no differential value associated with intentional results as contrasted with accidental ones, there would be no such symbolic behavior as self-affirmation accomplished by killing the bearer of ill tidings. Likewise, if there were no differential practices and evaluations which hinged on the distinction between "man" and "woman"and if there were no contrast drawn between being male and being manly and if there were not some prima facie grounds for the appraisal of manliness, there would be no such symbolic behavior as "demonstrating one's manhood by

succeeding at a strenuous, dangerous, worthwhile task," In this connection, we may recall the previous analysis in which what one is trying to do (course of action) is a derivative of what one is doing (social practice).

The conceptual overlap between the concepts of course of action and Case III symbolic behavior brings us to an interesting and significant special case where there is no existing behavior which would qualify as being literally IA_1, the desired behavior, and the one for which IA_2 is "substituted". The distinctive feature of the case in question is that IA_2 is engaged in in the hope that it will, post hoc, turn out to be IA_1. This is the major pattern of scientific investigation. For example, the type X investigator who describes his scientific behavior as "studying the biochemical basis of schizophrenia" may be assimilated to this pattern, since at the time when he engages in this behavior it is an open question as to whether there is such a thing as "the biochemical basis of schizophrenia."

What is involved in this particular case is a social practice, IA_3, of treating Q as the biochemical basis for Y. The social practice involves an interrelated set of alternative and compounded performances, and there are certainly literal exemplars and paradigm cases of IA_3. It is these performances in the existing paradigm cases which our type X investigator reproduces, as well as he can, in the new circumstances of dealing with schizophrenia as Y. Thus, the investigator engages in the behavior that he does (IA_2) because of the way in which it resembles the paradigm cases of IA_1, treating Q as the biochemical basis for Y. (Note that IA_1 refers to particular cases such as treating vitamin deficiency as the biochemical basis of skurvy, whereas IA_3 refers to a general behavioral formula for doing that sort of thing.) But it would be equally possible to say that he engages in IA_2 because it is a way of achieving what satisfaction he can (IA_3) by doing what he knows how to do (IA_2) toward that end. In this case, there is a possible achievement (IA_1, finding and showing something that would qualify as the biochemical basis) which contrasts significantly with merely operating in accordance with IA_3 ("being scientific"). Because of this contrast, there is also a point in speaking of "the substitution of fantasy satisfaction for real satisfaction."

The anchoring of particular investigations in social practices providing an open-ended set of exemplars is not a novel conception. It has been noted, for example, by Kuhn (1962) that major progress in science is accomplished not by the accumulation of details provided by particular investigations but by the introduction of a more sizeable package, a Paradigm, which includes a conceptual model and methods for collecting and analyzing data to be interpreted in terms of the model.

The description of a new Paradigm is the description of a new social practice. In a more fundamental context, not restricted to scientific practices, we find Wittgenstein's (1954, p. 226e) observation that

> "What has to be accepted, the given, is--so one could say--
> forms of life."

A similar formulation is developed in the following section, so that the task of the scientist is to invent exemplars of formula (5), of the behavioral scientist to invent exemplars of formula (7), and of the grammarian to invent exemplars of formula (10).

Clearly, Case III symbolic description can be overdone, and less substantial agreement among observers is to be expected than for Case II. Just as the SA System alone allows us to reconstruct an entire cosmology from a single observation, the IA system allows us to reconstruct an entire mythology from a single behavioral observation. Case III symbolic behavior was described above as "enriched" relative to the "obvious" normative description. However, where merely logical possibilities are taken as prima facie factual, the result is likely to be an impoverished description of behavior, in the sense that behavior thus described is likely to be merely colorful rather than being significantly embedded in significant larger patterns of behavior (compare: gilding the lily). Indeed, the psychoanalyst's type of burlesque and the experimental psychologist's type of burlesque (and here burlesque = polemic) may be seen as behaviors whereby each is driven to reject symbolically the excesses of the other.

7.4 The Common Element in Symbolic Behavior

In spite of the variety of cases of symbolic behavior, the IA formulation permits us to identify as a common feature the contrast between a more concrete and incomplete behavior description and a more significant and possibly complete behavior description. At the same time, our analysis of symbolic behavior warns us that most of the 'phenomenon' may be an observer artifact, even in the case where observer and observed are the same individual. In Case I and Case II it is only by virtue of first having given a deficient description of behavior that the problem of accounting for that 'behavior' arises at all, to be resolved by superimposing a less deficient description of a second behavior which provides the "symbolic significance" of the first but then in turn raises "the problem of symoblic behavior". With respect to these cases, the IA formulation starts at the other end of the series of embedded behaviors and encompasses exactly the same set of behavior descriptions as ways of characterizing the way in which the initially identified IA was accomplished. In this way, the same

ground is covered without any special recourse to the notion of symbolic behavior and, thereby, without the attendant pressure to invent 'internal' mechanisms which provide symbolic behavior.

With respect to Case III, both the more concrete behavior and the less concrete behavior are straightforwardly IA processes and the same standards of competence, evidence, and judgment apply to the attribution of either. The less obvious IA is merely less obvious--it is not hidden and nor do we establish its occurence by establishing the operation of an internal mechanism for producing it.

Thus, there is a single, simple, primary, in-principle prescription for studying H's possible symbolic behavior empirically: establish what IA he engaged in, and that will be the symbolic significance of "what he did" under any more concrete description.

8.0 Research Methodology

We have, so far, examined a schematic delineation of an interrelated system of concepts. Because of the mutual analytic relationships among these concepts it would be possible to say that the entire "three-system system" represented the concept of behavior in its "unpacked" form. But it would be equally possible to say that it represented the concept of "person" or of "the real world" (as contrasted, for example, with "the world of fashion", "the physical world," "the biological world," "the baseball world," et al, which are merely specialized social perspectives on the real world). Given the transition rules of the SA System, it is hardly surprising that the same conception can be expressed by making primary reference to a type of object or a kind of process or a system of states of affairs. At the present time, "the domain of behavior" and its jargon form, "the IA system" appears to be the most descriptive characterization.

We have seen that the concepts of verbal behavior and symbolic behavior are an intrinsic part of the system. That is, there could be no such system as the one presented if those aspects of it which correspond to verbal behavior and symbolic behavior were missing. Moreover, Formula (5) makes explicit one of the broad thrusts of present day "philosophical psychology", namely that all behaviors, down to the most commonplace and including the most violent and irrational, are not merely within a single conceptual domain, but are identifiable as behaviors only by virtue of their place in that system. Formula (5) exhibits verbal behavior, but also as the canonical form of the interrelationships which connect each behavior to every behavior. Behaviors, including our original bete noir, "the experimental study of verbal behavior," are therefore not something we are free to define at

our whimsy, nor yet something which we may encounter with simple empirical innocence as observational "givens", nor, finally, are they the by-products of some ontologically more basic goings on.

It should also be somewhat more clear than it was at the outset why it is that the presentation of the concept of the domain of behavior is the task of delineating a concept rather than, for example, asserting a set of propositions and justifying them. The entire logical domain of behavior is presupposed when a type H individual engages in the verbal behavior of "asserting that P," "postulating that P," "justifying the assertion that P," et al. Nor is there any question here of making assumptions in order to derive conclusions, for assumptions, too, are propositional and are merely a technically special case of "asserting that P." Since the domain of behavior is all-inclusive, it has neither contrasts nor correlatives in the way that "blue" has "green," "yellow", etc. There is therefore no place for a factual statement which distinguishes this system from others of the same general kind, for there are no others of this kind.

Propositions do not have a fundamental place in the domain of behavior, since (a) particular beliefs are individual difference characteristics, not part of the overall system, and (b) both propositions and assertions have to do only with the performative aspects of behavior (Case I and II symbolic behaviors, respectively) rather than with behavior as such. It is concepts, including concepts of states of affairs (which one acts on), which carry most of the weight that propositions might have been expected to carry. Thus, presenting the concept of behavior by uttering declarative sentences is not a devious way of smuggling in propositions after all. Rather, it is straightforwardly an IA process (presenting the concept) in which that concept (of behavior) is used (is part of the value of the K parameter) and which is accomplished by a suitable verbal Performance (the declarative sentences), and therefore qualifies, also straightforwardly, as verbal behavior and (Case II) symbolic behavior. Since the presentation was undertaken as a course of action, success is not presupposed by the foregoing description of it. But if it is understood in this way as an IA process or as a series of IA Processes having the logical structure of a course of action, then, to a substantial degree, it has been successful.

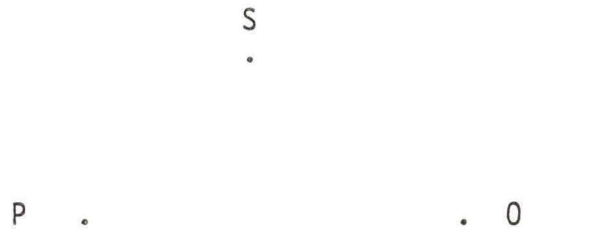
These consdierations have a bearing not only on how the presentation of the IA system is to be understood but also on how behavior is to be understood, and further on what it is to act on that understanding in engaging in the IA process of the experimental study of verbal behavior and behavior.

8.1 Heuristic Diagrams for Logical and Behavioral Roles

In a preliminary way, let us note that in the absence of propositions there are neither hypotheses nor deductions nor implication. So that if the present formulation is to have behavioral implications that result will not come about through the application of the "hypothetic-deductive method" or any of the other semantic devices devised by positivistic philosophers for non-behavioral sciences. But of course, a conservative representation of the range of logically possible behavioral facts would have no implications in any case, since to have implications would be to rule out some possible behavioral facts. Thus, the formulation of the system of behavior will, at least initially, serve as a resource for organizing the activities of investigators and their empirical data rather than primarily as an implicit prediction of the behaviors of experimental subjects. To focus on the experimenter is not, as we shall see, to change the subject. The principles which apply to investigators as such are not different from those which apply to their subjects as such, for the IA system principles apply to all behavior.

Toward this end it is helpful to employ some kind of notational device which will help to carry the "background" features of the system. For this purpose I have found the following "three-person diagrams" to have some heuristic value.

Figure 1. Three-Person Diagram : Case I



There are two such diagrams, having related uses. Case I, or the PSO diagram, is used to represent three logical roles. P is an observer, and for our purposes, a type H individual. S is the subject of his observation, and "S_p" is the description under which P acts toward S. That is, P's behavior is a case of treating S as a case of S_p. O is a second observer who observes both S and P and the behavior of P in regard to S, including his verbal behavior. In this diagram, P, S, and O represent logical roles, since any particular type H individual may fill all three roles, or any two of them, simultaneously. Thus, the diagram provides a conventional terminology, together with a visual representation, in regard to some portion of the public domain

of behavior (=S), the simple IA process (=P), and the IA process in its (formula (2)) recursive use (=O). This diagram suffices for most purposes, since for most purposes we do not need to represent a higher order of recursion. We may, of course, use the diagram on a "floating-point" basis, with P representing the nth level of recursion, S representing the (n-1)th level, and O representing the (n+1)th level.

Case II, or the ABQ diagram, is used to represent the interaction among persons, including the important special case of the negotiation of judgments. In this use, A, B, and Q each represent a type H individual who is capable of functioning in any or all of the P, S, and O roles at any given time. In a negotiation setting the ABQ diagram implies at least the following data.

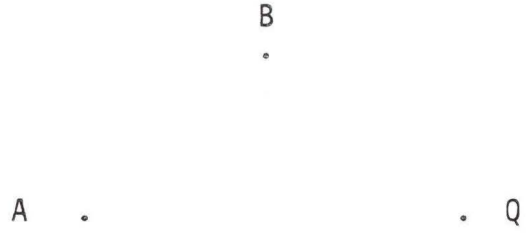
(a) A description of each of the individuals by each of the individuals.

(b) A comparison by each individual of each pair of descriptions of the same individual.

(c) (optional) Negotiations of any differences shown by the comparisons (if A and B differ about any member of the ABQ trio, they argue about it).

(d) An account of the eventual (with or without negotiation) results of each comparison, given by each participant.

Figure 2. Three-Person Diagram: Case II



In short, any pattern of sameness and difference between first person description and third person description, between two third-person descriptions, or between first person description and observer consensus may be represented here. Likewise, each of the S, P, and O roles is represented here. For example, Q serves as S in A's description of Q; he serves as P in Q's description of B; and he serves as O in comparing Q's and B's descriptions of A.

8.2 A Methodological Application of the PSO Diagram

Surprisingly, perhaps, the PSO diagram can be used to formulate the logical foundations of a behavioral science. This is accomplished as follows. First, we restrict the pehnomenon S to that of an individual behaving. In this way, we specify a subject matter which defines a behavioral science. There are no further restrictions on S, which is to say that the entire range of possible behavioral facts constitutes the subject matter of behavioral science.

Second, we initially restrict the behavior of P to verbal behavior and, in particular, to the description of the behavior of S. In this way we circumscribe the role of the behavioral scientist. Of course, even though we initially restrict the role of the behavioral scientist to that of giving descriptions, Formula (5) reminds us that such descriptions will be pointless if nothing further hinges on which description is applicable. (Or, it may be added in light of the discussion of verbal behavior, if nothing other than more verbal behavior hinges on which of the scientist's descriptions is applicable).

Third, the role of O is restricted to that of the description of the behavior of P. The role of O is, of course, the one which is adopted by us. O is a type H individual who undertakes to be systematically explicit about that behavior of P which consists of describing the behavior of S. (A slogan for moderns: The study of human behavior is a form of human behavior.) Note that any principle which applies to P will apply also to O, since O, no less than P, is engaged in describing someone's behavior. In this way, the recursiveness of the IA system renders unnecessary anything like the semantic stratification (systems G, X, B, A for non-verbal phenomena and infinite stratification for verbal pehnomena) which requires a ghost (the language user) outside the scope of its machinery in order to make it go.

This analysis (Ossorio, 1969) results in two kinds of products. The first deals with the possible logical forms of the descriptions given by P and is derived essentially from an analysis of S alone, defined by the parametric and recursive character of Formula (1). These forms are not a list, but a system which is recursive and generates distinguishable forms of behavior description of unlimited number and logical complexity. For obvious reasons, we may term this system the "grammar" of behavior description. The system of logical forms, which cannot be profitably summarized here, provides, among other things, a powerful descriptive tool for distinguishing and relating the various "fields" of behavioral science, from behavior genetics and psychopharmacology to humanistic psychology, sociology, and cultural anthropology, by reference to the logical type of behavior description which practitioners in a given field take as a paradigm and characteris-

tically try to achieve. Some indication of the substantive characteristics of this system may be found in the fact that the four forms of behavior identified earlier as "social practice", "course of action", "intentional action", and "deliberate action" are four of a dozen paradigmatic forms discussed explicitly, and these four forms already form a recursive system of unlimited complexity in its products.

The second type of product is generated by a joint examination of P and S. It is a set of procedural rules which stem primarily from the fact that the giving of a behavior description is itself an IA process. These procedural rules also serve, collectively, as standards of empirical validity of behavior description, since they determine which descriptions are compatible with which. When compatible or incompatible descriptions are independently obtained they serve as empirical confirmation or disconfirmation. The conceptual structure of behavior (formulas (1) to (4) is sufficiently complex and systematic to guarantee that there are multiple ways of treating something as a case of behavior X, just as the conceptual structure of arithmetic guarantees that there is more than one way of treating something as a case of "three". The reader of the analysis will recognize there an "operationalization" of the classic "coherence theory of truth"--it is the logical coherence of descriptions separately given in accordance with logical requirements which is the standard for judging a given description to be empirically warranted as being "in accordance with the facts."

We next further circumscribe the behavioral scientist's role by reference to formula (7), i.e., $V = \langle B_i, L_{i+1}, B_{i+1} \rangle$. (If we use formula (5) here instead, our further restrictions will hold for other sciences also.) The scientist invents one or more exemplars of formula (7). That is, he invents a behavioral concept, B_i, a locution which identifies that concept, and a set of behaviors which qualify as treating something as a case of B_i. A weaker condition would be that he extends the significance of a given concept B_i and locution L_{i+1} by inventing one or more behaviors B_{i+1} which qualify as treating something as a case of B_i. For example, he measures it or brings it about (formula (4)) by an experimental manipulation. (The view that the practice of science consists of the invention of behaviors rather than the confirmation of explanatory theories is developed at some length elsewhere (Ossorio, 1968b).

Finally, the scientist is one who exercises systematic care in taking precautions against his behaviors (B_{i+1}) going wrong by virtue of their dependence on the description he gives (L_{i+1}). Toward this end he sometimes performs experiments. Which is to say that the scientist is a negotiator in the ABQ diagram and a recursive observer, O, in the PSO diagram.

(a) The foregoing is a paradigm case formulation--what might be called "the compleat scientist." Clearly a division of labor is possible. For example, one individual might invent some verbal patterns and another might interpret them as meaningful locutions and invent some corresponding behaviors. Or one might take a limited set of standard precautions and leave it to the inventor of the significant behavior B_{i+1} to take additional precautions as required.

(b) One of the things that cannot be certified in advance or in general as being essential to the practice of science is any performative characteristic other than L_{i+1}. There is no a priori requirement here for measurement, observer agreement, manipulative experimentation, statistical tests, use of standard experimental designs, particular forms of theory or law, or anything of the sort. This is not an advocacy of anarchy, but a return to reason. It is a reminder that the relevant standard here is the rational standard of prudence in taking precautions and not conformity per se to the current scientific folklore and rules of thumb. Superstitions are notoriously self-perpetuating and self-concealing, and to suppose that the scientific community has a special dispensation against them is a curious conceit which might be expected to contribute to their perpetuation. Decisions as to precautions are negotiable and defeasible, but correspondingly, they cannot be reduced to a set of ritual perofrmances.

(c) In the final restriction on the role of the scientist, we may find the substance of the elusive "correspondence theory" of truth and of the notion that the scientist is characterized by "the disinterested search for truth". (Correspondingly, the preceding restriction generates the "convenient fiction" account of scientific practice: L_{i+1} is a convenient fiction because its only significance and utility is to subserve the behaviors B_{i+1} and nothing is required of it beyond that.) As a precaution-taker and negotiator within a methodological community the scientist <u>is</u> concerned not to have gone wrong in conducting his primary affairs (inventing $< B_j, L_{i+1}, B_{i+1} >$). This is to be concerned to avoid those errors (resulting in saying the wrong thing (L_{i+1}) or acting improperly (B_{i+1}) on what he said) which would call for the legitimate criticism, "You're not being objective." Likewise, the scientist aspires to formulations which are not subject to historical vicissitudes as further evidence accumulates, though success here is in good part an historical accident itself. "Coherence" and "correspondence" concepts of truth are complementary and under the aspect of eternity both will yield the same Truth. Thus, although truth and objectivity are empirical fictions in that we have no decision procedure for finally settling the question of when, if ever, we have attained them, the <u>concern</u> for objectivity and the <u>search</u> for truth are the normal behavioral characteristics of scientific precaution-takers and negotiators in good faith.

8.3 "State of Affairs" and "Stimulus" in Experimental Paradigms

Although the IA system generally and the logcial theory of behavior description provide standards of empirical validity, they do not determine particular judgments. In this respect they may be compared to the rules of a game, say, chess, which determine which moves are possible chess moves and therefore permit one to decide whether a given move on a given board is a chess move. What the rules do not do is to pick out any particular move as the move called for by the situation. Instead, the rules provide for that option to be exercised by the player. This "indeterminacy" in the rules is an essential condition for chess to be a game at all and for there to be behavioral phenomenon of playing chess.

Since the IA system is both a calculus of actions and a calculus of descriptions, the exercise of the options in this 'game' is, simply, the behavior which is our subject matter, and it is as lawful as the 'rules'. Just because of that, however, we shall need a research methodology in which this indeterminacy is not a fatal flaw or, indeed, a deficiency of any kind. Before proceeding to some initial efforts along those lines there may be some value in developing a limited example within a more familiar framework. This will also provide a demonstration exercise in "coming to grips with data" without empirical assumptions. The example was prepared with Lyle E. Bourne, Jr.

8.3.1 The Solution Shift Pehnomenon

Simple conceptual problems, in which the solution is shifted from one to another concept, have been used to explore developmental changes in behavior (Kendler, 1961). The plan of these experiments is to compare performance on what have come to be called reversal (R) and non-reversal (NR) solution shifts. To begin with, the subject is asked to try to discover the way to categorize a set of stimulus patterns into two groups that the experimenter has in mind. Call the group of patterns positive and negative instances. What makes a pattern positive is that it contains the one critical or relevant stimulus attribute singled out by the experimenter.

The population of patterns is typically multidimensional. But for simplicity, suppose there are only two dimensions, each with two values. An example might be the population of four geometrical designs generated by the dimensions size (large and small) and form (square and triangle). Unknown to the subject, the experimenter picks form

as the relevant dimension and triangle as the value to be called positive.

Patterns are presented to the subject, one at a time, and the subject guesses whether each is a positive or negative instance . After each guess, the experimenter tells the subject whether he was correct or incorrect. This procedure continues until the subject makes a string of, say, 10 correct responses in succession. At this juncture, without any forewarning or interruption, the experimenter changes the solution to the problem and the subject must learn a new way to categorize the patterns. The first sign of the shift for the subject is the statement by the experimenter that his first response after the shift is incorrect.

An R shift is one in which the stimulus-category assignments are simply reversed. If triangles have been positive before the shift, squares are positive after. The relevant dimension remains the same. An NR shift makes another dimension relevant. If form has been the basis for categorizing before the shift, size (or some other dimension) is relevant after. Large figures might be called positive and small figures negative.

Solution shift problems are quite simple and can be accomplished even by inarticulate organisms (e.g., rats, monkeys and proverbal children). The time required to master R and NR shifts decreases with the sophistication and (at least for human beings) with the age of the organism (Kendler & Kendler, 1962). But the most significant developmental phenomenon is the fact that, with age, the relative difficulty of R and NR shifts changes. Young children (like lower organisms) find the R problem significantly more difficult than the NR problem. With age the difference between the shifts is reduced and eventually reversed. For older children and adults, R problems are clearly easier than NR.

8.3.2 Mediational Theory

One commonly applied interpretation of these results arises from mediational S-R theory. Mediational processes are supposed to be internal representations of overt behaviors--behaviors which in general have been acquired and practiced to the point of mastery in the past. Mediators are ways of representing the knowledge of those behaviors, described in S-R terms. Suppose the subject has never learned to categorize stimuli on the basis of their shape or has not or is unable to internalize categorization responses (as mediators) on the basis of shape. S-R theory would then portray the learning in

Stage 1 of a solution shift experiment as the acquisition of unmediated S-R associations.

Diagrammatically,

Stimulus	Response	
Big Square	No	reinforcement
Small Square	No	reinforcement
Big Triangle	Yes	reinforcement
Small Triangle	Yes	reinforcement

For these subjects, when an R shift occurs all associations formed in Stage 1 must be extinguished and new associations formed; triangular stimuli are now negative and square ones positive. But an NR shift requires the extinction and replacement of only some fraction (here ½) of the old associations, for large triangles are still positive, though small ones are negative. Thus if the subjects learn in an unmediated fashion and if the number of old associations to be extinguished and/or new ones to be established is a measure of problem difficulty, NR shifts should be easier than R shifts.

