STRUCTURAL SIMPLICITY AND THE SELECTION OR REJECTION OF FORMULATIONS IN THE SOCIOLOGY OF EDUCATION

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ABSTRACT

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This dissertation is an inquiry into the possible role of structural simplicity as a criterion to be used by the sociologist of education and the educational practitioner in the selection of formulations in the sociology of education. Starting with Nelson Goodman's explication of simplicity and Richard Rudner's suggestions that structural simplicity might be an effective and objective criterion in the selection of nontheoretic formulations in the social sciences, the inquiry moved to focus upon the decision making process in the contexts within which the sociologist and educator operate.

It was concluded that the characteristic purposes, attitudes and the conceptual frame of reference of each decision context has a direct bearing upon the decision making process and that there are some

significant differences between the contexts of the philosopher of science, the sociologist of education and the educator. The philospher is primarily concerned with formal or logical matters in the context of validation, while the sociologist is primarily concerned with the development of concepts and their application to social phenomena in a context of continuing inquiry, and the educator is primarily concerned with the power to be derived from employment of sociological formulations in a context of use.

The problem of the evaluation of simplicity in the sociologist's and educator's context is considered. The specification of the role of simplicity in these two contexts is described in terms of six criteria developed and specified for evaluation of criteria to be directly used in the selection of formulations. Those criteria are: appropriateness, objectivity, effectiveness, compatibility, sequential significance and overall significance. It was found that Goodman's calculus of simplicity is inappropriate for use in such contexts because it can be applied only to formalized theoretic formulations and at present none exist in sociology of education. It was argued that simplicity might be made appropriate by formalizing formulations, but if this were done, it would demand premature closure of formulations for sociologists, and this

would be incompatible with the criterion of systematic vagueness. If such a strategy were used in the educator's context, simplicity would not necessarily be incompatible with other criteria, but would be sequentially insignificant in the light of the weight placed upon functional adequacy of formulations by the educator. It was argued that simplicity might be weakened or altered to be made appropriate to nonformalized formulations. This strategy is rejected because it led to a trivialization of simplicity.

The overall conclusion drawn is that simplicity as conceived by Nelson Goodman at this point in time has an insignificant role to play in the selection of formulations in sociology of education.

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To my son Franklin and my wife Louise who pretended that I was human through the whole episode. Without them I could not have completed the task, and without them I would not have desired to do so.

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CHAPTER I

INTRODUCTION

The first chapter of this dissertation includes a rationale for research of this kind, a discussion of the purposes of the inquiry, an elaboration of the general plan of the inquiry, and some preliminary definitions and distinctions.

1.1 The Need For Research Of This Kind

This dissertation is based upon the assumption that education finds its raison d'etre in what it can contribute to human welfare and the preservation of man. It is also assumed that the size and quality of that contribution is determined in part by the knowledge of the educative process attained by educators.

Sociology of education has promised to make intelligible certain aspects of the social context within which education is carried on, and it has accomplished this task to some extent, but has failed at least in part, because of the very enthusiasm with which new and different theories and formulations are produced. A brief look at the literature of the field discloses a shocking proliferation of overlapping and

competing formulations. This proliferation of formulations seems to have blocked the very intelligibility that is so diligently sought.

The reports of people that have made more than passing studies of the state of sociology of education tend to confirm this somewhat pessimistic assessment.[1] In fact, the present state of formulations in sociology of education is such that Sidney Morgenbesser recently asked whether it is a science.[2] Talcot Parsons, along with several other self-conscious theoreticians, has stated that the most disappointing single thing about the work done in sociology is that theory has failed to be cumulative.[3]

The question of the present state of theory in the sociology of education will be analyzed later. For now it will suffice to say that there is a destructive proliferation of formulations in sociology. A result of this proliferation is that a given term is used in more than one formulation and is assigned similar, but destructively different meanings in each of those formulations. Brookover, for instance, comments that

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[1]Richard Hoyme, "The Current Status of Educational Sociology," The Journal of Educational Sociology, XXXVI (1963), 130.

[2]Sidney Morgenbesser, "Is It A Science?," Sociological Research, XXXIII (1966), 255-271.

[3]Harry Alpert, "Some Observations On The State of Sociology," Pacific Sociology Review, VI (1963), 45.

such central terms as "social class" are given several diverse meanings in the literature.[4] This state of affairs adds up to confusion on the part of the educator seeking to use rather than develop formulations. For the theoretician it compounds the problem of providing a cumulative body of knowledge or set of concepts characterized by logical integration, clarity, power and theoretic fruitfulness.

It would seem that a definite contribution could be made to sociology and to educational theory and practice if some of the problems surrounding the proliferation of formulations and the consequent misuse of terms could be clarified. The problems involved in dealing with this proliferation of formulations are complex, but undoubtedly their solutions will involve the rating and subsequent selection of some formulations for use by the educational "consumer" and further development by the sociologist. The development of an adequate decision procedure requires among other things, the clarification of certain logical issues and problems not the least of which is the development of adequate criteria by which formulations can be rated. This dissertation is the report of an inquiry aimed at the clarification of the possible role of structural

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[4]Wilbur Brookover and David Gottlieb, A Sociology of Education (2d ed.; New York: American Book Co., 1964), 154.

simplicity as a criterion for the selection of alternate possibilities in the sociologist's process of formulation selection and development.

It should be noted that there is no clear consensus of opinion as to the relationship of the process of proliferation of formulations in sociology of education to the eventual achievement of an integrated body of theory, nor concerning the relationship between the existence of large numbers of diverse yet similar formulations to the usefulness of sociology of education to educational practitioners. It would seem that some sociologists think that "variety is the spice of life" and that the proliferation of formulations is a necessary, if not sufficient, condition for progress in sociology. Perhaps these sociologists have misconceived the task of science and confuse empirical research with creative theorizing.[5] On the other hand some sociologists focus directly upon the need for integrating theory.[6] The educator's relationship to this proliferation is unclear since it is

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[5]This is based upon the relative rarity of sociological literature concerned with theoretic integration.

[6]Sociologists such as Zona and Charles Loomis have made major contributions to comparative studies of sociological theories in their book Modern Social Theories: Selected American Writers (2d ed. rev.; New York: D. Van Nostrand Co., Inc., 1965)

hard to say exactly what the educator's relationship is to any body of theory. It must first be assumed that educational practitioners are users of sociological formulations, and second it must be assumed that the proliferation of formulations diminishes the clarity and hence the usefulness of certain terms and formulations for educators. It follows that the proliferation diminishes the power of the educator to control the social context of education by depriving him of useful (clear, precise) concepts. A corollary to this latter assumption is that a reduction of the number of formulations in use in sociology of education will make it more useful to educators. This inquiry is motivated by that assumption.

1.12 The Problem

The term "formulation" will be used interchangeably with what Professor Rudner calls "scientific formulations," which he defines as follows.

> "The written statements and parts of statements that are the product of social-science inquiry may be referred to conveniently as "formulations." Some, but not all, of them are formulations of theory. We shall refer to formulations of theory as theoretic formulations; formulations that, like typologies, definitional schemata, classificational schemata, etc., are not theories we shall refer to as nontheoretic formulations."[7]

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[7]Richard Rudner, Philosophy of Social Science, (Englewood Cliffs: Prentice-Hall, 1966), p. 10.

Rudner uses the term "empirical theory" to refer to a set of empirically testable systematically related statements, including some law-like generalizations. Rudner suggests that one of the important differences between theoretic and nontheoretic formulations in the social sciences is that nontheoretic formulations contain no empirical laws and hence are not confirmable or disconfirmable in the ordinary sense of those terms.

It must be stated that if the term "law" is construed as Braithwaite does to include the specification of a sufficient condition for the application of a classificatory term in the statement:

> "The laws may be merely the generalizations involved in classifying things into various classes. But to classify a whale as a mammal is to assert the generalization that all infant whales are provided with milk by their mothers, and this proposition is a general law."[8]

then the term "law" is not being used as Rudner does in the sense of a universal or statistical empirical generalization, but rather as an analytic statement. Such statements do not yield to the test of empirical confirmation--unless empirical confirmation is trivially reduced to mean simply finding an "entity" that

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[8]Richard B. Braithwaite, "Scientific Explanation: A Study of the Function of Theory, Probability and Law in Science, (Cambridge: The University Press, 1964) p. 1.

"fits" the specification. It seems that even if the term "law" is thus construed, the problem of selecting one formulation, that is, one specification and subsequent division and organization of a universe of discourse over another remains. It is precisely this problem of selecting a nontheoretic formulation that does not yield to confirmation or disconfirmation, and it is this problem, among others, that is faced by Sociologists of Education. Rudner states the problem nicely:

> "Now, empirical theories are assessed for their acceptability on the basis of being confirmed or disconfirmed by experimental and other tests. But this sort of assessment is precisely what is logically unavailable for nontheoretic formulations. By their very nature, nontheoretic formulations (since they are neither single hypotheses nor sets of systematically related hypotheses) are not susceptible to confirmation or disconfirmation. But if they cannot be confirmed or disconfirmed, by what criteria can nontheoretic formulations be assessed or validated or justified?"[9]

According to Rudner, any nontheoretic formulation might be included in a theoretic formulation if and when it generates at least one empirical law and to that extent becomes empirically testable. On the other hand, a theoretic formulation might be viewed as a nontheoretic formulation that has generated at least one empirical law. This notion gives rise to a distinction used in this dissertation. The term

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[9]Rudner, Philosophy of Social Science, 40

"nontheoretic component of a theoretic formulation" will be used to designate that part of any theoretic formulation considered apart from any empirical laws it might generate. For instance, the nontheoretic component of a social stratification formulation is the part of the formulation that specifies a universe of discourse and partitions it by forwarding classificatory terms such as the predicate ". . . belongs to middle-class" or ". . . belongs to upper-class."

Now since confirmation cannot be used as a test in these instances, other criteria must be used. Rudner and Ackermann have suggested that structural simplicity be used as a criterion to select nontheoretic formulations. Their suggestion follows from two considerations: First, other criteria such as confirmability, clarity and power are found unsatisfactory for one reason or another, and second, simplicity has traditionally been used in the rationales for the selection and rejection of theoretic formulations. Even though Rudner suggests that simplicity might be used in selecting and rejecting nontheoretic formulations his suggestion is untested and the applicability and hence the fruitfulness of simplicity in such cases is as yet untested.