Suppose the subject has internalized mediators appropriate to the task. These mediators might represent previously achieved distinctions between shape and other dimensions and between values within the shape dimension. What the subject learns in Stage 1 might then be mediated by some attentional and/or labeling response for the relevant dimension. Diagrammatically:

Stimulus	Mediator	Response
Big Square Small Square ------→ r	shape: square → s →	No → → → reinforcement
Big Triangle Small Triangle ------→ r	shape: triangle → s →	Yes → → reinforcement

When an R shift occurs, the same mediational sequence will work; the subject needs only to replace the s → R segment. An NR shift, on the other hand, requires the extinction of the mediator strengthened in Stage 1 as well as the s → R segment. Thus, if the subject learns in a mediated fashion, NR shifts should be more difficult than R shifts.

Mediational theorists then claim that lower animals and young children probably acquire unmediated associations in simple conceptual problems of the type described here. This explains why they find NR

easier than R shifts. But as the child matures, grows more sophisticated and (importantly for some theorists) develops language skills, there is an increasing probability that the mediational process appropriate to the task will be available to the subject. This explains why R shifts become relatively easier with age.

8.3.3 A State of Affairs Alternative

Consider the following alternative interpretation. We take it for granted that individuals act intentionally. Acting intentionally can be described in terms of concepts, in a way such that the use of concepts expresses both the individual's capabilities and his limitations. Given concepts K_1, K_2, . . . K_n as the individual's repertoire, we say that (a) he can treat a situation or object as being a case of K_1 or K_2 or . . . or K_n, but that (b) he cannot treat something as being a case of any other concept, C_1, C_2, . . . C_n. To be able to treat a situation as a case of k_i is to be able to distinguish cases of K_i from other cases, and so it is logically equivalent to being able to respond to a situation as falling under the description "K_i". Where no error is made, this amounts to being able to respond to the K_i aspect of a situation (i.e., K_i can be used to identify the 'stimulus' if the observer knows how to use K_i).

Ordinarily any situation exemplifies more than one of the concepts (descriptions) falling within the individual's behavior repertoire. Thus, the individual's ability to treat something as a K_i is the same as his ability to restrict what he responds to (i.e., to some certain aspect), the restriction being relative to what he has the ability to respond to, not merely relative to "what is out there".

The nonmediated formulation of the reversal problem given above now can be restated: The individual responds to the four situations under four discrete descriptions which do not codify any of the relevant similarities (i.e., bigsquare, smallsquare, bigtriangle, smalltriangle). This is equivalent to saying that the individual lacks the ability to distinguish C_1 = square, C_2 = triangle, C_3 = big, C_4 = small. or else has failed to exercise that ability in this training situation. The mediational interpretation might be reworded as follows: The individual responds to the four situations as falling under four discrete concepts which do codify the relevant similarities (triangle, square, big, small). Thus, his repertoire would include being able to treat something as a case of a (a) square, (b) triangle, (c) big, and (d) small (if the latter two are included, then his repertoire would probably also include (g) big-square, (f) small-square, (g) big-triangle, and (h) small-triangle).

Because the use of the concept K_i consists of treating something as a K_i (which may be identifiable only as some function (e.g., a truth-function) of some other K_j), we may say that what the individual learns is a fact (or state of affairs) which he then treats as being the case. In the present problem the relevant learning may be expressed in the form "P learns that a case of K_i is an opportunity for Z_w ("reinforcement") and treats it (the case of K_i) as such (as an opportunity for Z_w)." Treating a case of K_i as an opportunity for Z_w consists of making the response B_i if he wants Z_w or avoiding it if he doesn't want Zw.

The reference to "opportunity" here takes advantage of two essential features of the situation: (a) An opportunity is more than a mere logical possibility; if situation K_i provides P with an opportunity for Z_w, then in situation K_i, P can achieve Z_w by doing something, B_i, which he knows how to do. (b) To make use of an opportunity requires doing certain things and not others. Thus, the characterization of K_i as an opportunity for Z_w implies that there is a B_i such that $K_i + B_i = Z_w$. Two opportunities for Z_w may be different opportunities by virtue of requiring different behaviors B_i, B_j. In the reversal problem, there are two different opportunities, since square+ B_1 and triangle + B_2 both result in Z_w.

A general reformulation of what is learned in the cases under consideration would be

$$LL_1 : K_i + B_i = Z_w$$

In any given problem setting it will be partly am empirical question and partly a logical qeustion as to how many facts of the form LL, the subject has to learn in order not to make any mistakes.

(a) It is partly a logical question because it is a logical question as to what possible substitutions in formula LL_1 there are. The use of particular concepts by the subject determines the number of LL_1 facts. For example, when subjects do not have concepts which codify size separate from shape there are four facts: (1) K_1 = Big square, B_1 = "Yes"; (2) K_2 = big triangle, B_1 = "Yes"; (3) K_3 = big triangle, B_2 = "No"; (4) K_4 = small triangle, B_2 = "no". In contrast, when these concepts are used, there are two facts: (1) K_1 = square, B_1 = "yes"; (2) K_2 = triangle, B_2 = "No".

(b) It is partly am empirical question because which concepts the subject uses is a matter of fact, not logic.

(c) Note that (a) and (b) are not data concepts and therefore cannot be either in agreement or disagreement with data. If our numbers did

not work out, we might suppose either (1) that the subject had not fully mastered the use of some concepts he uses or, (2) we have not mastered the use of some concepts he uses or, (3) he uses different sets of concepts on different trials.

Let us introduce two person-descriptive maxims which, being maxims, are also pre-empirical.

(a) If a person has logically distinct reasons, A, B, and C for doing X, he has a stronger reason for doing X than if he had only some of those reasons.

(b) If a person has logically distinct facts, A, B, C, and D to learn, that is more difficult to learn than if he had only some of those facts to learn.

(c) Note that in neither (a) nor (b) is a metric characterization given, e.g., there is no assumption that all facts are equally difficult to learn or provide equal increments of difficulty to a given initial set or provide the same increment of difficulty to all initial sets. Conversely, there is no doubt that one can use an arithmetic framework, assign absolute difficulties and adopt some decision method to decide the goodness of fit.

If subjects do worse on R shifts, the representation might be as follows:

Original Facts (learned in stage I)	New Facts Required R Shift	(in Stage II) by NR Shift
LL1 : $Z_w = K_i + B_i$	$K_i + B_i$	$K_i + B_i$
Big square + Yes	Big Square + No	Big square + No
Small square + Yes	Small Square + No	
Big triangle + Yes	Small square + No	
Big triangle + No	Big Triangle + Yes	
Small triangle + No	Small triangle + Yes	Small triangle + Yes

But maxim (b) above, would lead us to conclude that subjects who find the R shift easier than the NR shift are not learning more new facts in the R shift. Thus we formulate a new set of concepts under LL_1 so that fewer new facts are required for the R shift. Consider some alternatives. (In the tables below, "0" = "no opportunity for Z_w is present.")

	Original facts	R	New Facts NR
	$K_i + B_i$	$K_i + B_i$	$K_i + B_i$
(A)	Sq. + Yes Tri + No	Sq + No Tri + Yes	Sq + 0 Tri + 0 Sm + Yes Big + No
(B)	Sq + Yes Tri + No	Sq + No Tri + Yes	Sq + Sm + Yes Sq + big + no Tri + Small + Yes Tri + big + No
(C)	Sq + Yes Tri + No	Sq + No Tri + Yes	Sq + Big + No Tri + Small + Yes Small + Yes Big + No
(D)	S + Sq + Yes S + Tri + No S + Small + 0 S + Big + 0	S + Sq + No S + Tri + Yes	S + Sq + 0 S + Tri + 0 S + Sm + Yes S + Big + No

(S = stimulus situation)

In formulations A and D of the NR shift, the subject learns that certain concepts now do not separate opportunities for achieving a wanted result. Further, he learns that other concepts do; he acquires new mediators. In formulation B, the subject learns that subdividing old concepts (shape) in terms of another (size) will produce a new set of four complex concepts which do separate opportunities from non-opportunities. In formulation C, the subject learns that (1) a subclass of previously correct responses is now incorrect and (2) a new set of simple concepts (large-small), does separate opportunities from non-opportunities.

In the general case, S cannot discover immediately whether the new requirements involve complicating the existing simple descriptions or substituting new simple descriptions. But if he has the concept of these two possibilities he will in general learn more quickly, possibly in one trial, given the right information.

Suppose that we allow the subject the concept of (roughly speaking) "one and only one of the descriptions from the set of descriptions generated combinatorially by K_1, K_2, . . . K_n." Practically speaking, this is the concept which will be used by a subject who looks for the relevant dimension (mediating response) we well as the "correct" values. Thus:

Original

LL_1: K_i + Yes; K_i = Square

K_j + No; K_j = Triangle

Reversal: Two New Facts

K_i + Yes; K_i = Triangle

K_j + No; K_j = Square

Non-reversal: Four New Facts

K_i + Yes; $K_i \neq$ Triangle

K_j + Yes; $K_j \neq$ Square

K_i + Yes; K_i = small

K_j + No; Kj = Big

Or, again:

LL_2: Z_w = $Shape_i$ + Yes or Shape $_{j \neq i}$ + No + i = Square

Then under reversal:

Only one new fact: i = triangle

Under non-reversal:

Two facts are new: (1) $Size_i$ + Yes or Size $_{j \neq i}$ + No

(2) i = small

8.4.4 Conclusions

An ability is not absolute, but always carries some qualifier

circumscribing the occasions of its exercise. If no explicit qualification is given, then "under normal circumstances" it is understood. An individual's ability to restrict what he responds to (see above) is not unlimited. Thus, intrusions, errors, etc., depending on prior experience and present inclination are possible events. Almost all questions of who has which inclinations and abilities are empirical, hence the influence of these is also empirical. On the other hand, if those inclinations and abilities were known, their influence would not be empirical, but instead would work in the same way as the formulas above do once the concepts used by the subjects are given. Thus, such influences can be incorporated in a formula the application of which is conditional upon the assessment or calculation of these individual difference characteristics.

Not only are abilities not absolute, but also, individuals learn this kind of fact about themselves, under recursive IA formula (2), and so their own abilities are part of the circumstances (K parameter of IA) to which they respond. Thus, subjects' limited abilities to process large numbers of combinatorial possibilities or to process combinations of size, 1, 2, 3, ... n simultaneously results in a new set of concepts associated with "strategies" in problem solving. One might suggest that the limitation in relevant abilities is part of the concept of a problem. (Recall "course of action")

Clearly, a "mediator" or "mediating response" is no more than a paraphrase, in a quasi-physiological idiom, of the description, K_i, under which the individual treats the situation (i.e., the distinction that we understand him as having made, e.g., "shape", "large", etc.). So long as mediating responses are restricted to a "conceptual nervous system" there is no way of establishing what mediating response occurs, and so no way of discovering empirically that a given mediator occurs whenever an individual uses a given concept. The mediational event is by definition the event which initiated the process which resulted in the (behavioral) state of affairs that Jack observed. Equally, the "hypothesis" which the individual "selects" (Restle, 1962) is the hypothesis that here is a case of K_i. Likewise, if we take it to be a "symbolic analogue" which is evoked, it will be the symbolic analogue of a case of K_i. To say that a symbolic analogue occurs with overlearning (Mandler, 1962) is to say that until an individual has acquired competence in the use of a given concept his behavior cannot yet be explained by reference to his use of that concept--a logical point. To say that a symbolic analogue sometimes shows up during learning is to remind us that the point at which an individual has acquired competence (rather than merely succeeded) is by no means unambiguous. Finally, the proposition which "controls" the correct behavior (Dulany, 1968) is the proposition that here is a case of K_i, and a "correlated hypothesis" is a state of affairs which is not mutually

exclusive with respect to K_j.

8.4 Methodological Aspects of the Solution Shift Example

Referring back to the PSO diagram, we may say that the solution shift phenomenon is S. The mediational account is an account of S given by P. So also are the state of affairs accounts alternative accounts which are available to P. Likewise, the hypothesis selection, symbolic analogue, and propositional control accounts mentioned briefly are also accounts given by P.

From the point of view of O, the dominant characteristic of the situation is the degree to which P's descriptions of S appear to be a function of P's personal characteristics rather than a straightforward reflection of S. What the various P's share is a description of an experimental state of affairs, including the sequential achievements of the subjects. These achievements are not integrated with a behavioral description of the behaviors of which those achievements were the outcome, since it is precisely that about which the various P's seem to disagree.

One of the things which both is essential to the various descriptions of S and is contributed by P is a maxim (b), i.e., the pre-empirical principle that if a task A is more difficult to learn to accomplish than task B, then it requires more units of learning. So that if the unit of learning is the making or breaking of associations, the more difficult task requires more of that; if the unit is the acquisition of facts, then the more difficult task requires more of that, and so on. As an empirical principle, the identification of difficulty with units of learning is obviously wrong, since some facts are demonstrably easier to learn than others, hence also, some associative bonds are easier to break than others, and so forth. The pre-empirical principle permits P to deny this at the cost of having to assert that if A is more difficult than B, then in spite of appearances, A requires more units of learning. Ordinarily this can be accomplished by supposing that a fact which is more difficult is a fact which is more complex and therefore does, after all, require more units of learning when we take account of its complexity. It might appear that this extension is simply a return to the discredited philosophy of logical atomism, of which modern Q-T psychology is the direct descendant. No doubt, for some, it is. However, P has some additional resources. If his analysis of facts A and B show that A is more complex than B and yet fact A is not more difficult to learn than B, P has the options of saying (a) that the learner has already partly learned A or has learned part of A or both, or (b) has a greater capacity

to learn A than B. Functionally, the two are equivalent, since the difference in the learner's capacity may be "operationalized" as the quantitative savings in learning or "conceptualized" as that part of A which has already been learned (but which may not be "available" in the absence of further learning, so that with further learning its increasing availability "accounts for" the savings in learning). The functional equivalence will not be altered if case (b), the greater capacity to learn A than B is paraphrased as a physiologically innate "cognitive structure" which is equivalent to that part of A which has already been learned. This is an option which has recently come to seem attractive in connection with the learning of language.

There are some parity considerations to be applied here. If fact A is more complex than fact B, then the concept of A is more complex than the concept of B, and the locution which gives the description of fact A has greater descriptive power than the locution which gives the description of fact B. Conversely, the use of the concept of A gives the user a greater descriptive power than the use of the concept of B. Consequently, the user of "A" has an information processing potential which exceeds that of the user, as such, of "B". In the state of affairs analysis above, this is shown by the visibly more complex LL_2 formula under which the solution shift could be learned by learning only a single fact, whereas the less complex and less "structured" LL_1 formulas required a minimum of two new facts. A learner who had the capacity to acquire formulas (concepts) of the former sort could thus be expected to outstrip one who could acquire only formulas of the latter sort.

Thus, it is not surprising that in the face of theories in which the LL formulas attributed to subjects would appear to require the learning of an infinite number of facts in order to have learned fact A (e.g., A = "Here is an English sentence," for an arbitrarily selected sentence) there is some temptation to move directly to the conclusion that most of fact A consists of an innate cognitive structure.

It is, of course, the recursive conceptual systems which have a kind of extended descriptive power which does not analyze into a finite number of facts. It is this kind of advantage which O has over P. The conceptual-empirical analysis by O of the various accounts of the solution shift phenomenon by the various P's will not differ in its logical form from the state of affairs analysis of the behavior of S. That is, O will account for the differential behaviors of the various P's on the basis of their personal characteristics, including, importantly, <u>their</u> LL formulas, which include both the concepts they are prepared to attribute to S and the broader formula ("theory") into which the data thus generated is fitted.

The advantage which O has relative to P is not in having available more facts of the same sort as P, or even simply having more facts. P is, so to speak, stimulus bound. Irrespective of the sentences he utters, he is in the methodological position of simply "responding to the facts and calling them the way they are." O necessarily does, and P logically cannot, describe the statement of the facts (about S) as a function of P. P's description is therefore subjective in that in its flat, declarative form its validity is relative to the giver of the description and no hint of this appears in the content of the description. In this respect, "S has selected hypothesis h_1" resembles "This quinine water tastes good," the latter being a kind of statement that is commonly taken to be a subjective judgment.

Referring back to a previous discussion (5.3, 5.4) we may say that whereas P has available the IA system as a calculus of representations (of S), O has available both that and the IA system as a calculus of operations (by P). To be sure, both of these are part of O's representation of P. The point is that this representation, exploiting the concept of "the operation whereby a representation was generated" (the action accomplished by the giving of the description of S), in principle exceeds the descriptive power of P's description of S not by an order of magnitude, but by at least one order of infinity. Qualitatively, it produces a different kind of description, i.e., a pragmatic one as contrasted with a semantic one, in a way which is not simply a matter of enumeration. Each description of S by P may be multiplied by the entire range of pragmatic possibilities, and that is what is available to O.

Confusion arises because P and O may utter declarative sentences which either are identical or show a first person--third person correspondence, and thus appear to be saying the same thing. For example, both may say, "From the point of view of theory X, . . .". And P may say, "It seems to me that..." while O says "It seems to P that...". But "it looks to me like a case of A" is just as much a factual statement as "that's A?" Indeed, as a factual statement, the former appears to be substantially more hazardous than the latter. One might wonder, therefore, why it is so often made as a prudential move, along with such modern classics as "Well, everyone has to make some assumptions, and here are mine." Of course such statements are not in their relevant (here) use, factual statements. Rather, they are performatives (comparable to "I don't promise you") whereby the speaker stakes out a (hopefully, tenable) position from which to negotiate. Which is to say that they are O-type statements disguised as peculiar P-type statements, i.e., "methodological" statements.

O-type declarations are not safe or self-evident P-type statements. In particular, they are not P-type statements describing P, i.e., they are not third person descriptions of P_1 by another individual,

P_2, for that is no different from P's description of S and raises the same unresolved problems. Consider the two standard justifications for P's type X procedures, i.e. "you have to make some assumptions" and "since we agree about X, we need not worry about whether X is really the case." Both appeals are hopeless in the same way. The appeals could be legitimate only if it were actually the case that we agree or that actually we all do have to make assumptions. However, if we could establish that either of these possible states of affairs actually obtained then neither appeal would be legitimate, for we would then have that stronger basis the absence of which these appeals were originally introduced to compensate for. That is, we would have a way of appealing to the facts and not merely to the assumption that we agree or to an agreement to assume, etc. These latter are not possible foundations for any objective procedure or conclusion, but they are what we have relied on, with the role of P_2 filled by our positivist philosopher of science who tells us that it is that P_i is (supposed to be) doing when he gives a mediational account of the solution shift phenomenon, (which, incidentally, aptly illustrates our tendency, mentioned initially, to describe phenomena in terms of an experimental paradigm). Here is an instance of the "division of labor" with respect to formula (7) which has had some pernicious consequences. For now the behavior of P_1 is a fact in the behavior of P_2, not P_1, and P_1 is left with an impoverished form of behavior description and an untenable methodological position from which he can give only subjective accounts of some behaviors.

Thus, we are led to the conclusion that significant advances in the science and discipline of behavior description are unlikely to be accomplished simply by the proliforation of P-type descriptions or their theoretical elaborations, since in either case we will be dealing with individual difference characteristics (and any assertion will have this methodological status). From a formulation in which the domain of behavior is maximally complex and conceptually all-inclusive, we are led to doubt that the symbolic paraphrase of behavioral facts in a physiological, mathematical, engineering, or other idiom will somehow exhibit in an elegant or comprehensive way the lawfulness of the domain of behavior.

Since the most central feature of behavior would seem to be its recursive character, we may hope that incorporating this feature in our research conceptualizations and procedures will yield more than a passing technical advantage. The non-reductive " calibration" analysis of meaning and the finitization of behavior descriptions through the interpersonal "calibration" provided by the ID system give us clues as to how we might proceed in this regard.

The two major research themes described below, which may be thought

of as the implementation of the concepts of meaning in verbal behavior and symbolic significance in behavior generally, are a way of following up these clues. No doubt they smack of a "brute force" approach -- initial efforts rarely fail to go wrong in this way. No doubt, too, they represent some P-type idiosyncracies. However, one need not, I believe, endorse the particular approaches described below in order to appreciate and act on the possibility of a new genre in the experimental study of behavior.

9.0 Research Approaches

To say merely that the primary task of the behavioral scientist is to invent exemplars of formula (7), i.e., $V = \langle B_i, L_{i+1}, B_{i+1} \rangle$, is to leave open the question as to how that is to be accomplished. One of the methodological innovations, or at least, a shift in emphasis, suggested by the present formulation has to do with the relation between the locution(s), L_{i+1}, and the behaviors, B_{i+1}. Ordinarily, the set of behaviors B_{i+1} is divided into two sets. The first is a set of experimental precautions, B_E, which lack intrinsic behavioral significance but do serve, within the current social structure of experimental psychology, to gain for the locutions the status of true, provisionally, at least. The second is a set of behaviors, B_A, which are not experimental and do have an intrinsic significance and thereby, as "applications", give significance to both L_{i+1} and B_E. The rationale for this stratification is that establishing the truth of L_{i+1} (ordinarily, a P-type description) insofar as that is possible, is done by experimentation, and if L_{i+1} is true, then an indefinitely large range of applications "follows". There does not appear to be a decision method for appraising the rationality of this form of social structure, and, as is typical of social structures, the question of its rationality or marginal utility is seldom raised.

The present alternative, in its extreme form, is to incoroporate L_{i+1} directly into B_A as part of its performative aspect, so that the question of truth never arises even when L_{i+1} has a propositional form. B_E is then devised so as to have a means-ends relation to B_A rather than an evidential relation to L_{i+1}. Since the fruitfulness of L_{i+1} with respect to any other case of B_A cannot, in any case, be guaranteed, we specify this as a desiderata and leave it to the skill or luck of the investigator to maximize it. In point of fact, we will normally begin with a set of related behaviors B_A rather than a single one.

The shift in emphasis is a shift from the semantic concepts of truth and meaning to the pragmatic concepts of value and significance. All of these concepts are represented in the general verbal formula (5) and therefore in the derivative cases such as formula (7) also. Roughly, meaning is associated with B_i and L_{i+1} in (7) and truth is associated with L_{i+1} so long as L_{i+1} is propositional in form. In contrast, significance is associated with B_{i+1} and, particularly in the special case, B_A, of intrinsic behaviors, so also is value. In type X theorizing (L_{i+1}) and experimentation (B_E), L_{i+1} is officially not merely the performative aspect of B_E. Rather it has "surplus meaning", which is exploited by the "applications", B_A. Successful experimental B_E serves as evidence for the truth of L_{i+1}, and such evidence then justifies the use of B_i, including its surplus of meaning, in further applications. Thus, the primary

focus is on the truth of L_{i+1}, and its applications are left more or less to chance. In the present formulation the question is not whether L_{i+1} is true or what it means, but rather, what the point of saying it is. That is, what is the difference between treating something as a case of B_i and treating it as a case of B'_i? What difference does it make whether something is a case of B_i or not? If L_{i+1} has any significance then there must be intrinsic social practices which, at least optionally, hinge on the distinction of B_i versus B'_i. The "invention of exemplars of formula (7)" is the invention of such social practices (B_{i+1}) directly or the invention of subsidiary practices which are new ways of accomplishing existing intrinsic practices (recall the "biochemical basis..." as Case III symbolic behavior).