The problem of calling simplicity into service is further complicated by the fact that an investigation

of the literature of simplicity reveals a number of explications of that term, and that two approaches to the explication of the term presently enjoy favor among philosophers of science. One approach taken by Carl Popper and John Kemeny is associated with the "curve-fitting problem." This approach attempts to isolate a criterion for the selection of one of a number of alternative hypotheses advanced to explain a set of data. The simplest hypothesis is represented by the "smoothest curve" that will "satisfy" or "fit" the graphed points.

The other approach is that taken by Nelson Goodman. It is an attempt to define a criterion that can be applied to the nonlogical primitive predicates of formulations, but only to those formulations that are formalized. Briefly stated, the simple formulation is the one that has few nonlogical primitive predicates. Just what is meant by this might be made plain by considering an easy example. Consider two text books on the topic of plane geometry. Suppose both of the texts contain a number of undefined terms, that is, terms that are normally considered part of geometry such as "point," "line," "plane" and so forth, from which other terms are defined. Both the defined and undefined terms are used in the postulates and theorems developed, and both texts have equal numbers of terms, postulates

and theorems but one text presents only three of ten terms as undefined terms and the remaining terms are defined "in terms of" the three undefined terms. The undefined terms would be considered primitives.[10] Say the second text presents five undefined or primitive terms and five terms defined "in terms of" them. Goodman would say that the first text presented the simpler formulation of plane geometry.

In sum then the problem is this: Educators who seek to bring intelligibility to the social context of education are faced with a large number of similar yet destructively different formulations in sociology of education. They are forced to make choices, yet they cannot rely upon "confirmedness." Can they rely upon "simplicity?" Sociologists are also forced to make decisions concerning the selection of formulations, and even though their purposes might be different from those of the educator, they also need a criterion

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[10]The terms "primitive" and "predicate" are used throughout this dissertation. The term "primitive" will be used to designate terms that are not defined explicitly within a system. The meaning of a primitive is presupposed in the construction of a logical system. The term predicate is used to designate a propositional function of one or more variables. Said in another way a predicate is a rule that is applied to linguistic entities. In common parlance a predicate is an attribution of something, a quality or a characteristic, to something else. For the purposes of this dissertation a predicate might be applied to either a linguistic entity or to the interpretation of that entity. Some examples of predicates might be: ". . . is a man," ". . . belongs to the set of infinite sequences," ". . . is a plane rectalinear figure," or ". . . is middle-class."

or set of criteria to make those decisions. Will simplicity satisfy their needs? This dissertation is a report of an inquiry aimed at the eventual improvement of educational theory and practice and sociological theory by determining the feasibility of using the criterion of simplicity as explicated by Goodman in the selection of formulations in the sociology of education. To accomplish this purpose, Goodman's explication and Rudner's suggestions concerning the application of simplicity, are taken as a point of departure in search of an explication to be applied to decision problems involving choice between formulations and between alternate paths of development of formulations in sociology of education. As the inquiry develops, questions concerning the relation of simplicity to other criteria, the applicability of simplicity to sociology of education formulations, and the evaluation of such a criteria are raised and answered.

1.13 Importance of the Problem

The development of a method of analyzing and evaluating partially-formalized nontheoretic formulations in the sociology of education is an important task for at least two reasons. First, partially-formalized nontheoretic formulations not only carry on an important function in the logical structure of sociology of education themselves by specifying and "dividing up"

and hence making intelligible a universe of discourse for educators, but sometimes they also become the basis upon which theoretic formulations are logically constructed and hence are very important to sociological theoreticians. That is to say the scientist's discovery of regularities and his consequent statement of them as empirical laws, is dependent upon the way he defines and partitions the universe of discourse. The definition and organization of a universe of discourse is often accomplished through the construction of a nontheoretic formulation of some sort. This is necessarily logically prior to the statement of any empirical generalizations.[11] For example, the discovery of any laws descriptive of relationships between a child's social class and his school achievement necessarily presupposes some delineation of society, an organization of the elements of that universe of discourse (society) into subgroups (social classes) through some set of categories, and finally some formulation delineating a second universe of discourse comprehending school behavior and organizing

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[11]This is a logical, rather than a temporal priority. In "science as a process" it might be the case that the theory is developed over a period of time and the nontheoretic component is chosen on the basis of theoretic fruitfulness. In this case the "laws" might be formulated before the final refinement of the nontheoretic base. The "laws" would require reformulation after the nontheoretic component was reformulated or refined.

that universe of discourse in such a way that "school achievement" can be clearly designated and differentiated from other patterns of behavior in the same universe.

Second, even though confirmation is seen by many researchers as the most important criterion in evaluating formulations, it has already been pointed out that it has some severe limitations in dealing with all nontheoretic formulations and some theoretic formulations for reasons mentioned above, and by itself, it is not an adequate criterion to select theoretic formulations, since an unsystematic formulation (if such a thing can be conceived), or one that generates vacuous or analytically true statements might, in one sense, be confirmed.

Other criteria might have been investigated but, as Rudner points out, simplicity shows promise of being both objective and effective where other criteria fail.[12]

It is widely held that the theoretic results that is, the empirical laws generated by a formulation can be no better than the primitive base (a nontheoretic component) of the formulation itself. If the nonlogical primitive predicates of a formulation are empirically empty or unclear, the generalizations generated from

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[12]Rudner, Philosophy of Social Science, 47

them will reflect this emptyness and lack of clarity. It is suspected, and an attempt will be made to establish as fact, that if a scientist can reduce the set of nonlogical primitive predicates to a set containing only those predicates that are characterized by certain desiderata, e.g., clarity and definite empirical content, then the explicitly defined terms and consequently the statements generated using those terms will somehow reflect those desiderata.

1.2 Some Definitions and Distinctions

Even though the problems discussed in this dissertation are important to the educational practitioner, the problems themselves properly "belong to" the philosophy of social science. That is to say, the problem has been defined and treated in the philosophy of social science. This statement does not completely clarify the frame of reference however, since there are several areas of disagreement among philosophers of social science. For that reason, several definitions and distinctions are made to make the basic assumptions of this dissertation clear.

It is to be noted that the definitions and distinctions offered here are not the only definitions that might reasonably be put forth for the terms defined, and that some of the distinctions made might be attacked as useless, or as positively damaging to

progress in the philosophy of social science, sociology of education, and education. In fact, the usefulness and adequacy of some of them is questioned later in this dissertation. The definitions and distinctions offered here are not the "natural" distinctions, or the "correct" definitions, but rather a set of definitions and distinctions currently used by part of the community of philosophers of social science. Only those definitions and distinctions needed to set the general frame of reference are offered here. Others will be offered later.

Richard Rudner makes several relevant distinctions early in his book Philosophy of Social Science. The first of those is the distinction between method and technique in science. For Rudner, a scientific technique is a specific mode of observation, experimentation, or experimental control. The techniques employed by the biologist vary from those used by the physicist or the psychologist. Method however, does not vary from field to field, but is the rationale on which all science bases the acceptance and rejection of hypotheses and theories. The following is his statement concerning this distinction:

> "To claim that there is a difference in methodology between two disciplines or two types of disciplines is, by contrast, to make a very radical claim. For the methodology of a scientific discipline is not a matter of its transient techniques but of its logic of

> justification. The method of a science is, indeed, the rationale on which it bases its acceptance or rejection of hypotheses or theories. Accordingly, to hold that the social sciences are methodologically distinct from the nonsocial sciences is to hold not merely (or perhaps not at all) the banal view that the social sciences require a different logic of inquiry. To hold such a view, moreover, is to deny that all of science is characterized by a common logic of justification in its acceptance or rejection of hypotheses or theories."[13]

As Rudner points out, this distinction goes a long way toward solving the problems raised by the "verstehen" discussion in the social sciences. For Rudner the dispute is resolved by allowing "verstehen" as a technique appropriate to the social sciences in the "context of discovery." This leads to the second important distinction made by Rudner. Concerning the controversey he says:

> "That social science is methodologically distinguished from the other sciences is a claim that falls within the area of philosophical interest called the context of validation, or the context of justification, in contrast to that area of empirical inquiry which is called the context of discovery. . .
>
> Now, in general, the context of validation is the context of our concern when, regardless of how we have come to discover or entertain a scientific hypotheses or theory, we raise questions about accepting or rejecting it. To the context of discovery, on the other hand, belong such questions as how, in fact, one comes to latch on to good hypotheses, or what social, psychological, political, or economic conditions will conduce to thinking up fruitful hypotheses."[14]

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[13]Rudner, Philosophy of Social Science, 5

[14]Rudner, Philosophy of Social Science, 6

A third distinction to be made is that between science as a product and science as a process. Rudner says:

> "On the one hand (as process term), it is used to refer to the activities or workings of scientists or scientific institutions, i.e., to experimenting, observing, reasoning, reading, organizing research projects, etc. But on the other hand, the same term is employed to refer to a result of these activities or processes, to the product of scientific activity, i.e., to a corpus of statements purporting to describe one or another aspect of the universe and embodying what counts as our scientific knowledge.
>
> To understand the following chapters, it is important to distinguish between science-as-product and science-as-process. In particular, it must be noted that 'science' (as product) refers to linguistic entities [sic] only, 'science' (as process) refers to extra-linguistic phenomena."[15]

Since this dissertation will be discussing criteria applicable to linguistic formulations it is necessary to make some major distinctions between kinds of formulations. This schema is based upon one offered by Richard Rudner in Philosophy of Social Science.