Within this format, to be sure, the traditional approach is still an option, for the investigator may still try his luck by recourse to a cookbook of B_E procedures in selecting L_{i+1}, though of course, that alone leaves most of the task yet to be accomplished. But also, if our experimental rules of thumb have not been sheer invention, we may expect that the precautions which make sense in relation to B_A will not be entirely unfamiliar. The research discussions which follow in Section 10 may give additional significance to the suggestion that we may hope to get ahead by using our heads instead of the cookbook.

9.1 ID Functions: Universal Laws or Initial Conditions?

A second innovation or change in emphasis stems from the fact that the formulation of the IA System provides an altered baseline or starting point for psychological research. Methodologically, it is as though the type X investigator had succeeded in discovering a single universal law of behavior. This is given by formula (1). I do not mean to suggest that everyone may be expected to agree that formula (1) is the universal law of behavior, but only that with this formulation there does not appear to be anything left to be accounted for by any second principle having the same methodological status as formula (1).

Current practice in behavior theory is no longer a search for truly universal laws or conceptualizations. Rather, it consists of a search for laws (or theories) which are universal across subjects but limited as to the situations to which they apply. Here again, there is a tendency to define situations in terms of experimental paradigms. Thus, we have independent theorizing with respect to concept formation, serial learning, free recall, language acquisition, problem solving, learning sets, et cetera. At the same time, such theorizing attempts to take into account the contribution of circumstantial variables within the paradigmatic state of affairs

which defines the scope of the "miniature theory". The functional regularities which are sought are generally mathematical relationships between aspects ("variables") of either behavior or circumstances.

In place of such endeavors as the primary thrust of psychological experimentation, formula (1) encourages us to formulate more directly the values of all the parameters of IA as logical determinants of behavior. The key term here is "logical determinant", and it stems from the earlier conceptual statement that the use of SA System terms is not the application of these terms to anything. A variant of this statement is that the lawfulness of the use of SA terms is a behavioral lawfulness because the real world is simply the logical boundary condition of our behavior and not a transcendental object or state of affairs which we perceive darkly and describe epiphenomenally.

In examining the solution shift phenomenon, we have seen how the causal processes which are described "objectively" by P are a direct consequence of the logical constraints on P as an observer-describer-responder (i.e., an H-object). The IA formulation reminds us that P's inability to attribute to S the use of a concept or rule which P cannot understand or knows nothing of is a more stringent constraint on the behavior of P than S's inability to hold his liquor is on S's behavior. Likewise, P's inability to square the circle or play a trump in chess is a stronger constraining on P's behavior than his being unable to fly by flapping his arms or being able to recognize more than seven at a glance.

Like "objectivity" and "truth", "reality" is a grammatical and empirical fiction and a logical dangler. Like these two, however, it has a basis in reality. The reality basis for "reality" used as a noun is "reality" used as an adjective. There are reality constraints on our behaviors, and these are given primarily by ability descriptions and, more generally, by individual difference descriptions. However, it is not that reality constraints are simply boundary conditions of behavior. The ways in which they limit behavioral possibilities is itself part of the lawfulness of behavior, and that is what remains to be systematized beyond the formulation of formula (1) as the universal law of behavior.

This enterprise will resemble the "miniature theory" genre of experimentation in representing behavior as being related to the circumstances of its occurrence in specific and detailed ways. It will differ, at least in emphasis, in at least these ways.
(a) Since the relationships in question are logical, not causal or even temporal, there will be no "dependent" or "independent" variables in the conceptualization of experimental procedures.
(b) The closest analogue to the independent-dependent variable formulation is the notion of "behavior selection". Circumstances and personal characteristics "select" behaviors, including values of the K parameter. The selection will be in-

determinate but lawful, in the way that the "solution" given by n equations in n + 1 unknowns will be indeterminate but lawful. The determinate selection is made by the observer, whose giving of the description he does give is behavior which is selected by his personal characteristics and circumstances. Thus, although technical elaborations are as yet prototypical, the two three-person diagrams provide the methodological basis for a good part of the empirical work reported in section 10.

(c) The functional relationsips which are codified are behavioral rather than mathematical. "Behavior selection" is just that, and the logical determination provided by personal and situational characteristics is simply a partial specification of which behavior occurs. This is to be contrasted with a mathematical function which connects quantitative characteristics of independent variables of a situational sort with quantitative characteristics of dependent, behavioral phenomena.

(d) The systematization of behavioral lawfulness is examined in a completely interactive and unrestricted context. There is no segregation of phenomena parallel to the subject matter divisions of our miniature theories. Instead, the methodological framework and the technical approaches illustrated below take it for granted that there is one phenomenon, behavior, not many phenomena among which, when the millenium comes, we may hope to find some unifying generalizations. This is possible primarily because formula (1) enables us to ask, what difference does a perceptual, or conceptual, or motivational, or historical, or ID circumstance make with respect to IA. Given the abstract formulation of the IA System, we do not need to reify every significant categorization of behavioral phenomena as a distinct phenomenon which must therefore be codified in a distinct type X theory. To be sure, only selected, prototypical examples are given below to illustrate this possibility of an integrated behavioral science for the future.

(e) Finally, the systematization is non-propositional, as how could it fail to be given the conceptual development of the IA System. What non-propositional alternative exists for the codification of the lawfulness of the domain of behavior? Briefly, an object which does not assert lawfulness, but instead exhibits it by its behavior. The relevant behavior is that of implementing the trans-personal correspondences discussed in section 5. Referring back to the heuristic example of "the shape of object X", we may imagine a computer system which, on being given a viewing location relative to the location of object X and a photograph of object X from that viewing location, produces, on a viewing screen, the appearance of the object from any specified viewing location, and does this for the range of possible shapes which are compatible with the photograph. Such a system might be characterized as an objective representation of the lawfulness of the perception of the shapes of objects. Roughly, this is the nature of the enterprise with respect to the representation of behavior. The operation of a computing

system may be described, and the principles of its operation may be written on paper as explicit rules or as a computer program. However, it will not follow from such descriptions that the system will operate in the way that it does from a behavioral point of view. Just as hypothetical objects, processes, et al have a "surplus significance" relative to statements of operating characteristics. It is just this non-deducibility of behavioral significance from the description of the system that makes the cumulative construction of the system an empirical enterprise. The behavioral significance cannot be deduced, but it can be demonstrated empirically.

9.2 Technical Issues

The representational approach sketched above will require the invention or evolution of technical solutions for a range of problems of implementation. For example, there is a problem of the representation of the general and specific forms of behavior. Here, "representation" refers not to a conceptualization, but to a product, something analogous to a game board, a scoreboard, a CRT display, a benzenering diagram. Human abilities are indeed limited, and human memory is short, so that an artifactual representation contributes in a perhaps essential way to cooperative effort and communication. In the present case we make use of behavioral formulas in paper-pencil form and also in the form of portions of a (so far, Fortran IV) computer program. A diagrammatic notation, with IA represented as a diamond, shows some promise as a general vehicle for the representation of behavior (Ossorio, 1969). Certain other technical problems are discussed below.

9.2.1 Representation of Specific Forms of Behavior

In a sense, the representation of formula (1) as the general case is vacuous, since it is the representation of more specific forms of behavior which requires the specification of parametric values. We have here an analogue of the in vivo-in vitro problem when we deal with specific behavioral phenomena. To examine a particular form of behavior in isolation is to run the risk of overlooking its essential characteristics given by its place in the system and being bemused instead by the accidental characteristics of particular sorts of examples. In principle, the problem may be minimized by carrying along surrogates (e.g., "input" and "output" categories) for the rest of the system. However, for a complex system approximations may be all that is, practically, possible. A characteristic way of dealing with this problem is exemplified by the "hostility formula" (Ossorio, 1968b), which fits a more general formula for emotionally motivated behavior and which introduces both the paradigm case and defeasibility "openers".

(11) Provocation by G elicits a correspondingly hostile response by R, unless

(a) R does not recognize the provocation for what it is, or
(b) R has a stronger reason not to express hostility or additional reasons to express hostility, or
(c) R is unable to express hostility when the 'opportunity' is present, or
(d) R believes that what he did was a correspondingly hostile response.

Note that the defeasibility options in formula (11) deal with the three IA parameters which are also the classic type X behavior theory parameters (K, W, KH), and they deal with the ID functions of Value, Knowledge, and Ability. They also implicate both the simple and recursive form of IA. The paradigm case receives a separate expansion, e.g., that of Mitchell (1967) in the "Maximum Want" model which is presented below as an illustrative research design. "Provocation" is a value of K and "hostility" is (for present purposes) a value of W. The latter is in turn analyzed into thirteen cases, including a "wastebasket" case to ensure that the analysis remains non-empirical. Each of the cases is associated with a set of performances which are in general differentially effective in bringing aobut an A which is the same as the W (i.e., effective in satisfying hostile motivation). Thus, we have three levels of the vertical embeddedness which was contrasted earlier to a "left to right" development. This fragment is not anchored at either end in either "real" definitions (What is provocation? What is hostility?) or operational definitions. It is also culture-free, whereas any more specific characterization probably would not be and would therefore have to be dealt with under individual difference concepts by reference to particular sociocultural norms. It is also a prima facie candidate for a substantive answer to "What is the meaning of 'hostility'?" In this regard it contrasts with either a dictionary type survey of near-synonyms and with an empirical summary of personal associations or a culturally relative survey of paradigm examples. The concept of hostility must be shared in order for there to be disagreement about its instances or about its significance. The individual differences dealt with in Mitchell's study may be regarded as differences with respect to the significance that hostility has for various individuals. It is apparently the confusion of meaning and significance that is expressed in the popular notion that judgments of, e.g., hostility are subjective because " 'hostility'means something different to everyone."

9.2.2 Behavior as Temporal Pattern

At the present time the emphasis has been on the methodology and on the "explanatory" parameters of behavior (K,W, KH) rather

than its performative aspects. In part, this reflects the policy of staying at a culture-free level as much as possible and as long as possible. One informal effort to systematize the performative aspects of a common social practice, dining, was made by J.E. Felknor. The incomplete result was strongly reminiscent of a generative grammar, complete with initial phrase structure, Dining → Preparation + Eating + Cleaning up, horizontal contingencies at lower levels, deletion and addition "transformations" at a minimum, nested structure possibilities in the "terminal string" and a lexicon of terms denoting foods, utensils, and settings, (at a minimum) for the final instantiations. It is not clear at present whether the nested structures require a recursive conceptualization. The problem of systematizing performance characteristics will have to be faced at some time; and borrowing some of the formal structure of grammatical theory and some of the analyses involved in dance notation may provide the most efficient beginning.

9.2.3 Behavior Selection by Dispositional ID Functions

The representation of behavior selection as an expression of ID dispositional functions (Traits, Attitudes, Interests, Values, Styles) is one of the problems initially addressed. This is exemplified in one way by the quantitative input (representing Knowledge and Value) to the Maximum Want model described below. It is exemplified in a different way by Mitchell's formula for the effect of P's (Trait) hostility on certain of his descriptions of S.

9.2.4 Behavior Selection by Power ID Functions

The representation of behavior selection as an expression of the power (ability) type of ID function presents a somewhat different set of problems. Ability concepts, perhaps more than any other ID concepts, have significant use in both positive and negative ways. (S did c, and his doing so is an expression of his level of ability to do C; S didn't do d, because he doesn't have the ability to do D.) An example of this sort is given by Putman's ability formula presented below.

Part of the attractiveness of "mechanism" explanations of behavior is that they combine positive and negative uses of ability concepts in a neat and non-empirical way. A mechanism for doing sums, for example, is one which intrinsically does (a) sums, and (b) nothing else. Non-intrinsically, it also does anything on a particular occasion of its operation that happens to be the same as doing sums or doing the particular sums that it does then. In the linguistic data processing demonstrations presented below we find a familiar psychometric procedure being used to construct a representation for abilities which has some of the technical advantages of a "mechanism"

without the contradictions inherent in a mechanistic conceptualization of behavior.

9.2.5 Behavior Selection by Multiple ID Functions

Eventually there is a problem of behavior selection as a joint function of more than one ID function. Putman's addition to the Maximum Want model, below, illustrates the combined use of trait and ability functions.

It is in connection with joint functions that technical gains and risks may be expected to increase rapidly. The risk is the familiar "order of magnitude" problem. The number of interrelationships among discrete items rises combinatorially whether the items be nodes on a graph, marbles, or person functions. Because of this, if all the interrelationships had to be explicitly formulated and eparately programmed, then quite possibly it would eventually be the case that for the number of distinct person functions which had to be taken account of, the number of such interrelationships would render the enterprise technically infeasible.

However, it is in this connection that rule-specification exhibits descriptive power without the working out of all possible interrelationships in the application of that rule, since a computer is an object explicitly designed to implement rule-specification. Moreover, the psychometric implementation of ability functions (exemplified by the linguistic data processing studies below) provide a way of maintaining a working balance of explicit-implicit representation, so that the eventual seriousness of the interconnection problem cannot now be foreseen.

The transition from Mitchell's original Maximum Want model to his elaboration of a trait function to Putman's addition of an ability function illustrates the increase in overall complexity associated with ID function increments. It also illustrates the carrying along of "surrogates for the rest of the system" in a way other than input-output designations. In the original model, P_{iK} is conceptualized neutrally as a likelihood, and behavior selection is accomplished by a multiplicative function, L_{iK}, of suitability and likelihood. In the trait elaboration by Mitchell, the likelihood is reconceptualized as "ability" but the multiplicative function, L_{iK} remains. In the ability elaboration by Putman, the ability analysis results in a decision table which replaces the multiplicative function, but the latter may now be seen as an approximation which produces roughly the same results as the former over a substantial range of cases.

9.3 Overview of the Research Approach

In general, the empirical procedures described below are

designed to implement the general theory of behavior description and to exemplify the special theory of scientific behavior description. It is therefore O-type behavior rather than P-type behavior. The specific research procedures presented in the following section are some of the initial exemplars of the class, B_{i+1}, of ways of treating the domain of behavior as being of the sort presented, L_{i+1}, at some length above.

The major thrust is perhaps best exemplified by the behavior descriptive, or "person perception", simulation of Mitchell and Putman. Here is an effort to represent the general case of behavior and the lawful correspondence between particular behaviors and particular circumstances and configurations of personal characteristics. The representation is implicit, in the form of rules, and operational, in the form of a computer program and system, and public in either case. The representation is a representation of P, the observer in the PSO formulation of the phenomenon of behavior description.

The success of this representational device would include the following:

(a) Taking as input information about a given P. This input would have the significance of an ID assessment of P's relevant characteristics.

(b) Taking as input various items of information about S that are available to P.

(c) Calculating correctly P's description of S and his expectations with respect to S based on the information about S.

(d) Doing all of this for various P's who give different descriptions of S and have different expectations about S.

(e) Taking as input the ID characteristics of two observers, P and P_2 and the description of S given by either one, and from this calculating the description given by the other observer.

(f) Taking as input the ID characteristics of an observer, P_1, and the information about S which is available to P_1; likewise, taking as input the description of S given by a second oberver, P_2, based on the same information as is available to P_1. Calculating from this the ID characterization which P_1 would give of P_2 if P_2's description of S and the basis of that description were known to P_1.

We may note that in this operation, the experimenter neither has nor needs a privileged access to the facts, as contrasted with experimental subjects. An experimenter will normally fit the role of P_1 in (e) or (f).

A relatively explicit characterization can now be given of what would constitute an objective characterization of the behavior of S (or of P). The state of affairs which constitutes what S's behavior "really was" is given by the set of ordered pairs of observers, P (specified in ID terms), and their descriptions of S. Each pair is equivalent to each other pair. Access to such states of affairs is given to any P_1 by any other observer whose ID characteristics and description of S are available. Here we make use of an extension of the "calibration" formula for expressing the unique concept identification provided by L in formula (5). The fact in question (S's behavior, or his bodily state, or whatever) is the fact that is identified by all of the person-description pairs which identify the same fact as this pair (P_2 and his description of S), which by definition identifies the fact in question.

(1) This way of putting the matter may be reassuring to the reader who has persevered to this point in spite of being upset over what he considers to be a dogmatic air of omniscience or, at least, a preemptive set of definitions. In the language of factor analysis, the presentation corresponds to the arbitrary methods we have for extracting factors which we then rotate for actual use. I have attempted to extract the conceptual variance of the domain of behavior by exploiting the concept-identification function of verbal behavior, but it is inevitable that the reader will rotate to his own version of simple structure. The IA System is designed to codify what is invariant under such "rotation".

At most, there is a residual argument to the effect that the language of the present formulation is a canonical form for behavior description. At present, such an argument would be largely redundant, since there is not at the present time any actual alternative form which covers the same ground.

(2) Is the IA approach antithetical to type X theorizing? Certainly not in the sense of being logically incompatible with such theorizing and experimentation. If S-R and other causal process accounts of behavior can be restated in IA terms, then clearly they could have been stated in these terms to begin with and pursued experimentally in that form. With respect to verbal behavior specifically the IA System, particularly as projected in the (a) through (f) program above, provides a currently needed resource, namely a format for expressing verbal behavior not merely as a function of S's grammatical competence, but also, jointly, as a function of his intended meaning, his memory limitations, et cetera. In this sense, the IA System provides a "performance model" for verbal behavior, though it is not, of course, a model of the physiology of verbal behavior which is what type X investigators have clearly had in mind in the search for a "theory of performance". It has a similar value if we are dealing with genuine physiology

rather than symbolic quasi-physiology. For example, it seems unlikely that behavior genetic studies at the human level will progress substantially beyond idiosyncratic 1-1 effects or "accounting for X percent of the variance" of gross behavior until some substantial implementation of behavior description along systematic individual difference lines such as (a) through (f), above, is achieved. Or again, a study of the behavioral effects of psychoactive chemicals is currently underway (Comtois, 1969) using the differentiation provided by the ID functions to achieve conceptual sensitivity in the dependent variables.

On the other hand, the IA formulation opens up some potentials which, for some investigators at least, will take precedence over most current type X predilections. In the IA formulation, physiological and other mechanisms do not produce behavior. They are, rather, part of the medium in which behavior is generally encountered. However, intervention by P based on a description of S as such a mechanism or couched in terms of such mechanisms is frequently effective in enabling P to exercise an influence on S's behavior or personal characteristics. The study of such mechanisms and their behavioral manipulation by P is therefore of practical advantage to P and thus has a primary value as a technology of behavior manipulation. In the case where only the verbal behavior of asserting a type X theory is the product of experimentation, that will still have the practical value of being the kind of performance required for the successful professional practice of experimental psychology in one of the ways that that is done.

In contrast, the implementation of the (a) through (f) program described above cannot be expected to have any immediate practical advantage of these sorts, though of course, it cannot be guaranteed not to. The implementation of the program will have its primary value in relation to the more symbolic and emotional scientific concern for systematization and understanding of behavior. In this connection we may note that there is nothing in the IA formulation which refers to a particular medium in which IA processes must occur. No doubt our conceptual curiousity has been initially stimulated by the readily observable, naturally occurring behavior of biological organisms, just as our curiosity about (what we did not <u>then</u> know were) electromagnetic phenomena was originally stimulated by the easily observable and naturally occurring phenomena of lightning discharges, fireballs, and the peculiar behavior of iron filings. To restrict our study to such naturally occurring examples of behavior has apparently been as stultifying to efforts at conceptual understanding of behavior generally as it would have been, historically, if we had been content to stay with the analysis of iron filings or to develop methematical models for

predicting lightning discharges or to dispose of Euclid's geometry as a "mentalistic" version of the survey of the Nile delta. Perhaps, then, it is time to lay aside our preoccupation with the workings of protoplasmic machinery and, as behavioral scientists, devote some effort toward a general understanding of behavior.

In this regard, the linguistic data processing studies described below provide an entree to implementation. As P-type efforts, these illustrate a number of formats for the empirical "measurement" of meaning, and they are vindicated by their level of success in processing linguistic data. As O-type efforts, they provide an array of primary abilities which are potentially organizable in accordance with behavioral principles in a medium consisting of electronic and mathematical mechanisms and structures. As such, they are assimilable to the (a) through (f) program above and complement the Maximum Want model in that respect.

10.0 Research Procedures

Implementation of the IA formulation is not a matter of a "research program" in the familiar sense of a project defined by explicit technical objectives and carried out by recourse to familiar procedural and calculational paradigms. The procedures presented more or less briefly below are illustrative of preliminary efforts at technical implementation along the two major lines, described above.

10.1 The Maximum Want Model

This model (Mitchell, 1967) follows the logic of the IA formulation in representing an observer as one who follows rules in the judgments which he makes about other persons. Thus, it is a model of P in the PSO diagram. The Maximum Want model represents P as making judgments of the behavior of S according to the following rules:

1. Assessment of motivation: "S's strongest (hence operative) motivation is given by that Want for the achievement of which the performance he carried out was most suitable."

2. Prediction of behavior: "S will perform the behavior (a) which he knows how to carry out successfully, and (b) which is most suitable for the attainment of (c) the single want which is the most intense of the wants appropriate to the situation.

The kind of situation chosen for an empirical demonstration is defined by the hostility formula presented above (provocation elicits hostility unless...). Consider a situation in which P is about to observe S and O asks P what he would expect S to do under a given provocation (e.g., S is standing in line at a movie theatre and someone cuts in in front of him). What P is prepared to say about S in advance of observation reflects P's expectation with respect to the norms and social practices of a reference group (e.g. "our society"). If P is informed as to what S did under that provocation, then against the normative background, he has a basis for assessing S's motivation by reference to rule 1, above. He also has the beginning of a standard basis for an ID characterization of S. If O mentions another provocation situation and again asks P what he would expect of S, P now has more than simply normative material to go on. Under this condition, what he is now prepared to say about S reflects both his prior information about S and also the use of rule 2. (Rule 2 is a rather Dionysian model; a more Apollonian "Total Want model" was tried by Mitchell with comparable success.) As the cycle continues, P will have more and more information about S on which to base his expectation. At the same time, simple actuarial methods are not available to P, since each provocation is a new one, and the way in which prior information about S becomes relevant, if it in fact is, is not obvious, even given rule 2. Evidently, a more cogent specification of what P brings to the situation is required.

Part of P's contribution is represented by a case breakdown of the concepts of "hostile performance" and "hostile motivation." These are given in Tables 1 and 2. Non-hostile performances and motivations are included here, following the IA principle that treating something as an X is a case of treating it as being X rather than Y. Table 3 is a list of 10 provocation situations used in the study.

Insert Tables 1, 2, and 3 about here

Given the more detailed breakdown, P's normative expectations can now be represented more perspicuously also in the following form.

(a) An intensity rating of each of the Wants, on an absolute scale ranging from 0 to 20.

(b) With respect to each Want, an intensity rating, on the same scale, of the degree of constraint (counter-motivation) against acting to achieve that want.

(c) With respect to each of the performances, a rating, on a 0-20 absolute scale, of the likelihood of that performance being engaged in under the general life conditions which prevail.

(d) Intensity ratings as in (a) and likelihood ratings as in (c) for each of the fifteen provocation situations in Table 3.

(e) Ratings, on a 10-point scale, of the suitability (expected means-ends effectiveness) of each performance relative to each Want.

Since these ratings represent P's contributions to the description of S's behavior, they serve as an ID characterization (knowledge) of P. In addition, P categorized a number of specific responses to the 10 provocation situations, using the performances in Table 1 as categories. The responses included those reported by S, so that if P was told by O that what S did was "threaten A," O had the assurance that this was P's description of what S did. Thus, the categorization was a precautionary measure on O's part and not part of the ID characterization of P.

There were two major elements in the demonstration. The first was the criterion performance by P which consisted of ten cycles of question-answer-feedback. (Question by O: What would you predict S would do? Answer by P: ranking of performances from most likely to least likely. Feedback by O to P: What S did was performance n.) This was repeated for 10 different S's. This entire procedure was repeated for four P's, one of whom (P4) was a psuedo-subject whose data was generated by a random number generator. Table 4 shows the

Table 1. Performances which one might carry out if he were provoked to hostility by another person, A.

1. Hit, push, kick A
2. Use weapon against A
3. Insult A
4. Threaten A
5. Tell A to stop
6. Tell third party of feelings
7. Ask third party for help
8. Refuse to speak to A
9. Give A a dirty look
10. Leave situation
11. Other hostile performance
12. Ignore A and A's actions
13. Let A know he's not angry
14. Divert A's anger to a different target
15. Show A his behavior is unnecessary
16. Go along with A's behavior
17. Other nonhostile performance

Table 2. Things which one might want if another person, A, did something to provoke his hostility.

1 - 17. The performances (Table 1) considered as ends in themselves.

18. Harm A physically

19. Harm A emotionally

20. Harm A socially

21. Harm A financially

22. Prevent A from doing the same thing again

23. Prevent A from attaining his goals

24. Undo the effect of A's actions

25. Restore own status

26. Remove A from the situation

27. Refuse to associate with A

28. Make known own feelings

29. Destroy A

30. Other hostile want

31. Help A attain goals

32. Encourage A

33. Make A happy

34. Get other people to like A

35. Let A do the same thing again

36. Associate more with A

37. Other want incompatible with hostility

38. Achieve own original goal

39. Other nonhostile want

Table 3. Hostility-provoking situations, The person performing the provoking action is person A of Tables 1 and 2.

1. You are standing in a movie-ticket line when someone your own age and sex breaks into it in front of you.
2. After getting back an examination you find that it has been scored incorrectly. The instructor refuses to look at the paper.
3. You are sitting at a desk working intently and someone gives you a hard slap on the back, startling you.
4. Someone borrows a book of yours and denies having it.
5. The "hot" soup you ordered in a restaurant is served cold.
6. You are about to back into a parking place when someone pulls into it behind you.
7. An acquaintance makes an appointment to see you and fails to show up.
8. You see a child bullying a smaller child.
9. One member of your classes dominates the discussion and monopolizes class time with trivia.
10. You are studying intently in the library when some persons at your table begin to talk.

correlations among the four subjects in respect to their individual difference data.

Insert Table 4 about here

The second major element was the simulation of P's predictions (likelihood rankings) about S by the Maximum Want Model, given P's baseline judgments as the initial input to the model, and thereafter receiving the same information (what S actually did) as P received by way of feedback. The details of the operation of the Maximum Want model are given below.

10.1.1 Operation.

Definition of terms. Let

- i be the subscript designating a performance
- j be the subscript designating a want
- k be the subscript designating a situation
- c_{jk} be the estimate during situation k of the observed person's constraint against want j
- L_{ik} be the likelihood of performance i in situation k
- P_{ik} be the estimate in situation k of the general likelihood of performance i in any hostility-provoking situation
- p^*_{ik} be the specific likelihood of performance i in situation k
- S_{ik} be the estimated suitability of performance i successfully in situation k
- w_{jk} be the estimate in situation k of the intensity for the observed person of want j in any hostility-provoking situation
- w^*_{jk} be the estimated intensity for the average person of want j in situation k
- $\hat{W}^*_{jk}$ be the total intensity for the observed person of want j in situation k.

Further, let

- v be the subscript designating the observed performance

Table 4. Product-moment correlations between P's baseline judgments over all categories and situations.

	P1	P2	P3	P4
P1		.63	.61	.05
P2			.56	.10
P3				.07
P4				

$Q(W,m)$ be the function of the set of wants, W, and the set of integer numbers, m, such that the value of the function is the subscript of the want which ranks m in order of total intensity (W).

$T(P,m)$ be the function of the set of performances, P, and the set of integer numbers, m, such that the value of the function is the performance which ranks m in order of total likelihood (P).

$R(W,v,m)$ be the function of the set of wants, W, and the observed performance, v, and the set of integer numbers, m, such that the value of the function is the subscript of the want which ranks m in order of suitability for achievement by the observed performance, v.

Prediction. In each situation k, define:

$$\hat{W}_{jk} = \frac{w_{jk} + w^*_{jk}}{2} - c_{jk} \qquad (1)$$

where $w_{jk} = w'_{jk-1}$ and $c_{jk} = c'_{jk-1}$ (see equations (11) and (12)). That is, define the total intensity of want j in situation k as 1) the mean of a) the estimated want intensity of want j for the average person in situation k and b) the estimate in situation k of the intensity for the observed person of want j, minus 2) the estimate in situation k of the observed person's constraint against want j.

Then, define:

$$q = Q(W,1)$$

$$L_{ik} = S_{iq} \frac{p_{ik} + p^*_{ik}}{2} - c_{ik} \quad . \qquad (2)$$

That is, determine the want whose total intensity is the greatest for the observed person of all wants relevant in situation k. Define the total ability of the observed person to carry out performance i in situation k as 1) the mean of a) the estimate in situation k of the observed person's likelihood of carrying out performance i, and b) the estimated specific likelihood of carrying our performance i in situation k; person's constraint against wanting performance i. Finally, define the likelihood of performance i in situation k as 1) the suitability of the performance i as a means for achieving the most intense want, q, multiplied by 2) the total likelihood of the observed person carrying out performance i successfully in situation k.

Comparison of observed and predicted performances.

Let

$$t = T(P,1) \quad . \tag{3}$$

Then, if

$t = v$, go to situation $k + 1$

$t \neq v$, go to the revision of assessment.

That is, observe the performance carried out in situation k. If this is the performance which had been predicted, the assessment of the observed person on which the prediction was based is sufficiently accurate to remain unchanged, and is used to predict the performance in the next situation. If the observed performance had not been predicted, then the assessment of the observed person on which the prediction was based should be revised before the performance in the next situation is predicted.

Revision of assessment of observed person. Revise the assessment of the observed person's wants and constraints so that the observed performance would have been predicted by equations (1) and (2), but in a way which otherwise changes the want and constraint values minimally.

Let

$$\begin{aligned} d &= R(W,v,1) \\ e &= Q(W,1) \\ f &= Q(W,2) \quad . \end{aligned} \tag{4}$$

That is, take the want for the achievement of which the observed performance was most suitable to be the want which was most intense for the observed person in situation k. Let e be the want which had been judged most intense, and f the want which had been judged next most intense, before situation k was observed.

Then, define

$$G = \hat{W}_{ek} - \hat{W}_{dk} \quad . \tag{5}$$

That is, define the correction factor, G, as the difference between the total intensities of 1) the want considered before observation to be most intense, and 2) the want considered after observation to be most intense.

Then, define

$$w'_{dk} = w_{dk} + \frac{G}{2} \tag{6}$$

$$c'_{dk} = c_{dk} - \frac{G}{2} \quad . \tag{7}$$

That is, assign the greatest intensity to the want considered after observation to have been most intense by 1) adding half the correction factor, (G), to the estimated intensity of that want for the observed person, and 2) subtracting half the correction factor, G, from the estimated constraint for the observed person against that want.

Then, define

$$I = \hat{W}_{ek} - \hat{W}_{fk} \quad . \tag{8}$$

That is, define a second correction factor, I, as the difference between the total intensities of 1) the want considered most intense before observation, and 2) the want considered next most intense before observation.

Then, define

$$w'_{ek} = w_{ek} - \frac{I}{2} \tag{9}$$

$$c'_{ek} = c_{ek} + \frac{I}{2} \quad . \tag{10}$$

That is, make the want which had been considered before observation to be most intense into the second most intense want by 1) subtracting from the estimated intensity of that want for the observed person half of the second correction factor, I; and 2) adding to the constraint against that want for the observed person half of the second correction factor, I.

Then, standardize the want and constraint intensities:

$$w'_{jk} = \frac{s_w}{s_{w'}} \; w'_{jk} - (\bar{w} - \bar{w}') \tag{11}$$

$$c'_{jk} = \frac{s_c}{s_{c'}} \; c'_{jk} - (\bar{c} - \bar{c}') \tag{12}$$

where $\bar{w}$ is the mean, and s_w is the standard deviation, of w, the uncorrected estimates of intensities of wants for the observed person; $\bar{w}'$ is the mean, and $s_{w'}$ is the standard deviation, of w', the corrected want intensities, etc.

10.1.2 Results. The results of the simulation by the Maximum Want model of the four P's across 10 S's is shown in Table 5.

Insert Table 5 about here

In Table 5, submatrix I shows the correlations between the ranking (of performance likelihood by S's) made by the P's. These correlations show substantial individual differences in judgment, though in only one case, P1-P3, is the difference significantly greater ($P < .05$, two-tailed, $n = 2550, 1878$) than the baseline judgments.

Submatrix II shows the degree to which each simulator duplicates the rankings of the simulands. The underlined correlations in this matrix are the correlations between simulator and corresponding simuland. For the genuine P's these values range from .40 to .49 and are all significantly different from zero.

Submatrix III shows the correlations between simulators. Comparison of II and III shows that on the whole, the simulators resemble each other slightly more than they resemble their simulands.

10.1.3 Discussion. In discussing the Maximum Want model, Mitchell (1968) writes as follows.

> "The Maximum Want model is a nonlinear model, since the value of an item of information in this model is not invariant with respect to the values of other items of information. For example, only for the most intense want does a performance have an effective suitability, i.e. a suitability value which is taken into account in predicting behavior and assessing motivation.
>
> "There is a basic difference between the Maximum Want model and any previous {person-perception} model. In other models, the value of an item of information is assumed to be constant. The weights (if any) to be attached to the items are either assumed constant (e.g., Anderson, 1965b) or are assumed to change slowly from one fairly large sample of judgments to another while remaining constant within one sample (e.g., Hammond et al., 1966; Peterson, Hammond, and Sommers, 1965).
>
> "In the Maximum Want model, on the other hand, the values of the elements on which the judgment is based can change. To change the values of such parameters as want intensities and performance suitabilities, which correspond in some sense to items of information or cues in other models, seems to be as conservative as the more traditional approach. For example, it seems likely that an observer's estimate of the motivation of the one he observes might change drastically on the basis of observing even one performance. Previous models present a static

Table 5. Product-moment correlations between rankings of likelihood of performance over 10 S's in all 15 situations. SP1 indicates simulation of P1, SP2 the simulation of P2, etc.

	I				II			
	P1	P2	P3	P4	SP1	SP2	SP3	SP4
P1		.55	.47	.01	.49	.36	.30	-.01
P2			.54	.00	.49	.40	.29	-.03
P3				.00	.31	.21	.42	-.06
P4					.02	.04	.02	.04
SP1						.59	.45	.03
SP2							.27	.14
SP3								.00
SP4								

III

description of the observer's fluctuating estimates of the motivation of the one he observes; the Maximum Want model is a dynamic description of such estimates.

"In yet another respect the Maximum Want Model is a different kind of model from many others. The Maximum Want model is radically psychological rather than mathematical. It is the symbolic representation of a psychological explanation for the phenomena of person perception, rather than an algorithm for the solution of problematical relations among quantitative aspects of such phenomena.

"The model proposed here is therefore not an isolated development; it is representative of a general approach to model building, i.e., the portrayal of a rule-following psychology (Ossorio, 1966). Different models, all employing the same parameters, but differing in the rule describing how such parameters are to be combined, might well be developed. A model portraying the rule that a person will perform the action most suitable for achieving many of his wants, rather than the single most intense want of the Maximum Want model, has already been developed. One might model still other rules, e.g., that estimated abilities to carry out performances change more quickly than estimated intensities of wants. Indeed, although the Maximum Want model is nonlinear, there is no constraint in this general approach against a linear model, provided that a psychologically reasonable linear rule be specified. In sum, the Maximum Want model, and models of the rule-following class in general, seem to promise a greater breadth of application than do models previously suggested."

Mitchell's reference to the model as being psychological rather than mathematical is entirely apropos. There are a fair number of numerical operations carried out in the operation of the model, but the mathematical conceptual systems in which these operations have their primary definition and significance are not here part of the conceptualization of the phenomenon. This is why I referred earlier to "electronic and mathematical structures and mechanisms" as the <u>medium</u> which was to be organized on behavioral principles. We identify these as "mathematical" operations because we have no other way of identifying them, just as we identify a certain familiar smell as "the smell of bacon" because that is the only way we have of identifying it (see Ossorio, 1966, Part I, for a discussion of "part description" and "partial description," which are involved in paradigm case methodology). But, just as that smell can be present in a room for unbaconlike reasons, <u>these</u> numbers and operations are present for unmathematical reasons. In the spirit of the Red Queen, we may say that these numbers and operations are there because they will behave in the way we want them to from a behavioral point of view, and if they do not, we will have their heads and replace them with numbers that will. Since

mathematics and mechanisms are gross anthropomorphisms to begin with, it does not require a great deal of imagination to take elementary components of these sorts and arrange them in such a way that they have a behavioral significance -- so long as we have some notion as to what behavioral significance amounts to.

As to the results shown in Table 5, it does appear that some new numbers are called for. However, the Maximum Want model presented above does not represent the current state of the art. It was the prototype and has undergone several changes, but is presented here because the empirical results are available. Some of the modifications involve (a) a decision table for selecting performances rather than the single rule, taking account of both absolute and differential suitabilities, want intensities, and constraints, (b) treating performances separately from other wants, and (c) predicting only the three (or n) most likely performances and evaluating goodness of simulation on the basis of either (1) degree of similarity between predicted and actual performances or (2) seriousness of error in predicting a given performance when a given other performance is the one that occurs; either of these may involve the kind of psychometric procedure exemplified in the linguistic data processing procedures described below.

It should be noted that, unlike many simulations, the Maximum Want model, SPN, does not achieve its results on the basis of feedback as to how well it is simulating its target, PN. The reason for this is that the aim of SPN is to duplicate PN's judgments, not to simulate them, and since PN's judgments are not in general based on what PN's prior predictions have been, neither are SPN's. The aim at this point is not accuracy, but the demonstration of a reasonable starting point for implementing the ID reconstruction described above. Since SPN represents a variety of oversimplifications, it would be extraordinary, extremely suspicious, and discouraging if it did not leave substantial room for improvement. The elaboration along ID lines would be expected to increase the diagonal values in submatrix II of Table 5 and to reduce the method variance which is evident in submatrix III.

10.2 The Maximum Want Model: ID Elaborations

In a separate study, Mitchell (1968) introduces a formula for modifying SP's prediction on the basis of a trait assessment of P. The idea here is that P's predictions are based on his assignment of values to the parameters of action for S and that these assignments are a function of P's status with respect to trait h (hostility) as well as the information available about S. In that case, some of the differences among predictions made by a set of P's could be attributed to their differences with respect to trait h. It would be expected, therefore, that if parametric value assignments by SP's were adjusted so as to compensate for the differences among the P's with respect to trait h, the predictions which would result therefrom would be more

homogeneous than the original SP predictions based on the original data provided by the P's. The desired adjustment could be made if the specific function relating the value of h for P to the modification of parametric value assignments by P were explicitly stated.

In the present study, h was the trait of hostility, and the trait assessment of the hostility of a given P was obtained by pooling information obtained from other P's who formed the other members of five-man interaction groups. Ratings of hostility were made on a seven-point absolute scale.

10.2.1 The Maximum Want Model: Statement of a Trait Function.

Let

a be the subscript designating a subject

H_a be the rated hostility of subject a

$\bar{H}$ be the mean rated hostility of all Ss

s_H be the standard deviation of the rated hostility of all Ss

Z_j be the rated hostility of want j

$\bar{Z}$ be the mean rated hostility of all wants

s_j be the standard deviation of the rated hostility of all wants.

Then, if for subject a

$$\bar{H} - .5s_H < H_a < \bar{H} + .5s_H$$

execute the simulation without changing any parameter values. That is, if the observer is neither unusually high nor unusually low in hostility, accept the original judgments of parameters without change.

But, if for subject a

$$H_a \leq \bar{H} - .5s_H$$

or if

$$H_a \geq \bar{H} + .5s_H$$

define

$$G = t \frac{|\bar{H} - H_a|}{\bar{H}} \qquad (13)$$

where t is a weighting factor to be empirically determined. That is, if the observer is rated unusually low or high in hostility, define an adjustment factor, G, proportional to the extremeness of his rated hostility.

Then, remembering that

i is the subscript designating a performance

j is the subscript designating a want

k is the subscript designating a situation

S_{ij} is the suitability of performance i as a means for achieving want j

w_{jk} is the estimate in situation k of the intensity of want j for the observed person in any hostility-provoking situation

w^*_{jk} is the estimated intensity for the average person of want j in situation k,

if

$$H_a \leq \bar{H} - .5s_H$$

define

$$w_{j1} = w_{j1} + (w_{j1}G) \tag{14}$$

$$w^*_{jk} = w^*_{jk} + (w^*_{jk}G) \tag{15}$$

$$S_{ij} = S_{ij} + (S_{ij}G) \tag{16}$$

for all i such that

$$Z_i \leq \bar{Z} + .5s_H \tag{i}$$

and for all j such that

$$\bar{Z} - .5s_Z < Z_j < \bar{Z} + .5s_Z \tag{ii}$$

That is, if the observer is unusually low in rated hostility,
1) increase the values he has assigned for moderately hostile want intensities by an amount which is a function both of the intensity rating he made and the adjustment factor, G, for his trait hostility;
2) increase the values he has assigned to the suitabilities of low and moderately hostile performances for achieving moderately hostile wants by an amount which is a function both of the suitability rating he made and the adjustment factor, G, for his trait hostility.

Or, if

$$H_a \geq \bar{H} + .5s_H$$

define

$$w_{j1} = w_{j1} - (w_{j1}G) \tag{17}$$

$$w^*_{jk} = w^*_{jk} - (w^*_{jk}G) \tag{18}$$

$$S_{ij} = S_{ij} - (S_{ij}G) \tag{19}$$

for i and j as defined in inequalities (i) and (ii). That is, if the observer is unusually high in rated hostility, 1) decrease the values he has assigned for the intensities of moderately hostile wants by an amount which is a function both of the intensity rating he made and the adjustment factor, G, for his trait hostility; and 2) decrease the values he has assigned for the suitabilities of low and moderately hostile performances for achieving moderately hostile wants by an amount which is a function both of the suitability rating he made and the adjustment factor, G, for his trait hostility.

The adjusted SP predictions were found to be significantly more homogeneous than the original predictions.

10.2.3 Statement of an Ability Function. A. O Putman (1969) has elaborated the Maximum Want model to include an ability function, namely, the ability to deal with provocation situations successfully. This ability appears in two places. First it is directly part of P's assessment of S. The modified SP predicts S's behavior on the basis of some new decision tables which incorporate an analysis of how S's behavior in the provocation situations is a function of his ability to deal with that kind of situation successfully. Second, it is one of the personal characteristics which in some circumstances has a selective relation to P's behavior of assessing S. The modified SP modifies the original prediction of S on the basis of an assessment of P's ability.

In the present elaboration, ratings of the ability to satisfy a given want in a provocation situation, both for the average person and for a given P, are designed to be obtained through a rating procedure analogous to Mitchell's. In the present experimental setup, P (and of course, SP) are given information regarding the outcome (Achievement parameter of IA) of S's performance, which is classified as successful or unsuccessful.

"Cluster Scores" are obtained for each Want by factor analyzing the previously obtained matrix of judgments of the suitability of each performance as a means of achieving each Want. For present purposes, two Wants are defined as being in the same cluster if they both have a

factor loading greater than .50 on the same factor. The following description was prepared with A. O. Putman.

(a) The Ability Function

Let

i be the subscript designating a performance

j be the subscript designating a Want

k be the subscript designating a situation

A_j be the estimate of S's ability to satisfy Want j in any hostility-provoking situation

D_j be the estimate of the ability required to satisfy Want j successfully.

U(P,m) be the function of the set of performances P and the set of integer numbers m such that the value of the function is the performance which ranks m in order of suitability for the achievement of the operative want.

Other terms are as defined in section 10.1.1.

Prediction: In each situation, k, define

$$W_{jk} = \frac{W_{jk} + W^*_{jk}}{2} - C_{jk} \qquad (1)$$

as previously. Then predict the performance from the decision table in Figure 3.

Insert Figure 3 about here

That is, determine the want, q, whose total intensity is the greatest for S of all the wants which are relevant in situation k. That want will be acted on unless S lacks the ability to satisfy that want, or in any case if want q is much more intense than any other want. The performance, u, most suitable for the attainment of the operative want is then selected unless S lacks the ability to carry out that performance successfully, or unless the constraint against that performance is greater than the total intensity of the operative want. In cases where performance u is much more suitable than any other performance it will be selected even if S is lacking in the ability to carry it out successfully, or the constraint against it is higher than the total intensity of want q.

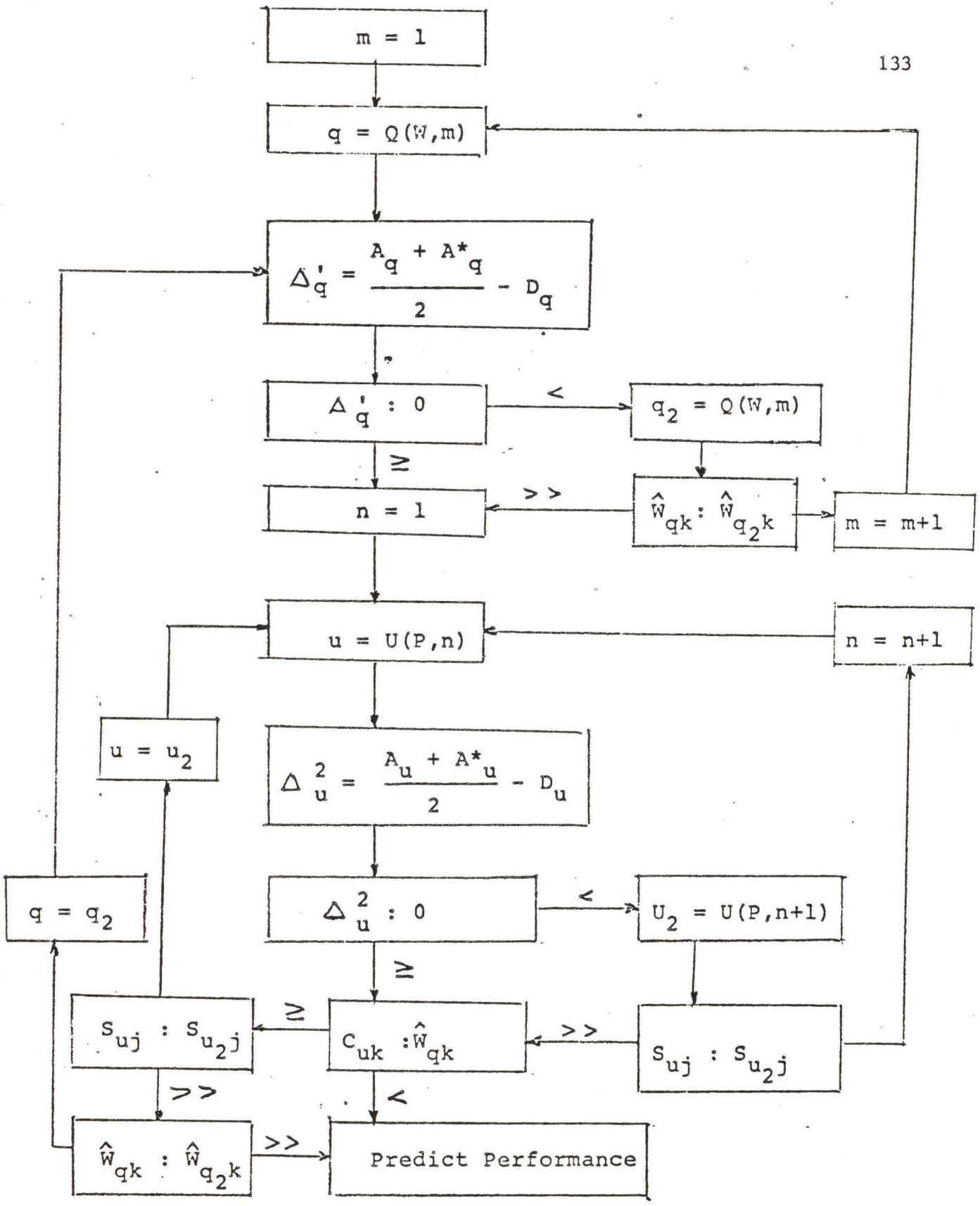


Figure 3. Decision table for ability function

Revision of Assessment of Observed Person. P's want, constraint, and ability estimates with respect to S are revised upon feedback as to what S was observed to do. The revised estimates are such that given the new estimates, the decision table in Figure 3 would have predicted both performance and outcome. This yields a two by two decision table for revision. Revision rules are as follows.