Rudner defines a formulation as the "written statements and parts of statements that are the

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[15]Rudner, Philosophy of Social Science, 8. Note here that Rudner first seems to include all of what might be considered the product of scientific activity. This might be a linguistic formulation and its interpretation. He then goes on to limit science-as-product to linguistic entities. He is either inconsistant or destructively vague here.

product of social-science inquiry."[16] All formulations are divided into two categories: theoretic formulations and nontheoretic formulations. A theoretic formulation is a set of systematically related statements, including some law like generalizations, that is empirically testable. Theoretic formulations enjoy a range of formalization. A fully formalized theoretic formulation is a completely articulated deductive system. Said another way, a fully-formalized theoretic formulation is a theory that has a set of nonlogical predicates that are taken explicitly as primitive (undefined in the formulation) predicates from which all other nonlogical predicates are defined. The fully-formalized theoretic formulation will also be characterized by a set of statements explicitly designated as axioms, and a set of transformation rules. All other well-formed statements are derived from the set of axioms by application of the transformation rules. The fully-formalized theoretic formulation is interpreted in some model, that is, each of the terms and statements of the formulation are assigned a meaning in some other linguistic or empirical system by rules of interpretation. These rules are commonly called rules of correspondence or semantical rules. Rudner says: "A model for a theory consists of an alternative

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[16]Rudner, Philosophy of Social Science, 10

interpretation of the same calculus of which the theory itself is an interpretation."[17] He gives an example of a Boolean algebra being interpreted in terms of elementary algebra. Hence the axiom: aO(bOc)=(aOb)oc, in Boolean algebra is interpreted as: x+(y+z)=(x+y)+z, in elementary algebra. Here a, b, c are interpreted as variables x, y, z, and the O is interpreted as the operation of addition. Parentheses are used in the same way and identity is used in both systems.

Theory T would then be made up of calculus C as it is interpreted in model M, while theory T', might be calculus C interpreted in model M'. If the model in which a calculus is interpreted is a linguistic system, as in the case of interpreting a Boolean algebra in elementary algebra, then the theory is an analytic theory. If on the other hand the Boolean algebra were interpreted in such a way that the a, b, c were the weights of piles of sand and O was the operation of heaping the piles together, then one would say that the Boolean algebra and its model were an empirical theory.

A partially-formalized formulation is a formulation that has at least one explicit definition, or at least one theorem. A non-formalized formulation

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[17]Rudner, Philosophy of Social Science, 24

will be one that has no explicit definitions and no theorems, that is, all nonlogical predicates are primitive, and all statements are axiomatic or empirical.

It is easy to see that the fully-formalized theoretic formulation will of necessity be clear in the logical sense. That is not to say that it will be clear in a psychological sense.

The second division of formulations is the nontheoretic formulations. Rudner names four types of nontheoretic formulations: the definitional schemata, the analytical conceptual schemata, the classificational schemata and typologies. Rudner defines the definitional schemata as follows:

> "This type of system of definitions consists of two sets of linguistic entities: a set W of predicates, and a set R of definitions which refer to those predicates. W will be exhaustively divisible into primitive predicates and defined predicates. R will be related to W (and indeed will systematize W by determining which members of W are primitive and which are not) in the following ways:
>
> 1. Every predicate in W that is referred to by an expression comprising a definiendum in any element (i.e., in any definition) of R, is a defined predicate of the system.
>
> 2. Every predicate in W that is referred to only in definientia of R, or does not occur in any element of R at all, is a primitive of the system."[18]

This might be made clear by an example. Suppose

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[18]Rudner, Philosophy of Social Science, 50

a researcher is interested in developing a definitional schema to be used later to describe family relationships in a primitive society. He might develop two lists, one of which will be composed of such terms as male, parent, sibling and so on--all the terms he thinks he will need. He will then define some of the terms, and take some of them as primitives. A very limited schema might look like this:

Undefined or Primitive terms:

I. Male

II. Biological parent

III. Sibling

Defined terms:

1. Father =df male parent
2. Mother =df non male parent
3. Brother =df male sibling
4. Sister =df non male sibling
5. Uncle =df father's brother

Terms I, II, and III are primitive terms and 1, 2, 3, 4, and 5 are defined terms. The W that Rudenr speaks of would be I, II, III, and 1, 2, 3, 4, 5. R is the set of definitions to the right of 1, 2, 3, 4, and 5.

Rudner goes on to point out that a particular definitional schema is accepted or rejected as a component of a theory on the grounds of its general

adequacy for a field of study, that is, does it include enough definitions for fruitful theory. Other criteria mentioned are structural simplicity and power of the system.

The analytical conceptual schemata is a type of schema that contains a definitional system as a subpart or a component, but it also contains a set of logically true or "truistic" sentences. These sentences are adjudged true on the basis of logical evidence rather than by reference to empirical evidence. If one looks at the example given of the definitional schema it is easy to see that if one stipulates that a person cannot be both male and non male at the same time, other analytic statements can be made such as "an uncle cannot be a mother." This statement is said to be true by analysis rather than by empirical reference.

Both the definitional schemata and the analytical conceptual schemata are pre-theoretic formulations insofar as they are destined for inclusion in some social science theory.

Another important kind of nontheoretic formulation mentioned by Rudner is the classificational schema. In general a classificational schema is a kind of nontheoretic formulation that lays down conditions for the applicability of its categorical or classificatory terms. It is to be noted that any classificational schema might be reformulated as either a definitional

schema or an analytical schema, while the converse is not true. Rudner makes a point of this:

> "While some classificational schemata are thus appropriately construed as definitional, the converse is not true: not all definitional schemata are classificational. . . Such systems are usually quite loosely presented, either wholly discursively or in only partially formalized manner; and where they are explicitly dubbed classificational schemata, they are also sometimes presented diagrammatically."[19]

Every classificational schema will presuppose its universe of discourse which it will divide in either mutually exclusive and jointly exhaustive sets or some set of categories that either fail to partition some of their respective universes of discourse exclusively or exhaustively, or, if they do partition all of them exclusively and exhaustively, it will not be by virtue of logical means, but due to some feature of the empirical world to which they relate.

A relevant example of a classificational schema in the educational literature is that proposed in Equality of Educational Opportunity to classify students.[20] In that report school populations were partitioned into six groups by the following categories: Mexican-American, Puerto Rican, Indian American,

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[19]Rudner, Philosophy of Social Science, 32

[20]U.S. Department of Health, Education, and Welfare, Equality of Educational Opportunity (Washington: U.S. Government Printing Office, 1966)

Oriental American, Negro, and Majority. No attempt was made to "order" the categories to say that the Mexican-American was more or had more of something than the Majority group.

The final nontheoretic formulation that will be used in this dissertation is that of typology. Typology will be the kind of nontheoretic formulation that is characterized by the following:

> "1. a concept determining the typology's universe of discourse.
>
> 2. some relation (s) that determine (s) an ordering (e.g., as serial or quasi-serial ordering) among the members of the universe of discourse.
>
> 3. statements implying that certain features (e.g., transitivity) characterize the relation (s) (if these statements are analytic the typology is theoretic)
>
> 4. a set of concepts (frequently a "polar-pair" or "extreme-opposites) usually designating some specific members of the universe of discourse that are "distant" from each other or at opposite ends of the array into which the ordering relation (s) order the members of the universe of discourse."[21]

The typology then has all the characteristics of a classificational schema and beyond that, it has a concept for the explicit determination of its universe of discourse, an ordering concept or set of concepts, and often a set of "polar-pair" concepts.

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[21]Rudner, Philosophy of Social Science, 37-38

Stratification formulations usually carry the import of a typology even when they do not satisfy the conditions that Rudner prescribes. The concept "social class" might well be construed as a concept determining a universe of discourse. The basis for allocating individuals to social classes varies considerably from formulation to formulation, but classes are "ordered" according to some such notion as prestige, political power, income or property owned. It is common to read in sociological literature that the mean income of "lower-class" individuals is less than that of "middle-class" individuals, and that the mean income of "middle-class" individuals is less than that of "upper-class" individuals.[22] In such an instance it is clear that the formulation is to be construed to designate a set of "polar-pair" concepts that is, "lower-class" and "upper-class." It is also clear that social classes are to be ordered; in this instance on the basis of income. It is on these two points that the stratification formulation differs from a simple classificational schema.

The sociology of education is defined in many different ways, and since the purpose of this dissertation is to investigate particular formulations in

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[22]This of course would be an analytic statement if the "ordering concept" were income, and not be analytically true, but might be empirically true if the "ordering concept" were personal prestige.

relation to structural simplicity, the selection of a definition of sociology of education is important only insofar as it must include the formulations chosen for discussion here. Wilbur Brookover forwards a definition in his popular textbook: "The sociology of education is the scientific analysis of the social processes and social patterns involved in the educational system."[23] No distinction is made between sociology of education and educational sociology.

This dissertation will later "test" the concept of structural simplicity in decision problems concerned with the selection of a classificatory schema, a typology and a theoretic formulation. The classificatory schemata to be studied will relate to the classification of students in various ways, while the typologies and the theoretic formulations will be drawn from the stratification literature that is associated with schools and education. Given the vagueness of certain central terms in Brookover's definition of sociology of education, it is easy to construe the definition to include the formulations to be discussed. It might also be pointed out that the formulations to be considered are in fact drawn from what is called the literature of sociology of education.

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[23]Brookover, A Sociology of Education, 11

Chapter two is a review of Richard Rudner's suggestions concerning the use of simplicity in the social sciences in general.

CHAPTER II

RUDNER'S SUGGESTIONS CONCERNING STRUCTURAL SIMPLICITY AND SOCIAL SCIENCE FORMULATIONS

In the past several years Richard Rudner has shown considerable interest in the problems associated with explicating and using the term simplicity.[1] In his writings on that topic he has repeated the theme that formal simplicity, as explicated by Nelson Goodman, is important in a logic of induction, and that it shows some promise of being an effective and objective criterion in some situations where other criteria are unsatisfactory. Rudner's discussion will serve as a point of departure for this inquiry.[2]

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[1]Rudner's interest is first apparent in Philosophy of Science Vol. 28, No. 2, April, 1961 where his article "An Introduction to Simplicity" appears. In his book Philosophy of Social Science, (Englewood Cliffs: Prentice-Hall, 1966), p. 43, Rudner relates Nelson Goodman's explication of simplicity to the problem of selecting nontheoretic formulations in the social sciences. Rudner also states his belief that Goodman's explication is important in his article "Nelson Goodman," Encyclopedia of Philosophy, ed. Paul Edwards, III (1967), 370-373.