Case 1. Performance predicted; outcome successful. In this case, no revision is made unless the outcome was predicted to be unsuccessful, i.e., in either of the two cases (20) or (21), below,

$$\frac{A_q + A^*_q}{2} < D_q \tag{20}$$

or

$$\frac{A_u + A^*_u}{2} < D_u \tag{21}$$

remembering that q is the subscript of the operative want and u is the subscript of the most suitable performance. If inequality (2) is the case, A_q is increased such that now

$$\frac{A_q + A^*_q}{2} = D_q \tag{22}$$

If inequality (21) is the case, A_u is increased such that now

$$\frac{A_u + A^*_u}{2} = D_u \tag{23}$$

Case 2. Performance predicted; outcome unsuccessful. Here, no revision is made unless a successful outcome was predicted, i.e., both

$$A_q = A^*_q \geq D_q \tag{24}$$

and

$$\frac{A_u + A^*_u}{2} \geq D_q \tag{25}$$

In this case, A_u is decreased such that now

$$\frac{A_u + A^*_u}{2} = 1.1 \times D_u \tag{26}$$

Case 3. Performance not predicted; outcome successful. Here, revision is carried out at reported above for the Maximum Want model, in equations (4) to (10), with the following modification. Remembering that d is the subscript of the want for the achievement of which the observed performance is most suitable, the values of A_q and A_u in inequalities (20) and (21) are checked. If (20) holds, equation (22) is used to revise A_u.

Further, if W_q and W_d, the "predicted" and "observed" wants are not in the same cluster, revise A_q such that now

$$\frac{A_q + A^*_q}{2} = 1.1 \times D_q \qquad (27)$$

Case 4. Performance not predicted; outcome unsuccessful. In this case, revisions are made as in case 3, except that A_d and A_u are checked in inequalities (24) and (25), respectively and A_u is revised by (26) if that is appropriate.

Finally, want and constraint intensities are standardized according to equations (11) and (12).

(b) An Ability Function for the Observer.

Let

a be the subscript designating an observer, P

$A_{a,j}$ be the rated ability of P to satisfy want j

$\bar{A}_j$ be the rated ability of all P's to satisfy want j

S_{Aj} be the standard deviation of the ability to satisfy want j

Then if for an observer, a, and want, j, $\bar{A}_j - .55_{Aj} < A_{a,j} < \bar{A}_j + .55_{Aj}$ execute the simulation with $A^*_j = \bar{A}_j$, That is, if this P is neither high nor low in ability j, employ the mean rated ability to satisfy want j as the initial estimate of S's ability.

However, if for observer a $A_{a,j} \leq \bar{A}_j - .55_{Aj}$ revise the estimate of A^*_j such that

$$A^*_j = \frac{\bar{A}_j + A_{a,j}}{2} \qquad (29)$$

or

$$A^*_j = \bar{A}_j - \frac{H_{a,j} - \bar{A}_j}{2} \qquad (30)$$

That is, if this P is unusually high in ability to satisfy want j, either increase (29) or decrease (30) his initial estimate of S's ability as a function of P's own ability.

The decision between (29) and (3) is made by considering the cluster pattern of abilities. Let W_x be any other want in the same cluster as W_j. If for any such want $| \bar{A}_j - \bar{A}_x | \leq .55_{Aj}$ then equation (29) is used. Otherwise (30) is used.

10.3 Iteration Possibilities in a Three-person Situation

Let us consider first a variation of Mitchell's procedure in the trait hostility study and then a generalization.

Let A, B, and Q each describe the other two in terms of an individual difference function, h, where h = the trait of hostility. Let g be an individual difference function of which the giving of the description "h" is an expression. As part of our initial special case, let g be identical with h. Thus, each of the three individuals gives trait hostility descriptions of the other two, but also the making of such judgments is itself a function of the trait hostility of the individual making the judgments. And let each judgment be made in a rating scale format with a simple metric 0-8 and scale categories anchored by descriptive statements, e.g., "3" = "moderately hostile" and "8" = "as hostile as could be."

If we represent the judgment of A by B with respect to the characteristic h as h_{AB}, our primary data consists of numerical values for h_{AB}, h_{AQ}, h_{BA}, h_{BQ}, h_{QA}, and h_{QB}.

Let f be a numerical function which expresses Δh_{ij} as a function of g(j). That is, the observer's description is not a simple function of his own degree of trait hostility; rather, his description is, in general, different in certain respects from what it would have been had his own hostility been different (recall the analysis of state and status functions in section 3). For simplicity, we shall say that $h_{ij} = f(g_j)$.

Let the initial estimates of g_A be given by $(h_{AB} + h_{AQ})/2$, and similarly for g_B and g_Q. Our primary data is now adjusted as a function of these values of g_A, g_B, and g_Q. For example, the new value of h_{AB} is given by $f(g_B)$, the new value of h_{QA} is given by $f(g_A)$, etc.

Since the original values of g were a function of the original values of h, we now have an iteration cycle which either converges to stable values of h and g or it does not.

Suppose that it does converge and that it converges to the same values for A, B, and Q when a fourth, and then a fifth, and then a nth individual is added, and that these results will also be found for any set of individuals, including the investigator, who might be selected for the A, B, and Q roles. Under these conditions, the investigator would approach negotiations from a position of strength: "If the state of affairs regarding those individuals and their personal characteristics had been as given by the final iteration, and if the function, f, relating g to h were as I have indicated, and if these were the only relevant circumstances, then you would see these individuals behave in just the way they did." What is potentially generalizable is, of course, the function, f. And the final iteration is the personification (the impersonification?) of our folk hero, the unbiased, objective observer with whom, just because he does tell it like it is, we are under some obligation to agree. Our hero is not, of course, a candidate for the role of A, B, or Q, and we might be curious as to what his fate would be if he were cast in the role of S in Mitchell's first study.

Of course, results of the sort described would be extraordinary. Still, we can imagine a number of weaker results which might be of some interest. For example, convergence might be obtainable for any set of individuals without its being a convergence to the same values. Or again, instead of a simple identity between g and h, we might have a closed set h_i and g_i such that each g_i could be estimated from a subset of h's and each h_i could be expressed as a function of a subset of the g's. Finally, in the complete person description, such a set of h_i would, once more, be identical with the set of g_i.

However, as soon as we take explicit account of other ID functions, it is quite clear that we may in general expect to find a number of equivalent solutions to the problem of accounting for particular behaviors of particular persons. For example, S may fail to do X either because he couldn't, because he didn't want to, or because he didn't recognize the opportunity. And additional observation may not settle the issue, since, for example, his inability to do X may be the result of a temporary state brought on by an emotional conflict (so he didn't want to, after all) or his lack of motivation might reflect a deficit state or a pathological state (so he couldn't, after all). If there are equivalent solutions, which shall an individual pick? Well, according to his ability to treat something as being of <u>that</u> sort, and according to how much he wants to treat something as being of that sort, etc. So we have reached an ABQ disagreement and iteration situation again.

Fortunately, we do not have an infinite series of such developments to look forward to. The ID system is a system and the set of g's is the same as the set of h's. There is not one conceptual system for describing persons differentially and another set for describing their disagreements and negotiations with one another. Their disagreements and negotiations are simply their type X behaviors and as such, their idiosyncracies in this regard are simply codified by ID functions. It was not a tremendous coincidence that in considering relevant ID variables for judgments of trait hostility that very trait was one of the relevant variables.

10.4 Symbolic Behavior and Linguistic Data Processing

When all is said and done, the simulation program is a computer program and it is subject to the well-studied limitations of computability. These limitations have exercised a powerful hold on our imaginations in regard to what can be done with computers, and how, precisely because of the mathematical character of the theory in which they are demonstrated. The formulation, above, of the concepts of verbal behavior and symbolic behavior directs our attention to certain possibilities for circumventing the limitations of computability in practice without having to challenge them in theory. To date the major empirical exploration of these possibilities has been accomplished in the form of a series of studies in linguistic data processing in which one of the principal aspects is the use of psychometric procedures in dealing with meaningful verbal behavior. Since the empirical effectiveness of these procedures is a significant methodological aspect of their symbolic employment, the two sets of studies are presented first simply as data processing studies and their further significance is discussed afterward.

10.4.1 Psychometric Procedures. The following is a schematic presentation of the elements of a psychometric treatment of particular classes of verbal behaviors. Heuristically, we may think in terms of a two-dimensional array of data defined by the two sets of marginal elements. Let us denote one such set as, simply, Elements, and the other as Variables. The array of data is thus one in which the variables can be intercorrelated and the correlations factor analyzed.

Elements and Variables may be simple or complex. For example, we will encounter a case where one set of elements is an ordered pair and the other is a two-place relation.

Next, let us consider a two-place functor (Carnap, 1958, p. 71 ff.), having the form of f(E,V). Finally, let f be restricted to functors which designate simple quantities, so that in all cases f(E,V) = n, where n is a number.

The functor formulation provides a relatively general format for collecting quantitative data concerning verbal behavior which can then be dealt with in further quantitative ways. From the point of view of P, "f(E,V) = n" is something which S is prepared to say, and different S's will be distinguished by the value assigned to n. Thus, for example,

"$f_1(E,V)$" = "the degree to which E is characterized by V"

"$f_2(E_1E_2,V)$" = "the degree to which it is appropriate for E_1 to engage in behavior V with respect to E_2"

"$f_3(E,V)$" = "the degree to which E is likely to be a part of V"

"$f_4(E,V)$" = "the degree to which E is suitable as a means to V"

"$f_5(E,V_1V_2)$" = "the degree to which V_1, as opposed to V_2, applies to E"

"$f_6(E,V)$" = "the degree to which V is an important dimension of variation for E"

"$f_7(E,V)$" = "the degree to which a case of E is primarily a case of V"

"$f_8(E,V)$" = "the degree to which E is relevant to V"

"$f_9(E,V)$" = "the degree to which E and V are similar in meaning

Thus, the "measurement of meaning" is a kind of procedure which is limited only by the number of meaningful questions of this general sort that can be asked of S by P. This suggests a new complexity problem, to which we shall return later.

If the variables are intercorrelated and the correlation matrix is factor-analyzed, the result is an N-dimensional Euclidean space which serves as a representation of the set of variables V. To the extent that these variables are representative of the second domain of f, so also is the Euclidean space. {Following Carnap, 1958, the second domain of a relation R (mem_1, mem_2) is the class of members of mem_2.} Thus, if $f = f_9$, the space in question is a "meaning space"; if $f = f_8$ (with the further specification that V_1 is a field of knowledge) then the space in question is a "subject matter relevance" space; if $f = f_1$ it is a "property space," and if $f = f_5$ (with the

further specification that V_1 and V_2 are polar-opposite adjectives) it is the "semantic space" of Osgood, et al. (1957).

Given judgments of the form f(E,V) = n, for all the V elements in the marginal set (or a selected subset of these) an Element, E, may be "located" in the f space by being assigned a set of coordinate values for that space. This will hold not merely for the Elements of the original data matrix but for any other member of the first domain of f for which the information f(E,V) = n is available.

Since the correlations from which the factor analytic representation is derived are based on variation, the factors (the reference axes in the f space) correspond to independent (considering orthogonal factors only) ways in which members of the original set of E's differ from one another. Thus, the geometric representation is a parametric representation of the members of the first domain of f.

Note that the procedure described thus far does not imply any of the following:

(a) that the numerical assignments by S are correct or that they are not or that correctness vs. incorrectness is one of the parameters of such assignments.

(b) that the members of E or V are drawn from a population having any particular mathematical characteristics

(c) that the numerical scale format in which the judgments f(E,V) = n are rendered is a nominal, ordinal, or ratio scale or has any scale properties whatever.

(d) that there is any process of making the judgment f(E,V) = n or that the making of that judgment is a multidimensional procedure.

(e) that the factors represent genotypic variables or causal influences

(f) anything else whatever other than tautologies.

This is to say that, as a procedure, it carries with it no truth claims whatever. This characterization is in line with the approach outlined in section 8.0 in which we go from L_{i+1} to B_A and devise B_E only in the light of B_A. What we have described so far is some general aspects of B_A and the issue of precautions has not arisen. The non-mathematical use of numbers and mathematical operations is a special case of the strategy of going directly from L_{i+1} to B_A. We will see this strategy exemplified further in the studies which follow.

10.4.2 Case I: The Classification Space Studies. This group of studies is reported elsewhere (Ossorio, 1966) in some detail. The presentation here is illustrative only. The substantive problem dealt with is one which is familiar to all members of the academic community, i.e., the increasing sense that the battle has already been lost when one tries to use the library subject matter index to locate material which is relevant to a task at hand. The general tenor of the studies may be found in the following abstract.

Abstract

A conceptual approach to linguistic data processing problems is sketched and empirical illustrations are presented of the major software components--indexing, storage, and retrieval--of a document processing system which offers, in principle, the advantages of complete automation, unlimited cross-indexing, effective sequential retrieval, sub-documentary indexing reflecting heterogeneity of subject matter within a document, and a procedure for automatically identifying retrieval requests which would be inadequately handled by the system.

The indexing schema, designated as "Classification Space" consists of a Euclidean model for mapping subject matter similarity within a given subject matter domain. A schema of this kind is empirically derived for certain fields of Engineering and Chemistry. A set of five related empirical studies provide convincing evidence that when appropriate experimental procedures are followed a very stable C-Space for a given content domain can be constructed on a surprisingly small data base.

Other empirical studies demonstrate specific computational procedures for effective automatic indexing of documents in a C-Space, using a relatively small system vocabulary. One study demonstrates that a C-Space maps subject matter relevance as well as subject matter similarity, and thereby promotes effective sequential retrieval; this result is also shown under conditions of automatic indexing.

Negative results are found in an attempt to use the structual linguistic distinction of subject and object as a means of improving techniques for automatic indexing.

For our present purposes the following portions will be most relevant: (a) An example of instructions to S for making the f(E,V) = n judgments; (b) a Classification Space factor analysis; (c) the formula for automatic indexing; and (d) an empirical demonstration of effective sequential retrieval. These are presented in the following sections.

10.4.2.1 Classification Space Instructions

The purpose of this procedure is to obtain quantitative estimates of the degree to which a selected group of scientific and technical fields overlap in their subject matter.

This is accomplished by having people make judgments about a set of "sample items" in relation to a field of knowledge in which they are competent. The sample items include words, phrases, sentences, and paragraphs selected randomly from the literature of the fields which we are investigating.

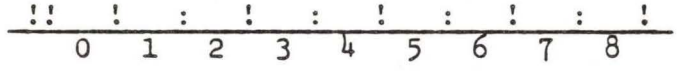
Your basic task in rating each sample item is to decide the degree to which the content of the sample item is relevant to the field of _____.

Your decision for each sample item is expressed by making a checkmark on the numerical scale which accompanies each sample item. The use of the scale is explained on the next page.

Rate each sample item independently with respect to your field. Do not try to take account of any relationship which the item may have to any other field--that will be done by people who are rating with respect to the other fields. Do not try to take account of how you have rated other sample items.

The Scales

You will be using scales like this one:



In general, the more relevant the sample is to the field you are judging, the higher the number of the scale position you should mark. Use the following as a guide to the use of specific scale positions.

The sample item has no particular significance for this field; it is essentially irrelevant.

Mark !! ✓ !
0

The sample item may have some relevance to the field, but it would have to be regarded as peripheral, tangential, or incidental. Ordinarily, you wouldn't associate it with this field. Under these conditions:

If less relevant, mark ! ✓ :
1

If more relevant, mark : ✓ !
2

The sample item does have some relevance, but it is of a borderline nature. For example, the sample item might be primarily an ordinary English expression which happens to have some bearing on the content of the field; or it might fall in a "fringe" content area about which there is some question as to whether it should "really" be included in the field; or it may refer primarily to general scientific methodology rather than specifically the subject matter of this field. Under these conditions:

If less relevant, mark $\frac{! \checkmark :}{3}$

If more relevant, mark $\frac{: \checkmark !}{4}$

The sample item is quite relevant to the subject matter of the field. It refers to objects, concepts, or processes, etc., which are definitely part of the subject matter of the field.

If less relevant, mark $\frac{! \checkmark :}{5}$

If more relevant, mark $\frac{: \checkmark !}{6}$

The sample item is highly relevant to this field. For example, it may be a technical term representing a very refined distinction in which a great deal of the conceptual apparatus of the field is implied. Or it may be a sentence or a paragraph which mentions or implies a number of relevant concepts or which states facts or conclusions which are very significant for people in the field.

If less relevant, mark $\frac{! \checkmark :}{7}$

If more relevant, mark $\frac{: \checkmark !}{8}$

10.4.2.2 Classification Space Factor Analyses

Given the description of procedure above (10.4.2) a factor analytic study of this sort is given schematically by a specification of the functor f, the sets of elements E and V, and the factor results. As is evident from the instructions, f in this case is a subject matter relevance relationship and is therefore a variant of f_8, above. The elements V are a set of fields of knowledge which, collectively, define a subject matter domain. The set of 24 fields is given in Table 6. The set of elements V was a set of 288 technical terms, 12 from each of the 24 fields. The set of 12 terms for a given field was obtained by a quasi-random selection from a corpus of six 6-paragraph

passages selected as representative of that field by a person with graduate-level training in that field. The method of analysis was Comrey's Minimum Residual method of extraction and the rotation employed the Kaiser Varimax criterion.

Insert Table 6 about here

The data matrix consisted of pooled judgments by various S's. For each field 3-5 judges (in most cases, the number was 3) were selected on the basis of professional experience and training. Each judge rated all 288 terms in regard to their relevance to his field of competence. Ratings of the several judges in a single field were pooled, so that the data collected from 77 judges was compacted to a data matrix where V = 24 and E = 288.

Table 7 shows the results of several factor analyses, of which the present one is Analysis G. The results are presented in this unusual form in order to facilitate the comparison of results for Analyses A to G which differed from one another in regard to the size of the sample of technical terms taken from the corpus of each field. Sample size ranged from $N_A = 3$ to $N_G = 12$. All the results show six major factors and one or two minor factors. The degree of matching between factor loadings in different analyses is shown by the fact that of 126 different pair comparisons, the smallest coefficient of congruence (Harmon, 1960) was .97. Qualitatively the pattern of factor loadings is entirely intelligible and unproblematical.

Insert Table 7 about here

The exploration of the sample size parameter was one of several precautionary steps taken in connection with the Classification Space construction. Stability of the factor results was shown not only under changes of sample size, but also under a different selection of terms from the same corpus, under a selection of terms from a different corpus arrived at by the same method, under a variation in the method of factor extraction (Minimum Residual to Maximum Likelihood), under a change in the judges, and finally under all these variations simultaneously. The order of correspondence was quite comparable to the degree of agreement shown in Table 7 among Analyses A to G. Thus, these results stand as one of the most stable set of factor results ever reported in the factor analytic literature, and they were obtained under less than optimal conditions since no effort was made to maximize the correspondence in the course of the rotation procedure.

Table 6. Classification Space Fields

*	1.	Electric Machinery
	2.	Power Transmission
	3.	Instrumentation
	4.	Radar
*	5.	Field Theory
	6.	Audio Engineering
	7.	Power Generation and Distribution
	8.	Solid State Engineering
	9.	Telephony
*	10.	Aircraft Structures
*	11.	Aerodynamics
	12.	Aircraft Design
	13.	Air Properties
	14.	Beam Theory
	15.	Catalysis
*	16.	Self-Consistent Field Theory (SCF)
	17.	Fluctuations and Brownian Movement
*	18.	High Energy Nuclear Chemistry (HENC)
	19.	Dipole Moment and Polarizability
	20.	Drugs and Poisons
*	21.	Biosynthesis
	22.	Structural Polysaccharides
*	23.	Simple Lipids
	24.	Enzymes

Table 7. Classification Space Factor Results

Factor I Atomic and Subatomic Dynamics

Analysis							Field
A	B	C	D	E	F	G	
.672	.720	.717	.810	.804	.790	.796	Dipole Moment and Polarizability
.450	.712	.730	.543	.746	.710	.722	Self-Consistent Field Theory
.417	.433	.612	.539	.583	.600	.610	Solid State Engineering
.541	.533	.335	.652	.518	.627	.599	High Energy Nuclear Chemistry
	.552	.456	.426	.642	.508	.569	Field Theory
.415	.537	.352	.769	.574	.508	.541	Fluctuations and Brownian Movement
.467	.281	.223	.475	.382	.384	.413	Catalysis
	.300	.327		.377	.332	.354	Radar
		.297					Instrumentation

Factor II Electronic Machinery

Analysis							Field
A	B	C	D	E	F	G	
.830	.749	.769	.754	.703	.782	.754	Audio Engineering
.802	.708	.723	.522	.630	.714	.675	Instrumentation
.577	.637	.743	.569	.651	.656	.643	Telephony
.735	.638	.677	.505	.577	.677	.601	Radar
.689	.550	.480	.454	.445	.501	.483	Solid State Engineering
.522	.520	.441		.359	.446	.377	Field Theory
.606							SCF

Factor III Molecular (Fluid Dynamics)

Analysis							Field
A	B	C	D	E	F	G	
.848	.871	.800	.863	.862	.890	.884	Aerodynamics
.844	.821	.787	.829	.817	.812	.882	Air Properties
.742	.784	.598	.800	.725	.764	.740	Aircraft Design
.635	.606	.564	.420	.487	.587	.536	Fluctuations and Brownian Movement

Factor IV Aircraft Structure

Analysis							Field
A	B	C	D	E	F	G	
.881	.895	.921	.885	.888	.896	.898	Aircraft Structures
.873	.878	.832	.872	.864	.884	.879	Beam Theory
.456	.444	.652	.409	.516	.429	.481	Aircraft Design
		.461					Aerodynamics

Table 7, Page 2

Factor V Biological Chemistry

Analysis							Field
A	B	C	D	E	F	G	
.921	.911	.876	.923	.912	.904	.914	Biosynthesis
.907	.913	.867	.887	.904	.899	.903	Enzymes
.782	.813	.799	.815	.760	.841	.815	Drugs and Poisons
.612	.637	.718	.709	.649	.708	.694	Simple Lipids
.623	.645	.264	.688	.527	.584	.557	Catalysis
.502	.500	.495	.578	.458	.572	.515	Structural Polysaccharides

Factor VI Electric Machinery

Analysis							Field
A	B	C	D	E	F	G	
.806	.818	.833	.877	.859	.810	.830	Electric Machinery
.800	.771	.831	.838	.857	.784	.824	Power Transmission
.782	.806	.808	.852	.821	.807	.807	Power Generation and Distribution
.428	.372	.354	.537	.432	.398	.425	Telephony
	.344	.249	.404	.342	.311	.323	Instrumentation
		.351	.351	.365			Audio Engineering

Factor VII Field Theory

Analysis							Field
A	B	C	D	E	F	G	
.530		.447	.705	.352	.370	.372	Field Theory
		.388	.486	.359	.189	.331	Radar
			.603				Self-Consistent Field Theory

Factor VIII Minor Factor

Analysis							Field
A	B	C	D	E	F	G	
	.325			.406			Simple Lipids
	.253						Drugs and Poisons
		.587					Catalysis
		.548					High Energy Nuclear Chemistry

10.4.2.3 A Formula for Automatic Indexing

The psychometric procedure for f(E,V) = n is such that indexing of documents in a library could logically be done on this basis, with each document comprising one of the elements E. However, the dimensions of the library problem are such that a genuine technical solution appears to require nothing less than completely automatic indexing in the sense that the routine indexing operation is "untouched by human hands." The major clue as to how to proceed comes from a consideration of how a person decides what the degree of relevance is of a given document to a given subject matter field. Crudely speaking, the answer is, he reads the document. Thus, the notion is generated that if a system vocabulary of technical terms is indexed on the basis of human judgment, those terms and their indices (coordinate values) can be used to index automatically an indefinitely large number of documents in which those terms appear. Of course, this requires an effective formula for calculating a single set of indexing coordinates for a document as a function of the several sets of coordinates of terms appearing in the document.