[2]Rudner's discussion includes a classificational schema for explications of simplicity, arguments for the weight of simplicity and a discussion of some problems in the use of Goodman's explication of simplicity.

In the last part of the chapter certain questions are raised concerning the appropriateness of Rudner's frame of reference to problems in sociology of education. For instance, Rudner talks only about simplicity in relation to "science as a product." It is indeed possible that, because of its present stage of development, sociologists of education are more interested in "science as a process." Rudner attributes importance to simplicity on the basis of its possible function in a "context of justification." Some sociologists, after Merton, would argue that sociology is best served by exerting effort toward developing "middle range" formulations in the "context of discovery." Theories of the middle range would be theories of limited scope, such as a theory of small group interaction or of teacher socialization, as opposed to theories on a grand scale, formulated to explain the workings of whole societies. This dissertation is written assuming that this approach may have been misleading, and that constant attention must be given to the logical aspects of formulations as they are developed. This is necessary to eliminate the wasting of resources through attempts to confirm poorly conceived and overlapping formulations, and to eliminate the confusion that grows with the proliferation of formulations.

2.1 The Classificational Scheme for Simplicity

Rudner forwards a classificational schema based upon one devised by Robert Ackermann.[3] The basic classifications are the same as those used by Ackermann, but the terms used are different. The classificational schema as altered by Rudner first appeared in Philosophy of Science in "An Introduction of Simplicity" in April of 1961, and is repeated virtually without change in his book Philosophy of Social Science, in 1966. The following rather lengthy quote contains the gist of his schema:

> "Now, allusions to simplicity in present-day science and in the historical literature of the sciences and of philosophy are immensely varied in intent and nuance. . . . all of the immensely varied references to simplicity (can be placed) under a relatively uncomplicated classificational schema.
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> Uses of 'simplicity,' then, may be classified either as ontological (i.e., extra-linguistic)

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[3]Robert Ackermann, Simplicity and the Acceptability of Scientific Theories, Doctoral dissertation, Michigan State University, 1960.

> or descriptional (i.e., linguistic). Subclassifications under both these main rubrics are subjective (i.e., psychological) and objective (i.e., nonpsychological). Moreover, under descriptional it is useful as well to distinguish notational and logical (or structural) as subclassifications of the kinds of simplicity."[4]

Professor Rudner points out that in the first category, that of ontological simplicity, statements of simplicity supposedly attribute some quality to the universe or the way we perceive the universe. If the statement is meant to attribute a characteristic of the universe independently of how we perceive it, then it is Objective-Ontological Simplicity. If on the other hand, it is taken as a predicate of our responses to the universe, whether we see the universe as simple or not, then it is Subjective-Ontological Simplicity. Rudner rejects this set of concepts as "fundamentally obscure to me."[5] This obscurity might be a function of Rudner's distinction between "science-as-process" and "science-as-product." Insofar as Rudner hesitates to speak of simplicity in relation to "science-as-process" and ontological simplicity would lead to assertions about "science-as-process" Rudner may be rejecting an approach to philosophy of social science as well as one notion of simplicity.

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[4]Rudner, Philosophy of Social Science, 42

[5]Rudner, Philosophy of Social Science, 42

The second main category is that of descriptional or linguistic simplicity. Subcategories under descriptional simplicity are notational and logical. Rudner describes this distinction as follows:

> "An attribution of simplicity to a description on the basis of such a notational property of it as the number of (e.g., alphabetical) characters it contains, independently of anyone's psychological responses to such a property, will be classed as an instance of Objective-Notational simplicity. On the other hand, an attribution of simplicity to a description on the basis of the familiarity of the notation, or its elegance, or its convenience, or its efficiency for manipulation, or any aesthetic quality it has, etc., will count as an instance of Subjective-Notational simplicity. . . .
>
> In the sense just indicated, then, neither objective nor subjective notational simplicity is our topic of concern in what follows. What is being attended to is the logical (or, alternately, the formal,or structural) simplicity of descriptions--and especially those descriptions which constitute scientific theories. Moreover, since our interest is not in how people psychologically respond to logical properties of theories, we may characterize our field of attention as Objective-Logical Simplicity."[6]

Here Rudner charges to the heart of the problem of simplicity as it is interesting to the philosopher of social science. He is interested in Objective-Logical Simplicity.

Professor Rudner goes on to note that philosophers and scientists, (with the notable exception of

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[6]Richard Rudner, "An Introduction to Simplicity," Philosophy of Science XXVIII, No. 2 (1961) 111, 112.

Mario Bunge) have taken two major approaches to the explication of Objective-Logical Simplicity. The two approaches are fundamentally distinct and Rudner has some misgivings regarding the application of this classification to one of them. The approach taken by Nelson Goodman has shown considerable positive results. The second line of inquiry, an older one, is associated with the "problem of curve-fitting." This approach assumes the notion that in confrontation with data represented as a set points on a graph, the scientist should "induce to" the simplest (smoothest) curve or function descriptive of the data.