The Classification Space used for an empirical study of automatic indexing was provided by the six major common factors in the analysis described above together with eight "unique" factors involving fields with little common variance. Coordinates for E elements were calculated by means of a weighted average formula in which the several Variables having the highest loadings on a given factor are used jointly as estimators of loadings on that factor. Specifically, the following formula was used for computing coordinates:

$$X_{ki} = \frac{\Sigma\, A_{ij}^{3}\, R_{kj}}{\Sigma\, A_{ij}^{3}}\, A_{if} + 0.50$$

where X_{ki} = the computed coordinate value of unit K (a term or a paragraph) on the ith reference axis

A_{ij} = the factor loading of the jth field on the ith reference axis, with j ranging over those fields used as estimators for i

R_{kj} = the rated degree of relevance of unit K to field j

f = the one field having the highest loading on the ith reference axis

The use of this formula provides a simple weighted-average estimation of coordinate values

(a) with substantially greater weight being given to fields having higher as against lower factor loadings on the reference axis in question

(b) in a C-Space having essentially the same metric as the rating scales, i.e., a range from 0.0 to 8.0

(c) except that the upper bound for coordinate values is not 8.0 but rather that proportion of 8.0 given by A_{if}

(d) the constant 0.5 being added in order to avoid problems of computer underflow in the application of the estimation function.

The formula used for automatic indexing is given by (A), (A1), and (A2), below. This formula is referred to as the "Classification Formula."

$$(A) \quad X_{ip} = (A_{ip} + B_{ip})/2.0$$

$$(A1) \quad A_{ip} = \frac{1}{N} \sum_{k=1}^{n} A_{ikp}$$

$$(A2) \quad B_{ip} = 8\, A_{if}(A_{i1p}\, A_{i2p} \cdots A_{inp}) / \sum_{i=1}^{r} A_{i1p}\, A_{i2p} \cdots A_{inp}$$

Where

X_{ip} is the computed coordinate value of document p on reference axis i;

N is the number of terms used as estimators;

K_p is the kth term in document p;

A_{ikp} is the preestablished coordinate value of kp on i;

A_{if} is defined above (definition of f and of A_{ij});

r is the number of reference axes in the C-Space.

More discursively, A_{ip} is the average of the i-coordinate values of the constituent terms in the document, and B_{ip} is the product of the

i-coordinate values of these constituents, normalized, first, with respect to the sum of these products over the 14 reference axes, and second, with respect to the metric of the C-Space. The formula was selected on the basis of the functional properties of A_{ip} and B_{ip}. The first, being a simple average, tends to preserve the effects of single occurrences of substantial projections of constituent terms on the i reference axis. The second, being a product ratio, is a measure of the preponderance of substantial projections of constituents on one axis rather than another; it reflects consistency, rather than single occurrences, and, if used alone, tends toward an all or none pattern of a maximum value on one axis and essentially zero values on the remaining axes.

Automatic indexing of documents was compared with psychometric indexing in a C-Space in which the maximum distance between two points in the space was approximately 24.0. The discrepancy between psychometric and automatic indexing was studied as a function of the number of terms used in the automatic indexing. The average discrepancy ranged from 3.47 for one term and 3.13 for two terms to 2.43 for 13 terms and 2.95 for 14 terms. The number of documents on which these means are based were 8, 8, 3, and 2, respectively.

10.4.2.4 Effective Indexing and Retrieval

The colloquial rendering of the library problem is that there is a User who has a use for a certain kind of information. Most often he is involved in a task whose means-ends structure is such that at a certain point a certain question needs to be answered. Because the User is accustomed to the library, he paraphrases his information need as best he can into a subject matter need. Thus, he comes in the front door with a Topic about which he wants information and which he hopes to relate to the library subject matter index. If he successfully collates his Topic with the library subject index headings he then faces the problem that all the items listed under a given heading are in that regard indistinguishable, and unless he can get a hint as to the differential contents of the documents listed he may have to gain access to a large number of documents and inspect them more or less closely in order to decide which, if any, has any practical relevance to his Topic. Among those which are relevant at all, some will be more to the point and others less so. Thus, the User's ideal is to be able to say simply "I want to know about Topic" and receive just those documents which are relevant to Topic and moreover, receive the most relevant first, the next most relevant one second, and so on. The final vindication of the C-Space conceptualization and procedures was the demonstration that an unusual degree of approximation to the User's ideal could be obtained by recourse to those procedures.

In this study the "documents" were paragraphs drawn from the 36-paragraph corpus for each field used in the factor analytic study.

Eight of the 24 fields were chosen for study. These are identified by asterisks in Table 6. For each field, the following procedure was accomplished.

(a) One of the paragraphs in the six 6-paragraph corpus for that field was selected randomly.

(b) A Topic designation was given by selecting the title of the reference or subheading under which the selected paragraph appeared in the original text or else constructing a close paraphrase thereof.

(c) Two other paragraphs were chosen at random from the corpus of the same field.

(d) One paragraph was selected at random from one of the fields in each of the other three major content areas. (The four major areas were Electrical Engineering, Aeronautical Engineering, Physical Chemistry, and Biochemistry.)

(e) The six paragraphs so chosen were given identifying letters A, B, X, Q, etc. and each was printed on a separate 5x8 card.

(f) The six paragraphs and the Topic were indexed in the Classification Space.

(g) The distances from the Topic to each of the six paragraphs in the C-Space was calculated and the paragraphs were ranked in accordance with these distances (closest = rank 1). This ranking was designated as the System Ranking.

(h) Judges (ranging in number from 2 to 6) with graduate level training in the field of the Topic were selected.

(i) Each judge was given the Topic and the six cards with the paragraphs printed on them. The judge was instructed to think of the Topic as one about which he might want some information and then rank the paragraphs in the order of their relevance to the Topic.

(j) The rank orders assigned to the six paragraphs by the several judges were averaged. The average ranking constituted the Criterion Ranking of the six paragraphs. The rankings by individual judges were correlated with the Criterion Ranking.

(k) The System Ranking was correlated with the Criterion Ranking.

(l) The preceding steps were accomplished for the following eight Topics: Vector analysis; Types of fields; Atomic and tonic recoil; Non-reacting collisions of energetic recoil atoms; The

relation of nucleic acids to proteins; The synthesis of fat; Parameters of aerodynamic moments and forces; Contraction properties.

The results for the eight replications were as follows. In seven of the eight cases the validity correlations (System Ranking - Criterion Ranking) ranged from .896 to .984. With one exception, these correlations were higher than the average correlation between individual judges and the criterion ranking which represented their consensus. With respect to an independent empirical criterion, validity coefficients of this magnitude are impressive, even allowing that with the breadth of content covered, very low correlations would be exceptional.

Indeed, for this very reason, the eighth case is equally impressive even though the validity correlation is .196. This relatively non-obvious result was predicted as a function of the distance of the Topic from the C-Space origin. For the eighth Topic, this distance was 2.64, whereas for the first seven these distances ranged from 5.22 to 8.28. The reason why distance from the origin is relevant takes us back to the pragmatic formulation of verbal behavior on which the C-Space approach is based.

It will be recalled that in the geometric interpretation of a factor analysis (and it is this interpretation which is represented by the Euclidean N-space) the variables, which in the present case are fields of knowledge, appear as vectors of unit length fanning out from the origin. In the procedures described above, both the Topic and the paragraphs were indexed in the Classification Space by being associated with a point-location defined by a set of coordinates. However, although the computational procedure is the same in both cases, the Topic and the paragraphs have a different pragmatic status and that difference is reflected in a difference in the significance of the coordinates. Roughly, the Topic represents a hypothetical subject matter field, analogous to the original V elements and therefore calls for a vector representation. The point location of the topic is thus interpreted as the point where a hypothetical subject matter field vector enters the Classification Space. If that point is close to the origin, then most of the vector lies outside the space. In effect, the field defined by the Topic is mostly extraneous to the entire subject matter scope of the C-Space. Under these conditions, no item in the C-Space, even one close by, could have a large projection on this vector and so distances in the C-Space no longer have the significance of subject matter relevance with respect to that Topic. Since the loss of relevance appears to be a threshold phenomenon (between 2.64 and 5.22) rather than a continuous function over the entire range of distance from the origin, it appears that a C-Space indexing and retrieval system will have one of the most important auxiliary characteristics of an automatic system, namely the means for recognizing when it is dealing with a request which it cannot process effectively.

10.4.2.5 Comments on the C-Space Studies

(a) The Classification Space approach has been used on a number of different occasions in connection with different ranges of scientific and technical content. Among the various procedures mentioned here for dealing with linguistic phenomena, the C-Space device is the closest to being "reduced to technology," with a set of practitioners with "know how" and rules of thumb for adopting existing procedures to new occasions, estimating likelihood of success in advance, etc. Nevertheless, there is even here a very considerable scope for investigating alternative procedures.

(b) The reader will recognize a connection between the general formulation of verbal behavior as uniquely involving concept-identification and the interpretation above of a User's information request uniquely identifying a subject matter field even when, in the usual sense, no such field exists. Part of the point of going to the trouble of factor analysis and factor measurement in a purely descriptive (data summarizing as against hypothesis testing) way is to generate the possibility of just such occurrences.

What we are dealing with here is a modern of the "intervening variable" - "hypothetical construct" issue. At the present time the hypothetical construct is, by default, in the ascendant. It is customary to assert that the method of choice in experimentation is to employ theories, which have constructs, which have "surplus meaning" over and above any set of experimental results. It is by making a commitment to the real existence of those hypothetical entities, we are told, that we are able to go beyond our data and take advantage of the empirical hypotheses generated by the surplus meaning of those entities and propositions.

In the present formulation, the issue is one of representational power. To summarize data in a format which essentially has just enough representational power to summarize that set of observational descriptions is to use an "intervening variable" format. To summarize observation descriptions in a descriptive format which has substantially more representational power than is required to summarize those observational descriptions is to use a "hypothetical construct" format. It is the conceptual system used by P which has or has not a surplus representational power, and its having that is not a matter of P's intention, his beliefs, or his ontological or spiritual commitments. Any observation summary given in terms of SA system concepts will necessarily and automatically have "surplus meaning" by virtue of the fact that the transition rules permit us to redescribe in terms of a new logical category. Thus, an observed state of affairs, the occurrence of behavior X, may be redescribed as the outcome of a process, P_X. The process, P_X, if it is not observable, is neither hypothetical nor real, neither fictitious nor genuine--it is <u>by</u>

definition the process of which X is the outcome. And if P specifies the process P_X as consisting of stages 1-k and identifies various observable behaviors as exemplifying these stages, that will not 'confirm' the 'real' existence of that process, for it is still by definition that P_X is the process of which the stages 1-k are exemplified by those observable behaviors and of which behavior X is the outcome. If it is not, then neither does it summarize those observations, and it cannot be given any relevance to those observations simply by virtue of P saying that for him it has that relevance. The significance of his saying that is that he does exactly what it would be intelligible for him to do if he said the opposite. Where P_X is in principle unobservable, as mediating responses of any sort are, since they have no identity criteria, there is no difference between talking about processes and employing process-talk. With observables there is a difference, and that is crucial, because it makes imaginary processes negotiable in a way that observable processes are not.

However, there is an additional perspective on the problem. Surplus representational power is relative to descriptions, not to phenomena per se. And descriptions may be deficient in representational power as well as excessive. Since the IA system subsumes all concepts whatever, the use of IA concepts in description provide the advantage of "surplus meaning" relative to any other type of description whatever. And any paradigmatic type H individual necessarily has the competence to give IA descriptions on an observational basis, for if he could not give them on that basis, he could not give them at all. Which is to say that the "surplus meaning" which is so attractive to the type X investigator is simply a function of the artificial impoverishment of his descriptions of behavior--he is describing performances, not IA processes. In the discussion of symbolic behavior, we noted that it was the introduction of a differential in significance between two descriptions of the same behavior that led us to speak of symbolic behavior at all. In the present context, we may say that the description by P of behavior observation in the deficient language of performances or movements will require that P find a source of symbolic significance, or surplus meaning, for 'behavior' under that deficient description, for, as a type H individual P is perfectly well aware that it has that significance and that its having that significance is what makes it a behavioral fact at all. But if P's commitments to the role of a type X investigator do not permit him to acknowledge that significance where it necessarily lies, namely, in behavior itself, then indeed, his only recourse would seem to be to some of the transition possibilities and their "surplus meaning" provided by the SA calculus.

The geometric representation of $f(E,V) = n$ judgments has "surplus meaning" relative to the numbers in the data matrix. The distance

relationships with which we have dealt in the Classification Space are not already there in the data matrix under the description of the data matrix as a table of numbers. They are there implicitly under the description of the data as a set of ingredients for a factor analyzable table of correlations, and there is nothing in the data that makes one of these descriptions observational and the other not or that makes one of these characterizations a description and the other an inference (or whatever). I shall suggest later that the increment from numbers to geometry here exemplifies the kind of resource presently available for composing a set of processes in which mechanical and behavioral aspects are not in conflict.

10.4.3 A Tripartite Quantification of 'Meaning'. In the description of the library user's dilemma we noted that in general, the user transforms his information needs into subject matter needs out of sheer necessity, since that is the form of the library index. Part of the problem for an information storage and retrieval system is that not all information needs can be effectively transformed into subject matter needs. Thus, subject matter indexing is in principle limited in its effectiveness, and this limitation may be expected to be most in evidence in dealing with information needs which involve more than one conventionally designated "field of knowledge" and can be precisely stated in general terms, so that although the user knows exactly what he wants a miss is as good as a mile and there is probably no single place (document or part of one) where an explicit answer to that question may be found. (Example: "What statistical-experimental design programming packages are available for establishing the statistical distribution of words or concepts in English text?") Clearly, therefore, indexing by reference to principles other than subject matter will be required in an optimal information system. Among the possible additional principles which are evidently relevant, the conceptual content of the document is perhaps the most salient. Thus, a study was undertaken to provide the technical means for indexing documents by reference to their conceptual content. The psychometric, factor analytic procedure exemplified in the construction of the Classification Space was adopted.

Since "conceptual content" and "meaning" are not as conceptually homogeneous as "field of knowledge," the task was accomplished by combining three separate procedures. Referring to the examples in 10.4.1, the three sub-tasks were defined by f_1, f_6, and f_7. These are designated as the "Property Study," the "Functor Study," and the "Category Study," and the three, collectively, are designated as the "Semantic Study." Correspondingly, the results were a "Property Space," a "Functor Space," and a "Category Space," and the three, collectively, are designated as the "Attribute Space."

10.4.3.1 The Property Space.

The Property Space is defined by "$f_1(E,V)$" = "the degree to which E is characterized by (has the property) V." The instructions and list of elements, both of which were used for each of the three studies, are given in Table 8 and Table 9, respectively. The list of properties is given in Table 10. The Property Space represents the simplest and perhaps the most straightforward notion of "meaning." Factor results are presented in Table 11. All three factor analyses made use of a Minimum Residual extraction and Varimax rotation. Likewise, in all three studies, the entries in the data matrix for correlation represented the average of ten individual informants, most of whom were college students. As has generally been the case with the factor analysis of linguistic data using the procedural format described above, the factor results require no discussion, since the nature of the factors is unproblematical upon inspection, and in the present use, nothing hinges on whether the descriptive title for each factor is what that factor "really" represents.

Insert Tables 8, 9, 10, and 11 about here

10.4.3.2 The Functor Space

The real world is not as simple as that portrayed in the Property Space. It is not always possible to say of a kind of E that it is or is not characterized by a given V to a given degree. For example, people per se are not tall, but neither are they small or medium-sized; colors per se are not bright, but neither are they dull or neutral; mistakes per se are not serious, but neither are they trivial. Evidently we need a more abstract characterization of Elements by reference to significant dimensions of variations, or parameters, rather than by determinate values of such parameters. Thus, the functor study was defined by grammatical variations of "f_6 (E,V)" = "the degree to which V is an important dimension of variation for E."

The list of functors (V) for the study is given in Table 12. The factor results are given in Table 13. (The doublets in factors 1, 2, and 11 were introduced for technical reasons which are not of interest here.)

Insert Tables 12 and 13 about here

10.4.3.3 The Category Study

Although in logical theory class membership and attributes are equivalent notions, in that being a member of Z is to have the attribute "member of Z" or "Z-hood" and having the attribute "Y" is to be a member of the class of Y's, there seems little question that the

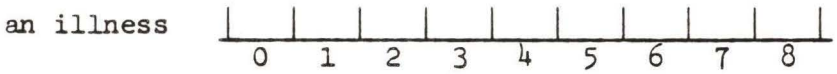
Table 8. Semantic Study Instructions

ORIENTATION

This is a data-gathering procedure in which you will be asked to make judgments based on your knowledge of certain common objects, actions, events, or situations. (For convenience, the word "object" will be used here to refer to either an object, an action, an event, or a situation.)

For each object, you will be given a set of descriptive statements and your task is to decide to what extent the description applies to the object. For example, the object might be "an illness" and the description might be "the consequences of X are important." Here, you would consider "an illness" to be the "X" in the statement and you would judge to what extent the consequences of an illness are important.

You would express your judgment by making a checkmark on a scale like this:



In general, the greater the degree to which the description applies to the object the higher should be the number that you check on the scale. Keeping this general principle in mind, use the following as a guide in making your ratings:

1. Check "0" if the description doesn't apply at all to the object. For example, it may be definitely false to describe the object that way, or it may not make any sense at all to describe the object that way.

2. Check either "1" or "2" if the description applies only to a minimal degree, but you wouldn't want to say that it doesn't apply at all. For example, it may make sense but be far-fetched to describe the object that way, or the description may apply but only in a very qualified or restricted sense. If you are inclined to say "Yes, you could say that, but . . .," then "1" or "2" is an appropriate rating.

3. Check either "3" or "4" if the description does apply but is relatively uninformative. For example, it may refer to a trivial or incidental feature of the object, or it may apply to only a minority of the specific instances covered by the "object" expression.

4. Check either "5" or "6" if the description definitely applies and is informative. For example, the description may refer to a

Table 8, Page 2

significant feature of the object, or it may represent what is normally to be expected of the object, or it may refer to a characteristic which, though not a usual one for the object, is significant when it is present.

5. Check either "7" or "8" in the most important or significant cases of a description applying to an object. For example, the description may refer to a defining characteristic or a necessary characteristic of the object, or to one of the most crucial or outstanding features of an object, or to a characteristic which would be absent only in very special circumstances.

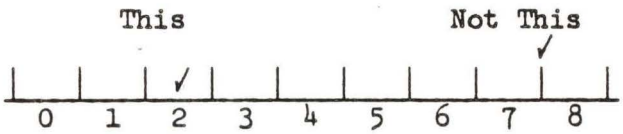
In deciding between "1" and "2," "3" or "4," "5" or "6," "7" or "8," use the general rule that the greater the degree to which the description applies to the object, the higher the number that you should check on the scale.

On each page of your booklet you will find one description at the top of the page and below, twelve scales with the object given alongside. Take each of the objects in turn and relate it to the description, making your checkmark on the corresponding scale each time.

IMPORTANT:

1. Rate each item in turn. Do not skip any.

2. Make your check mark in the middle of the scale sections, not on the divisions:



3. Make each judgment independently. Do not try to remember how you rated other objects or descriptions. Take each page in order. Do not look back and forth in your booklet.

Table 9. List of Objects (Elements) for Semantic Study

I Invalidity

1. breaking a rule
2. a false promise
3. a sales pitch
4. an erroneous proof
5. an accident
6. a mistake
7. a dream

II Criteria

8. a definition
9. a calculation
10. a measurement
11. an experiment
12. a custom
13. putting it to a vote
14. a referee
15. a textbook
16. flipping a coin
17. remembering something
18. seeing it right there

III Pathology

19. an illness
20. a stalled automobile
21. a slow wristwatch
22. dying
23. a fit of coughing
24. an earthquake
25. an explosion
26. a yawn
27. an argument

IV Therapy

28. flushing a radiator
29. a hospital
30. mending a fence
31. tuning a piano
32. optimization
33. spring cleaning
34. curing an illness

Table 9, Page 2

V Contests

35. a chess game
36. a lawsuit
37. a hand-to-hand battle
38. broken-field running
39. keeping up with the Joneses

VI Assertions--communications

40. giving a lecture
41. a radio broadcast
42. giving directions to someone
43. describing something
44. praying
45. persuading someone
46. a press release

VII Decomposition

47. cutting meat
48. grinding ore
49. taking a clock apart
50. analyzing an argument
51. decomposition

VIII Tools

52. a pair of pliers
53. a hand drill
54. a microscope
55. a blowtorch
56. a hose
57. a lock

IX Biological

58. a man
59. a tree
60. blood
61. a sweetheart
62. a moth
63. a virus
64. a seed

Table 9, Page 3

X Costs

65. buying something
66. paying a fine
67. a traffic ticket
68. being drafted
69. making a down payment
70. a gas bill

XI Creativity--discovery

71. a hunch
72. an inspiration
73. discovering something
74. exploring
75. inventing something
76. wondering about something
77. making something

XII Construction

78. building an airplane
79. moulding clay
80. hammering a nail into a plank
81. an assembly line
82. making a round hole

XIII Production

83. fertilizing the crop
84. a full tank of gasoline
85. a quantum of energy
86. a computer program
87. an atomic pile
88. being at bat
89. getting the answer
90. rotating crops

XIV Mechanisms

91. a clock
92. an IBM computer
93. a gas meter
94. the solar system
95. a television set
96. a guided missile
97. a train

Table 9, Page 4

XV Artifacts

98. a radar antenna
99. a cradle
100. a dollar bill
101. a pair of snowshoes
102. a lens
103. a bear trap
104. a dart
105. a calendar
106. a high-voltage wire
107. a workbench
108. a milk bottle

XVI Structures

109. a claw
110. a building
111. a lattice
112. a crescendo
113. a wire
114. a piece of lace
115. a bubble
116. a blob
117. an arrow
118. a slab
119. a sheet
120. a box

XVII Natural objects

121. a river
122. a cloud
123. a shadow
124. a boulder
125. the sun
126. a valley
127. a flame
128. an island
129. the ocean

Table 9, Page 5

XVIII Aggregates--quantities

130. a combination
131. a beginners' class
132. a nation
133. a square dance
134. adding more of the same
135. a collection
136. a heap of stones
137. a pound of meat
138. a ton of metal
139. a pile of wood

XIX Fruition

140. harvesting wheat
141. splitting the profits
142. declaring a dividend
143. a glass of beer
144. a hearty meal

XX Representations

145. a pencil sketch
146. a portrait
147. a map
148. a blueprint
149. a theory
150. a photograph
151. an explanation
152. a diagnosis

Table 9, Page 6

XXI Miscellaneous

153. a table of random numbers
154. a railroad schedule
155. radio waves
156. a beacon
157. a pinch of salt
158. a bright light
159. sound
160. music
161. asking somebody
162. an infinite set
163. dripping water
164. the ticking of a clock
165. a pleasant mood
166. excitement
167. a novel
168. a chance encounter
169. penetrating a barrier
170. crossing over a river
171. going around a mountain
172. a log in the road
173. comparing two samples
174. calibrating a compass
175. a candidate
176. a criminal
177. a refugee
178. running a business
179. a novel
180. a gas bill
181. a foggy night
182. having your luck run out
183. imitating someone
184. taking something for granted
185. good health
186. a pinch of salt
187. the weather
188. having a strong suspicion
189. buying a lottery ticket
190. the direct wire to Moscow
191. an exceptional case

Table 10. Semantic Study Properties

1. X is large
2. X is microscopic
3. X is astronomically large

4. X is precise
5. X has a small range of uncertainty

6. X has definite boundaries
7. X has a regular boundary

8. X is hard to distinguish from its surroundings
9. X is a very clearcut sort of thing

10. X is far away
11. X has a large spatial range
12. X has a finite range

13. X receives energy
14. X transmits energy
15. X requires a lot of energy
16. X contains a lot of energy

17. X is electromagnetic
18. X radiates energy
19. X is magnetic
20. X conducts electricity

21. X is observable
22. We can recognize X when we encounter it
23. Instances of X can be recognized immediately
24. X is intrinsically unobservable
25. The hidden qualities of X are the important ones

26. X is unreal
27. X is imaginary
28. X is subjective
29. X is valid
30. X is correct

31. X is dense
32. X is heavy

33. X is complete in itself
34. X is changed by its own action

Table 10, Page 2

35. X is linear
36. X is non-linear
37. X is parametric
38. X is topological
39. X is axiomatic

40. X by itself replaces a lot of things
41. X combines a lot of things into one

42. X requires constant attention
43. X requires occasional attention
44. X requires only routine attention
45. X requires special attention

46. X has several colors
47. X has a characteristic color

48. X changes in microseconds
49. X changes in seconds
50. X changes over a period of days
51. X changes over a period of years

52. X has to be taken through successive steps
53. X is hard to stop once it is started
54. X has to be controlled at all times
55. X has to be done one step at a time

56. X has a known cause
57. X has no known beginning
58. X has a beginning, middle, and end
59. X has no known limit or end

60. X is a means to an end
61. X is a very effective means
62. X is important in its own right
63. The important thing is X, no matter how you arrive at it
64. X has to be generated in a particular way
65. X occurs only under specific conditions

66. X develops in a regular way
67. X develops slowly
68. X progresses in an orderly fashion
69. X is part of a definite sequence

Table 10, Page 3

70. X is an intermittent process
71. X is part of an irregular sequence
72. X is recursive

73. X has to work just right or it's no good
74. X is normally in constant balance
75. X shifts from one form to another
76. X shifts from one state to another
77. X should remain in the same condition
78. X should retain its relative position

79. Something should be done about X
80. If only X could be gotten rid of
81. X is bad
82. X is good

83. X is simple and undifferentiated
84. X has a definite shape
85. X is irregularly shaped
86. X is highly structured
87. X is complicated

88. X has complex constituents
89. X has simple constituents
90. X is part of a definite structure
91. X is part of a larger aggregate

92. X is continuous
93. X is discrete
94. X is all-or-none
95. X is gradual

96. There is a standard form for X
97. Every X is a special case
98. Most X's are pretty much alike

99. X is very rapid

Table 11. Property Space Analysis

Factor 1	Negative Evaluation
.935	X is bad
.919	If only X could be gotten rid of
.630	Something should be done about X
Factor 2	Electromagnetic Phenomena
.920	X is electromagnetic
.878	X transmits energy
.863	X is magnetic
.793	X radiates energy
.721	X changes in a matter of microseconds
.702	X conducts electricity
.678	X contains a lot of energy
.640	X receives energy
.628	X requires a lot of energy
.513	X has a large spatial range
.450	X changes in seconds
.440	X has a finite range
.409	X is very rapid
Factor 3	Lack of Reality
.898	X is imaginary
.844	X is unreal
.660	X is intrinsically unobservable
.651	X is subjective
-.473	X is observable
.463	X had no known limit or end
-.427	X is a very clearcut sort of thing
Factor 4	Demand Characteristics
.874	X requires special attention
.845	X requires special attention
.832	X requires constant attention
.630	X has to be controlled at all times
.610	X is complicated
.545	Every X is a special case
.528	X has to be taken through successive stages
-.504	X is simple and undifferentiated
.469	X has complex constituents
.445	X combines a lot of other things into one
.416	X has to be done one step at a time
.401	X is important in its own right

Table 11, Page 2

Factor 5	Decision Monitoring	
.844	X is correct	
.825	X should retain its relative position	
.783	X has a small range of uncertainty	
.696	X is valid	
.615	X is parametric	
.535	X is axiomatic	
.426	X has to work just right or it's no good	
.418	X progresses in an orderly fashion	
.412	X has a finite range	
.390	There is a standard form for X	
Factor 6	Observable Individuality	
.839	X has a definite shape	
.828	X has definite boundaries	
.774	X is discrete	
.769	X has several colors	
.733	X is highly structural	
.714	X has a regular boundary	
.672	X is complete in itself	
.651	X should remain in the same condition	
.619	We can recognize X when we encounter it	
.597	X should retain its relative position	
.588	X is heavy	
.571	X is irregularly shaped	
.559	X is observable	
.557	X is a very clearcut sort of thing	
-.515	X is an intermittent process	
.485	X changes over a period of years	
.432	X is dense	
.423	Most X's are pretty much alike	
.415	X has complex constituents	
.415	X is normally in constant balance	
.397	There is a standard form for X	
Factor 7	Macrocosmic Characteristics	
.832	X is astronomically large	
.637	X is far away	
.429	X is large	
.422	X has no known beginning	
.420	X has a large spatial range	

Table 11, Page 3

Factor 8	Origination	
.817		X occurs only under specific conditions
.811		X occurs only under specific conditions
.546		X has a known cause
.456		X has to be generated in a particular way
Factor 9	Active Phenomena	
.800		X changes over a period of days
.746		X shifts from one state to another
.712		X is changed by its own action
.689		X shifts from one form to another
.421		The hidden qualities of X are the important ones
Factor 10		
.802		X is microscopic
.329		X is hard to distinguish from its surroundings
Factor 11		
.795		X is all or none
Factor 12	Goal Focus	
.784		The important thing is X no matter how you arrive at it
.638		X is good
.418		X is important in its own right
Factor 13	Identifiability of Particular Instances	
.775		Instances of X can be recognized immediately
.447		We can recognize X when we encounter it
.414		X is observable
Factor 14	Means Focus	
.774		X is a very effective means
.762		X is a means to an end
.453		X has to work just right or it's no good
.438		There is a standard form for X
.421		X by itself replaces a lot of things
Factor 15	Momentum	
.760		X is very rapid
.539		X is hard to stop once it is started
.385		X changes in seconds

Table 11, Page 4

Factor 16

.752	X is recursive
.379	X is an intermittent process
.311	X is part of a definite sequence

Factor 17 Process Focus

.698	X has a beginning, middle, and end
.642	X develops in a regular way
.641	X has to be taken through successive steps
.629	X progresses in an orderly fashion
.575	X is gradual
.555	X develops in a regular way
.545	X has to be done one step at a time
.439	X is part of a definite sequence

Factor 18

.696	X has a characteristic color
.282	X is simple and undifferentiated

Factor 19

.681	X is dense
.633	X is heavy

Factor 20 Part Focus

.675	X is part of a definite structure
.534	X is part of a larger aggregate
.384	X should retain its relative position

Factor 21

.657	X is hard to distinguish from its surroundings
.242	X develops in a regular way

Factor 22

.632	X is non-linear
.328	X changes in a matter of microseconds
.306	X changes in seconds

Factor 23

.621	X is linear
.304	X has a regular boundary

Table 11, Page 5

Factor 24

.602	X is topological
.394	X has a large spatial range

Factor 25 Bounded vs. Unbounded

.543	X has no known limit or end
.313	X has a beginning, middle, and end

Factor 26

.487	X requires occasional attention

Factor 27

.481	X has to be generated in a particular way

Factor 28

.437	X shifts from one form to another

Factor 29 Sources vs. Media

.412	X conducts electricity
-.333	X radiates energy

Factor 30

.413	Every X is a special case
.292	X is important in its own right

Factor 31

.422	X is normally in constant balance

Factor 32 Standardization

.389	Most X's are pretty much alike
.359	There is a standard form for X

Table 12. Semantic Study Functors

Group		
	1.	It's important to avoid X
A	2.	The control of X is important
	3.	It's important to keep X within certain limits
B	4.	The dynamic balance of X is important
	5.	The dynamic properties of X are important
C	6.	The weight of X is important
	7.	The mass of X is important
	8.	The density of X is important
D	9.	The flow of X is important
	10.	The movement of X is important
	11.	The emission characteristics of X are important
	12.	The radiation characteristics of X are important
E	13.	The amount of X is important
	14.	The number of X's is important
F	15.	The velocity of X is important
	16.	The rate of change of X is important
	17.	The rapidity of X is important
G	18.	The numerical range of X is important
	19.	The variability of X's is important
	20.	The observable characteristics of X are important
H	21.	The usual condition of X is important
	22.	It's important to know what state X is in
I	23.	The static properties of X are important
	24.	The form of X is important
	25.	The shape of X is important
J	26.	The energy required for X is an important consideration
	27.	The efficiency of X is important
	28.	The time cost of X is important
	29.	The monetary cost of X is important
	30.	The man-hour cost of X is important
	31.	The size of X is one of its distinctive features
K	32.	You have to distinguish each X from every other X
	33.	The identity of X is important

Table 12, Page 2

L	34.	The analysis of X is important
	35.	The amount of skill required for X is important
	36.	The precision of X is important
	37.	The range of error for X is important
M	38.	The temporal progression of X is important
	39.	The temporal sequence of X's is important
	40.	The temporal span of X is important
	41.	The duration of X is important
N	42.	The boundary of X is important
	43.	The spatial extent of X is important
	44.	The distance to X is important
O	45.	The cause of X is important
	46.	The beginning of X is particularly important
	47.	The history of X is important
	48.	The origin of X is important
P	49.	The later portions of X are particularly important
	50.	The end of X is important
Q	51.	The consequences of X are important
	52.	The implications of X are important
	53.	The long-term effects of X are important
	54.	The immediate effects of X are important
	55.	The outcome of X is important
R	56.	The immediate circumstances associated with X are important
	57.	The momentary state of X is important
S	58.	The physical constituents of X are important
	59.	The chemical composition of X is important
	60.	The internal characteristics of X are important
	61.	The substructures of X are important
	62.	The microscopic structure of X is important
T	63.	The part-whole characteristics of X are important
	64.	The means-ends characteristics of X are important
	65.	The productiveness of X is important
	66.	The output of X is important
U	67.	The rigorousness of X is important
	68.	The proof of X is important
	69.	The validity of X is important
	70.	The success of X is important

Table 12, Page 3

71. The number of subdivisions of X is important
72. The test of X is important
73. The capacity of X is important
74. The access to X is important
75. The outside of X is important
76. The maintenance of X is important

Table 13. Functor Space Analysis

Factor 1	Identity of Individuals
.913	The identity of X is important
.909	The identity of X is important
.821	You have to distinguish each X from every other X
.739	The history of X is important
.525	The origin of X is important
.555	The variability of X's is important
.487	The analysis of X is important
.454	The number of X's is important
.422	The internal characteristics of X are important
Factor 2	Cost
.989	The man-hour cost of X is important
.895	The man-hour cost of X is important
.814	The time cost of X is important
.789	The monetary cost of X is important
.389	The means-ends characteristics of X are important
Factor 3	Emission and Radiation Characteristics
.879	The emission characteristics of X are important
.849	The radiation characteristics of X are important
.474	The energy required for X is an important consideration
Factor 4	Space-time Dynamics
.892	The velocity of X is important
.862	The rapidity of X is important
.739	The movement of X is important
.698	The dynamic properties of X are important
.600	The temporal progression of X is important
.582	The dynamic balance of X is important
.543	The energy required for X is an important consideration
.501	The temporal sequence of X's is important
.486	The flow of X is important
.430	The rate of change of X is important
.400	The control of X is important
Factor 5	Weight-mass-density Characteristics
.873	The weight of X is important
.766	The mass of X is important
.434	The density of X is important

Table 13, Page 2

Factor 6 The Factual Implication

.843	The consequences of X are important
.837	The immediate circumstances associated with X are important
.772	The immediate effect of X is important
.711	The implications of X are important
.662	The outcome of X is important
.629	It's important to avoid X
.601	The long-term effects of X are important
.472	The momentary state of X is important
.444	The origin of X is important
.424	The beginning of X is particularly important
.414	The proof of X is important

Factor 7 Pragmatic Validity

.792	The range of error for X is important
.787	The rigorousness of X is important
.786	The validity of X is important
.782	The precision of X is important
.715	The test of X is important
.632	The proof of X is important
.579	The efficiency of X is important
.557	The amount of skill required for X is important
.523	The means-ends characteristics of X are important
.516	The success of X is important

Factor 8 Observable Form

.783	The form of X is important
.632	The shape of X is important
.393	The outside of X is important

Factor 9 Constituent Composition

.781	The chemical composition of X is important
.516	The density of X is important
.380	The physical constituents of X are important
.342	The internal characteristics of X are important

Factor 10

.779	The observable characteristics of X are important

Table 13, Page 3

Factor 11 Spatial-structural Characteristics

.776	The boundary of X is important
.769	The distance to X is important
.749	The distance to X is important
.744	The spatial extent of X is important
.545	The size of X is one of its distinctive features
.414	The physical constituents of X are important

Factor 12

.751	The numerical range of X is important
.344	The number of subdivisions of X is important

Factor 13

.750	The later portions of X are particularly important
.696	The end of X is important
.572	The beginning of X is particularly important
.519	The outcome of X is important
.427	The amount of skill required for X is important
.409	The temporal progression of X is important
.402	The success of X is important

Factor 14

.735	The usual condition of X is important
.724	The maintenance of X is important
.581	It's important to know what state X is in
.523	The capacity of X is important
.497	The outcome of X is important
.423	The velocity of X is important
.378	The control of X is important

Factor 15

.725	The amount of X is important

Factor 16 Structural Characteristics

.715	The sub-structures of X are important
.649	The part-whole characteristics of X are important
.613	The number of subdivisions of X is important
.450	The internal characteristics of X are important
.336	The analysis of X is important

Table 13, Page 4

Factor 17

.677 The flow of X is important

Factor 18 Productivity

.640 The productiveness of X is important
.604 The output of X is important

Factor 19 Duration

.741 The duration of X is important
.623 The temporal span of X is important
.386 The rate of change of X is important

Factor 20

.591 The number of X's is important
.276 The size of X is one of its distinctive features

Factor 21

.538 It's important to avoid X

Factor 22

.524 The means-ends characteristics of X are important

Factor 23

.456 The capacity of X is important

Factor 24

.454 The control of X is important

Factor 25

.445 Access to X is important

Factor 26

.438 The long-term effects of X are important

two are psychologically different. For prudential reasons, therefore, categorical judgments were quantified separately from the properties and functors. The list of categories is given in Table 14. Factor results are presented in Table 15.

Insert Tables 14 and 15 about here

10.4.3.4 Comments on the Semantic Study

(a) The factor results are fairly typical of perhaps a dozen such studies in which meaning, in the sense of Carnap's "intension," has been quantified using unipolar scales defined by sentence frames, and in which the individuals (E) and the intensions (V) are conceptually stratified within a conceptual domain rather than being sampled randomly from an empirical domain. In general, the factor results follow the lines of conceptual stratification, though not so strongly as to be a foregone conclusion. Thus, for example, the 98 properties were grouped into 28 conceptual clusters, and the Property Space showed roughly 30 factors. Given conceptual stratification and minimum sampling, the ratio of factors to variables is generally high, frequently approaching 1:2. In replication studies, clear replication of about two thirds of the factors and perhaps 90 percent of the major factors, may be expected without any special measures being taken to match the factors. Data representing the average of five or more subjects is recommended. The finding that "good" and "bad," when allowed to vary independently, do vary relatively independently instead of being tied together as polar opposites, is a typical one, though in a minority of cases we do find a Good-Bad bipolar factor.

(b) The analysis in terms of properties, functors, and categories may be regarded as a way of "unpacking" Kelly's (1955) triadic format in which the judgment made by the subject may be summarized as "E_1 resembles E_2 in a respect (V) in which they both differ from E_3." If E_1 and E_2 do not belong to the same logical category as E_3, then the respect in which they differ may be expected to show up as a category difference, reflected in their respective locations in the Category Space. Since the objects in Kelly's procedure are generally persons, this will be a rare case. If E_1, E_2, and E_3 belong to the same logical category, then V identifies a significant (for the respondent) dimension of variation of individuals of that sort, and it must be a dimension of variation, since E_3 is differently located with respect to it as compared with E_1 and E_2. This result may be expected to show up in the Functor Space. Finally, if E_3 is differently located as compared to E_1 and E_2, then there will be some property which E_3 has

Table 14. Semantic Study Category

1. X is primarily biological
2. X is primarily tangible
3. X is primarily tentative
4. X is primarily speculative
5. X is primarily observational
6. X is primarily procedural
7. X is primarily causal
8. X is primarily transitional
9. X is primarily relational
10. X is primarily conceptual
11. X is primarily physical
12. X is primarily logical
13. X is primarily temporal
14. X is primarily spatial
15. X is primarily chemical
16. X is primarily social
17. X is primarily statistical
18. X is primarily empirical
19. X is primarily numerical
20. X is primarily experimental
21. X is primarily structural
22. X is primarily imaginary
23. X is primarily magnetic
24. X is primarily linguistic
25. X is primarily technological
26. X is primarily electrical
27. X is primarily final
28. X is primarily information-transforming
29. X is primarily electromagnetic
30. X is primarily periodic
31. X is primarily mathematical
32. X is primarily affirmative
33. X is primarily energy-transforming
34. X is primarily evaluative
35. X is primarily conventional
36. X is primarily hypothetical
37. X is primarily illustrative
38. X is primarily normative
39. X is primarily organic
40. X is primarily mechanical
41. X is primarily physiological
42. X is primarily geometric
43. X is primarily kinetic
44. X is primarily mental
45. X is primarily sequential

Table 14, Page 2

46. X is primarily productive
47. X is primarily recreational
48. X is primarily self-correcting
49. X is primarily artistic

Table 15. Category Space Analysis

Factor 1	Electromagnetic Phenomena
.972	X is primarily electromagnetic
.921	X is primarily electrical
.910	X is primarily magnetic
.543	X is primarily energy-transforming
Factor 2	Biological Phenomena
.947	X is primarily biological
.886	X is primarily physiological
.835	X is primarily organic
Factor 3	Conceptual vs. Physical
.882	X is primarily imaginary
.829	X is primarily mental
.816	X is primarily hypothetical
.805	X is primarily conceptual
.624	X is primarily speculative
-.617	X is primarily tangible
-.610	X is primarily physical
.534	X is primarily tentative
.491	X is primarily logical
.459	X is primarily evaluative
.434	X is primarily affirmative
.433	X is primarily linguistic
Factor 4	Mathematical Phenomena
.868	X is primarily numerical
.665	X is primarily statistical
Factor 5	Geometric Phenomena
.834	X is primarily geometric
.777	X is primarily spatial
.569	X is primarily structural
.365	X is primarily physical
Factor 6	Instantiation
.824	X is primarily observational
.447	X is primarily illustrative

Table 15, Page 2

Factor 7 Temporal Phenomena

.819 X is primarily sequential
.756 X is primarily temporal
.743 X is primarily periodic
.504 X is primarily kinetic
.455 X is primarily transitional

Factor 8 Experimental Phenomena

.790 X is primarily experimental
.785 X is primarily empirical
.565 X is primarily procedural
.479 X is primarily speculative

Factor 9 Intelligence

.785 X is primarily information-transforming
.720 X is primarily linguistic
.673 X is primarily illustrative
.594 X is primarily logical
.489 X is primarily affirmative
.465 X is primarily evaluative
.451 X is primarily conceptual

Factor 10 Mechanical Devices

.764 X is primarily mechanical
.670 X is primarily technological
.568 X is primarily structural

Factor 11 Convention-norms

.756 X is primarily conventional
.625 X is primarily normative
.545 X is primarily social

Factor 12

.749 X is primarily recreational
.706 X is primarily artistic

Factor 13 Chemistry

.692 X is primarily chemical
.476 X is primarily energy-transforming
.362 X is primarily causal

Table 15, Page 3

Factor 14 Productivity

.688	X is primarily productive
.264	X is primarily technological
.254	X is primarily affirmative

Factor 15

.659	X is primarily final
.322	X is primarily causal
.311	X is primarily procedural

Factor 16

.615	X is primarily transitional

Factor 17

.531	X is primarily self-correcting

Factor 18

.494	X is primarily tentative

and the other two do not and there will be a second property which E_1 and E_2 have and E_3 has not, and this would show up in the location of E_1, E_2, and E_3 in the Property Space. For example, E_3 is "rich" and E_1 and E_2 are "poor" and the dimension of variation is "the amount of money possessed by S." Since the "packaging" of the triadic procedure and the tripartite quantification of intension is different, it seems unlikely that they would be generally interchangeable as experimental procedures. The analysis of the similarity does suggest that many comparisons of results obtained in these two ways would be feasible.

10.4.4 Conceptual Content Indexing in Use. A second retrieval demonstration making use of conceptual content indexing was carried out (Ossorio, 1968a). For this purpose 31 of the factors of the Semantic Study mentioned above were used as an Attribute Space for indexing purposes. The content domain was the aerospace sciences. A seventeen-factor Classification Space for this domain was also constructed. The major purpose was to obtain a level of performance of both subject matter and conceptual content indexing in an operational setting. One of the unusual features of the demonstration was that the retrieval requests were simply statements made by Users expressing what they wanted to know rather than paraphrases couched in subject matter or other library-dictated terms. The major elements of the demonstration were as follows:

(1) Eight Users selected a total of 94 documents from recent journal sources as being representative of their general professional interests. Ninety-four dissertation abstracts were later chosen so as to give a subject matter coverage roughly comparable to the 94 initial documents. These 188 documents constituted the Library for the demonstration. The selection was designed to produce substantial opportunity for "false positives" and "false negatives" on retrieval. (In the procedure used, these would show up as rank-order anomalies.

(2) A system vocabulary of 1125 terms was indexed in the Classification Space and the Attribute Space. Each of the 94 journal articles contained at least five system vocabulary terms, and indexing of documents in either space was accomplished with the Classification Formula described previously.

(3) Eleven information requests were made by the eight users.

(4) For each request, sequential retrieval of all 188 documents was accomplished using subject matter indexing only.

(5) For each request, the User inspected all 188 documents and rated them as "relevant" or "not relevant" to the request.

(6) The results are summarized as follows: There were, on the average, six relevant documents for each request. On the average, half of the relevant documents for the request were among the first ten documents selected for retrieval and two thirds of the relevant documents were among the first twenty selections. For every request, all the relevant documents had been selected before half of the documents in the library were examined.

(7) A parallel procedure was carried out for the same requests, using conceptual content indexing only.

(8) Overall, the results for the conceptual content indexing were very nearly identical to those for subject matter indexing. For individual requests, however, there were appreciable differences in the rankings and the effectiveness of the two methods.

(9) A third procedure, parallel in form, was carried out using both subject matter and conceptual context indexing.

(10) The combined indexing was superior to the separate use of subject matter and conceptual content. The combined indexing gave, on the whole, earlier selection of the first relevant document, earlier selection of the last relevant document, and earlier selection, on the average, of all relevant documents.

(11) The system vocabulary terms which appeared in a given request were used as key words for that request, and a key-word retrieval was carried out. In this way, 190 documents were retrieved. For these requests, 37 documents were relevant, and of these 37, 26 were included in the 190 documents retrieved. That is, the key word procedure retrieved 70% of the relevant documents at the cost of 6.3 irrelevant documents for each relevant one. By way of comparison, the combined procedure retrieved 100% of the relevant documents at the cost of 5.1 irrelevant documents for each relevant one.

(12) Because information retrieval experiments are carried out in widely different circumstances which are crucial to the level of difficulty of the retrieval task it is extremely difficult to compare the level of accomplishment represented by various storage and retrieval methods. With this reservation in mind, on the basis of (a) the fact that the information requests were unconstrained and in ordinary English and yet were handled without any grammatical analysis and (b) the level of efficiency (in terms of irrelevant documents) at which 100% retrieval was obtained, the present methodology appears to be

representative of the state of the art in general purpose information retrieval.

10.4.5 Quantification of Other Relationships. The following relationships have been studied empirically using the general procedures described above. Most of these results are reported at some length elsewhere (Ossorio, 1968a).

10.4.5.1 Part Whole Relationships

More accurately, this is a study of part-part relationships. The problem stems from transition rule 3 of the SA system, where an object (read "whole") is decomposed into a set of smaller (read "part") related objects. The general implementation of this rule requires ways of representing the relations which one part has with another by virtue of their being parts of the whole of which they are parts. It is by virtue of the range of possible relations of this sort that a change in relationships among parts may have the significance of a change of state of the whole. In the special case where the whole is a human body, Rule 3 is the primary means of rendering intelligible in a non-reductionistic methodological framework (paradigm case methodology) the study of physiology by P as a means of obtaining a practical advantage in the manipulation of the behavior and personal characteristics of S.

In the present case, the whole in question was of a more 'intangible' sort, namely a social group, the family. The study consisted of a quantification of the following two functors. Since E_1 and E_2 were identified by family roles, e.g. "father," "older daughter, about 17 years old," it is not necessary to add the qualification "{the relation they have} by virtue of being members of the same family."

"$f_2\ (E_1E_2,V)$" = "The degree to which it is appropriate for E_1 to engage in behavior V with respect to E_2.

"$f_{10}\ (E_1E_2,V)$" = "The degree to which E_1 typically engages in behavior V with respect to E_2.

The results of this study provide a fairly sensitive representation of certain facets of family life; for example, the differential discipline accorded to sons and daughters, and the reduction of the disciplinary relationship with increasing age of the children. Again, there was an intelligible pattern of "concealment from" within family members and between family members and outside persons such as female neighbors and policemen. For an appreciable proportion of the E_1E_2 pairs studied, a very substantial amount of concealment was exhibited as both typical and appropriate.

10.4.5.2 Means-Ends Relationships

This study was defined by "$f_4(E,V)$" = "The degree to which E is suitable as a means to V." The data matrix marginals consisted of a set of procedures (E) and a set of goals (V). Two content domains were investigated. The first was a set of psychotherapists; the second was a two-year project in laser-beam measurement by a physical chemist.

In the first case (Holmes, 1969), three groups of therapists differing in conceptual orientation (psychoanalytic, client-centered, and IA) were distinguished in both individual and group analysis of means-ends relationships. No hierarchy of means-ends relationships was found.

In the second case, the means-ends relationships exhibited by the factor analysis were validated against the project plan of the principal investigator. Individual means-ends relationships fared quite well and hierarchical relationships were revealed, but the overall hierarchy fell short of reproducing the project plan at the levels immediately below the statement of the overall goals. Examination of the data suggested that a good part of this failure could be attributed to the failure to distinguish between temporal and atemporal means-ends relationships. In IA terms, it was a failure to distinguish between courses of action and symbolic behavior, and the result of not preserving the distinction was a failure to preserve unambiguous means-ends transitivities.

10.4.6 "Surplus Meaning" and Computability. In this section I shall try to present the psychometric approach in a certain light in relation to the problem of computability as it is relevant to actual information processing. Since doing this is different from substantiating a thesis of any sort, I shall proceed with declarative sentences and a minimum of negotiation relating to details, irrelevant exceptions, and possible alternatives.

(1) The problem of computability is the problem of systematic propositional knowledge. For our purposes, the limits of one may be regarded as the limits of the other.

(2) It has been shown in a number of different contexts that propositional knowledge is inseparable from the ability to act on that knowledge. This is most easily shown in connection with rules or instructions. Having a rule, or stating it, is one thing. Having the ability to apply the rule or follow it is quite something else. This ability cannot be replaced by a second rule for applying the first rule, for, as the tortoise brought home to Achilles, the same problems arises again and an infinite regress is begun.

(3) Although abilities are indispensible boundary conditions, rules for using rules and propositions about propositions do have a systematizing and unifying potential, as the theory of recursive functions shows.

(4) Thousands upon thousands of scholarly man-hours have been devoted to the articulation of proofs, well-formed formulas, propositions, and statements. By comparison, the effort devoted to the systematic elucidation of ability concepts (as contrasted with an empirical taxonomy of achievements) is scarcely detectable with the naked eye.

(5) A computer may be regarded as a physical realization of a formal system defined within the theory of partially recursive functions. If it is so regarded, the primary ability of the computing system will be expressed as the ability to perform some primitive functions. In the main these abilities will fall in the category of simple mathematical operations such as addition. The fact that more complex operations can be wired in adds no basically new resources to the system, since these could have been programmed instead.

(6) Information systems do in fact provide us with conclusions which do not per se fall within the scope of the logical operations of which our computers are capable. The basis for this is quite simple and universally known. Computer input is coded and computer output is interpreted by a User whose knowledge is not limited to what is computable. (Another variation of the ghost outside the machine.) In this way, all manner of phenomena such as the temperature and blood count of a hospital patient or the current balance and credit rating of a loan applicant are, for some purposes, effectively represented in current information systems.

(7) Coded input is most readily conceived of as being propositional in nature, e.g., as representing definitions or observational data. If the input is factual, the output has a corresponding significance. The transition from significant input to significant output depends on the ability structure of the computer and does not alter that structure. The significance is represented only within the User, not within the computer.

(8) In contrast, the geometric representations of subject matter and conceptual content relationships may be regarded as additions to the ability structure of the computer rather than as factual input which is transformed into output. In this connection, let me mention several points:

(a) A Classification Space is implemented by inputting a system vocabulary with each term associated with

identifying coordinate values. This input is never retrieved as output. Neither does it have deductive or statistical consequences which might appear as output or even as intermediate calculations. The system vocabulary does operate on a table look-up basis, but the Classification Space per se does not. Input here is not factual in the usual sense, because it is not treated as data in the usual sense.

(b) Although the Classification Space is achieved by recourse to a specific set of judgments relating the system vocabulary to a specific set of subject matter fields, its indexing and retrieval operation is not restricted to these fields. On the contrary, retrieval is accomplished by interpreting the retrieval request as a hypothetical new subject matter field, and documents are selected sequentially on the basis of their relevance to that new field. The applicability to an indefinitely large number of unique new instances is the mark of an ability or a concept rather than a proposition or a fact.

(c) The appropriate analogue for a Classification Space is not a table of data, but a subroutine for calculating square roots. For the square root function, the subroutine format is a matter of convenience only, since in principle it is merely a discriminated segment of the computer program. In our present case, it is a behavioral function, i.e., f_8 (E,V), subject matter relevance, that is evaluated. But the Classification Space is not merely a discriminated segment of the computer program, since relevance judgments are neither programmable nor computable. Strictly speaking, the Classification Space and Attribute Space are not segments of a computer program at all, any more than the temperature and blood count of our hypothetical hospital patient are segments of a computer program. The latter example provides a second relevant analogy: Just as temperature and blood count represent the encoding of human factual (propositional) knowledge for the computer to operate on, so the Classification Space input represents the encoding of human ability for the computer to operate with.

(d) One of the common reactions to the two geometric representations is that they are "models" of subject matter relevance and conceptual content, respectively. More accurately, the operation of, e.g., the Classification Space for indexing or retrieval purposes, is regarded as a model of the process of making subject matter relevance judgments. However, this is what the

> geometric representations explicitly are not, and for good reasons. From a behavioral point of view, it is highly doubtful that it will ever be more than marginal nonsense to suppose that there is any such process to be modeled, and so our two geometric representations are based on no such dubious supposition. What these two systems do is to reproduce achievements rather than processes. The two systems produce subject matter relevance judgments and conceptual content judgments, and it is because they produce these results that they have the logical status of abilities in an information processing system.

I mentioned earlier that the number of psychometrically derived spaces that could be constructed was limited only by the number of questions that could be put to S by P in the form f (E,V) = n. In certain respects, this is a dismaying prospect, for where are we to stop, and how are we to choose? However, this is like being embarrassed at having available not merely square root functions, but other power functions, and combinatorial functions, and linear functions, and transcendental functions, and so on. That is, at worst, it is something we may hope to come to terms with. Clearly, however, the situation calls for efforts to develop a behavioral theory of abilities and achievements, so that with a limited number of fundamental abilities we can derive (synthesize?) an indefinitely large number of others. The several cases of f (E,V) for which empirical studies have been reported represent a current appraisal as to which abilities might serve as fundamental starting points.

At the present time preliminary consideration is being given to an empirical demonstration of a system which is perhaps best characterized as a material mode synthesis of abilities, as contrasted with a propositional theory of abilities (Ossorio, 1968a). The system brings together the following basic resources.

(a) A representation of a state of affairs in terms of an extended form of f_1 (E,V) where E_i are the logical individuals in a domain of interest and V_i are their attributes of interest. Formally, it has the characteristics of Carnap's "state description." Functionally, it is merely the "scoreboard" aspect of a larger system for generating descriptions. The larger system includes the implementation of the following basic abilities or operations.

(b) Subject matter distinctions

(c) Conceptual distinctions

(d) Part-whole relation analysis and recognition

(e) Means-ends relationship analysis and recognition

(f) Process analysis and recognition

(g) Deductive inference

(h) Inductive generalization and concept formation

(i) Time ordering of events and states of affairs

(j) Assignment of validity indices (negotiation status) to descriptions

(k) Class membership identification

We have seen the level of representational power provided by simple systems for (b) and (c), above. The representational power of the present system may be thought of as a simple multiplicative function of all the component systems, although in principle one can generate endless chains on the model of "this is the dog that chased the cat that ate the rat that lived in the house that Jack built."

The system is designed to operate on input that has the form of (a), and we may consider this to be the equivalent of an observation report. Unlike the usual simulation, the present simulation of a domain of facts is not a causal process simulation. The system operations which come about by virtue of an input representing a change in the state of the domain of facts are not a representation of the causal processes which bring about subsequent changes in that domain. On the contrary, the system operation is designed to calculate redescriptions of that same change of state. This is possible because the current state of that domain is already represented in the system (and has just been updated by that input). The redescriptions, ideally, exhaust the information content of the input. The system is thus a device for cumulatively analyzing and collating the information content of various messages (documents, reports, inputs) into a single, coherent system (the domain of facts) so that the totality of information is selectively available for retrieval without regard to the historical accidents of which items of information were received together in the same input and without regard to verbal constraints on how much information is explicitly stated within single messages.

A simplified example would be the following. Individual S does z (system a input). Question: Is there a process of which doing z is one of the components? Answer (from system f): Yes -- It is process Y and contains stages z, m, n, r. Question: Does doing m (and n and r) require any props? Answer (from f): Yes, it requires T_1 and T_2. Question: Are T_1 and T_2 members of the class of S's possessions? Answer (from k): T_1 is and T_2 is not. Question: Is there any member

of S's possessions which has the same major properties as T_2? Answer (from c and k): Yes -- It is G which differs only in dimensions d_1, d_2, and d_n in system c. Question: Does S have T_2 for purposes of Y? Answer (from g and j): Yes, but with a reservation. Question: Cross-check indicated? Answer (from h): Yes -- Go to d. Question: Is there a whole which includes T_2 and G as alternative constituents? Answer (from d): Yes. Answer (carryover from g and j): S does have T_2... Answer (carryover from f): S has started to do P (status 3 - conclusion, not observation).

Thus, from a linguistic viewpoint, the present system is an instrument for discourse analysis. Pragmatically, it is a device for synthesizing 'implicit' facts from 'given' facts. Since it is a way of dealing with an input in terms of its significance rather than merely its occurrence it will function as a device for recovering the symbolic significance implicit in an impoverished description of "what happens."

I said earlier that we might be able to circumvent the theoretical limits of computability in practice without challenging them in principle. Now it seems otherwise. If we do circumvent those limits in practice in the ways suggested, then, I think, we shall have to challenge them in principle. Whatever is, is possible. If I am correct, the challenge will come from assimilating computer systems to the pragmatic principles of behavior rather than trying to assimilate the facts of behavior to the propositional logic of computability theory. This is not to say that perhaps there will come a time when we can show that current computability theory is false. Rather, the logical theory of behavior description will enable us to see that that was an impoverished way to look at things and that it was hardly surprising, even predictable, that those who approached the matter with that narrow view were correspondingly restricted in the range of their information processing behaviors and achievements.

11.0 The Representation of Behavior

In the simulation of personal judgment we have seen empirical procedures designed to explore the domain of behavior by reconstructing the logical dependencies between particular behavior and the circumstances and personal characteristics of the individual who is behaving. The reconstruction is in accordance with the methodological principles developed in terms of the PSO diagram. In turn, these principles are derived from the recursive concept of behavior as IA process.

The specific relevance of the PSO diagram is twofold. First, the principles of behavior are located, methodologically, in the role of P and O, the observers, and not in the role of S, the simple object of observation. For the same reason, "says" and "describes" belong to the role of P.

Second, the principles of behavior are codified in a representational device which corresponds to the concept of behavior and are therefore, in principle, objective in a way which is impossible for propositions about behavior, be they in the form of assumptions, observation reports, or consensual agreements, or whatever. Propositions about behavior, as well as about the world generally, are individual difference phenomena. Because of this, they are also logically subject to disagreement among persons. The logical dependencies among P's particular behaviors and his circumstances and personal characteristics provide the reconciliation of such disagreements among persons. To implement such reconciliations is part of the role of O, and the dependencies in question are not an additional theory about behavior or a nonbehavioral theory of epistemology (or whatever)--they are the ways in which, in the role of O, we do, observably, reconcile such disagreements. Thus, the primary standard of adequacy for our reconstruction is that the set of principles used should, indeed, reconcile differences among various P's whether they be our experimental subjects predicting responses to provocation or ourselves and our colleagues explaining solution shift phenomena. However, short of that accomplishment, data-oriented progress checks, e.g., of the sort employed by Mitchell, are available.

The personal judgment simulation represents two of the three IA systems. As an operational device, it responds to changes in states of affairs, but does not itself provide a general representation of states of affairs. The linguistic data processing procedures are the complement of the personal judgment simulation in this respect. If intentional action, as the paradigm case of behavior, is a process whereby a type H individual transforms one state of affairs into another, the state of affairs system sketched above is designed to be capable of representing transformations of that sort as well as simpler transformations of simpler states of affairs and the relations between the simpler and more complex transformations. Relative to the mathematical and electronic descriptions of the operations of its components, such a system operates on a symbolic level. Its behavioral operation will be neither deterministic (whatever that may mean) nor

predictable from the description of its component operations. And, of course, only a system which could operate on the behavioral-symbolic level could be sufficiently free of primitive reality constraints to perform the further and idiosyncratic symbolic transformation of representing behavioral operations as an expression of simpler, non-behavioral operations or as simply illusions.

The primary purpose of such a behavioral system is to serve as the medium for the systematic reconstruction of the principles of behavior. One of the principal criteria of adequacy is that human behavior, including the descriptions by humans of the behavior of organisms and non-organic individuals be derivable as a special case. Since human behavior provides our only currently known naturally-occurring exemplars of paradigmatic type H objects and IA processes, we will naturally begin by reconstructing human-like abilities, concepts, etc. It is as a precautionary measure in this regard that we turn to empirical data representing the verbal behavior of subjects or the verbal behavior of an observer who describes the non-verbal behavior of subjects. The primary checks will not be laboratory type verification-confirmation sorts of experiments. The indicated precaution against the possibility of failing to reconstruct human-like abilities, concepts, etc. requires eventual empirical checking against a broad spectrum of intrinsic behaviors, and that requirement would not be met if we restricted our checking to an examination of only the very special forms of behavior and social practices which consist of participating in psychological experimentation, either as a subject or as a type X investigator. Instead, we will turn to just such behaviors as are called forth in the provocation-hostility situations of the Maximum Want model and the information-seeking situations dealt with by the Classification Space and the Attribute Space retrieval studies.

In certain respects, this is something of a reversal of the standard roles of "pure" and "applied" procedures. In the present case, the indicated precaution for the theoretical-experimental use of a purported principle of behavior is that the principle be demonstrated to have some apparent practical utility, since it is in just such practical situations that significant reality constraints are most readily tapped. This is, however, in accordance with the shift in the role of L_{i+1}, B_A, and B_E discussed in section 9. And of course, it is a generally indicated requirement, not a hard and fast one.

The reconstruction of the principles of behavior is here described as a "theoretical" enterprise rather than a practical one because it is responsive to the achievement standards which are taken to be constitutive of scientific behavior and scientific understanding, i.e., standards of objectivity, universality, logical consistency, and a putative real-world relevance based on rational precaution-taking. In light of prior commentaries on the ways in which type X theorizing fails categorically with respect to objectivity and universality and

avoids straightforward self-contradiction only by a heroic restriction in its conceptual scope which produces the "ghost outside the machine." It should be clear why, in the present formulation, the construction and elaboration or confirmation of type X theories appears not as a theoretical enterprise per se, but primarily as the practical activity of carrying on the professional practices of a relatively autonomous social institution.

One may foresee two major kinds of practical applications of the conceptual systematization of behavioral principles. The first is the manipulation by P of the behavioral and personal characteristics of S. Since the conceptual systematization codifies the joint personal-situational contingencies of which S's behavior is a function, P has, thereby, within his own personal-situational limitations, practical guidelines as to how to go about achieving particular results with respect to S. Both major current applied approaches are subsumed here, i.e., the manipulation of S's behavior and personal characteristics through the study and manipulation of situational contingencies and the study and manipulation of physiological contingencies. Of course, this is not a one-way street. The success or failure of particular efforts by practitioners whose concerns are in this way primarily practical may provide clues as to behavioral principles which, once formulated, can be systematically appraised by seeing at what level of generality, effectiveness, and equivalence they operate in the conceptual systematization of IA processes.

The second application is in the construction of individuals having sufficient type H characteristics to warrant a status as a special sort of H-object. Such constructions may be essential for obtaining exemplars of non-organismic behavior in order to provide checks on formulations of some general principles of behavior. Depending on the ID characteristics of such individuals, a variety of achievements, e.g., in information processing, may be envisioned which we now conceive as desirable and are unable to accomplish by virtue of our own ID characteristics.

However, there is some substantial possibility of conflict between practical and theoretical concerns. It seems unlikely that a behavioral David Hilbert will ever arise at a convention to say, "Of course pure and applied behavioral science are not incompatible--they have nothing whatever to do with one another." The fact remains, however, that the task of enlarging our understanding of behavior is different from the task of extending existing behavioral technologies, and the modal or optimal motivation, talent, and temperament for each may well represent substantially different ID characteristics. The apparent difference is perhaps most clearly represented as a difference in the distribution of emphasis between temporal and atemporal means-ends relationships, i.e., courses of action vs. symbolic behavior (Case III). Cavell (1958) has drawn a related distinction in comparing positivistic and analytic philosophy.

> "For Aristotle, to speak the truth is to say of what is that it is. In this {the analytic} way of talking, to speak the truth is to say of what is what it is."

To enlarge our understanding of behavior is in large part to reconceptualize it under more powerful descriptive concepts, hence to increase its significance, or symbolic value. But to do that is to increase our behavior potential, which is limited ineluctably by our conceptual repertoire no less than by our technology. For the "compleat scientist" who invents $< B_i, L_{i+1}, B_{i+1} >$ both types of means-ends relationships are likely to be substantially involved. However, to the behavior modifier who is devoting his energies to shaping up a type X response, to the physiological specialist who is in stern pursuit of the genetic or enzymatic substrate of schizophrenia, to the historical specialist who is tracing the process of acquiring syntactic structures, and to the practitioner's practitioner who artfully composes the locutions of a type X theory, it might well seem eccentric, if not actively perverse, to raise questions about what behavior was involved there or to be generally concerned about such matters.

Still. . . But why go on? We all know the fables and parables which remind us that getting what you want may be worse than not getting it. Moreover, we have pollution problems of various sorts to remind us that the practical hazards of merely technical solutions are not merely fabulous. We all know, too, the arguments to the effect that science is intrinsically a conceptual enterprise which carries its own (symbolic?) reward, for all that it may very well have a practical payoff in addition. Perhaps, then, on practical grounds if nothing else, among our more pressing professional concerns there is, after all, a place for the scientific study of behavior.

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