The second approach has produced various explications of simplicity by Harold Jeffreys, K. R. Popper, and John Kemeny. Professor Rudner rejects the approach:

> "The concept of inductive simplicity as elaborated by Jeffreys, Popper, and Kemeny comes to depend on some such notion as the number of "freely adjustable parameters" which occur in alternative hypotheses. . . . Even if such treatments were otherwise wholly successful, it is doubtful that they would furnish any tenable criterion or test of simplicity-especially of formal simplicity. Thus, for example, there seems to be no good reason for believing that a hypothesis with n+1 parametric expressions is less simple in the sense of Goodman's calculus than a hypothesis with n parametric expressions."[7]

Professor Rudner goes on to point out that it will not in general be the case that the set of predicates from the hypothesis of n+1 parameters will have

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[7]Rudner, An Introduction to Simplicity, 115

a higher complexity value than sets of predicates from alternative hypotheses of less than n+1 parameters. This will depend on, among other things, whether or how some of the predicates in such sets are definable by others in the same set. According to Rudner, this will lead to conflict of judgments with the assessment of simplicity by Goodman's calculus.

Rudner points out that all this proves is that the two concepts are not identical.[8] But since this is so, he goes on to ask why they are not identical. If

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[8]W. V. O. Quine points out that the "curve fitting" problem, as a problem of selecting the "smoothest curve" may involve something as simple as the fact that the probability that subsequent data will confirm the hypothesis is raised when "round figures" are used in constructing a curve. He says: "True, we do not customarily say "simple hypothesis" in the round-number case. We invoke here no maxim of the simplicity of nature, but only a canon of eschewing insignificant digits. Yet the same underlying principle that operates here can be detected also in cases where one does talk of simplicity of hypotheses. If we encompass a set of data with a hypothesis involving the fewest possible parameters, and then are constrained by further experiment to add another parameter, we are likely to view the emendation not as a refutation of the first result but as a confirmation plus refinement, but if we have an extra parameter in the first hypothesis and are constrained by further experiment to alter it, we view the emendation as a refutation and revision. Here again the simpler hypothesis, the one with fewer parameters, is initially the more probable simply because a wider range of possible subsequent findings is classified as favorable to it. The case of the simplest curve through plotted points is similar: an emendation prompted by subsequent findings is the liklier to be viewed as confirmation cum-refinement, rather than as refutation and revision, the simpler the curve." This occured in "On Simple Theories of a Complex World," Synthese, XV, (1963), 106.

the "curve-fitting approach" measures something other than what Goodman's calculus measures, he would like to know just what it is. He concludes that whatever the cogent criteria may be for ordering a selection of hypotheses in the "curve-fitting" situation, it would be misleading to classify them as considerations of Objective-Logical simplicity.[9] Rudner's rejection of this approach is taken as sufficient grounds for eliminating it from further consideration here.

Professor Rudner points out that Goodman's approach is the only one that can reasonably fall under the rubric of Objective-Logical simplicity. He points out that it is not implausible to assume that the formulations of science all share a common apparatus of logical expressions. This turns his attention to the extralogical expressions in any formulation. It is not unlikely that one would first attempt to assign simplicity on the basis of the set of axioms or postulates of a system. He points out that this approach immediately runs into a problem since any formulation can have its number of axioms trivially reduced to one by the logical operation of conjunction. This leads to the sorry conclusion that every formulation would be trivially equivalent by reduction to maximal simplicity.

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[9]Rudner, An Introduction to Simplicity, 117.

This leads to the assessment of simplicity on the basis of the characteristics of the extralogical predicate bases of formulations. Rudner points out that this is exactly the approach that Nelson Goodman has taken, and points out that Goodman has been able to construct a calculus of simplicity which provides a means of assessing the simplicity of the predicate bases of fully formalized systems. "In general (and here, vaguely), Goodman's assignments of simplicity-value may be thought of as depending on the manner in which the extralogical primitive predicates of a system organize (by virtue of such of their logical properties as reflexivity or of symmetry) the entities comprised in the total extension of the system."[10] This is a limited but precise description of Goodman's explication of simplicity.[11]

2.2 The Importance of Simplicity In Science

Professor Rudner argues the importance of simplicity on two points: (1) simplicity is important to the development of an adequate logic of induction, and (2) due to the lack of other adequate criteria, simplicity may be a very important criterion in the

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[10] Rudner, Philosophy of Social Science, 44

[11] Goodman's explication is discussed more fully in the following chapter.

selection of nontheoretic formulations in the social sciences. Concerning the importance of simplicity to a logic of induction he says, "the problem of acquiring an adequate measure of simplicity is crucially important for the logic of induction itself."[12] A "logic of induction" is an adequate body of methodological principles upon which decisions concerning the selection and rejection of formulations can be based. This need for a body of principles is necessary for the simple reason that no one criterion is applicable to all decision situations.

Simplicity is seen as an important criterion because it is so closely related to systematicity, an essential characteristic of scientific descriptions. To make the point, Rudner quotes Goodman:

> "We are inevitably concerned with simplicity as soon as we are concerned with system at all: for system is achieved just to the extent that the basic vocabulary and set of first principles used in dealing with the given subject matter are simplified. When simplicity of basis vanishes to zero--that is, when no term or principle is derived from any of the others--system also vanishes to zero."[13]

Insofar as simplicity is related to systematicity, it is also related to "explanatory power." Even though the notion of "explanatory power" is probably reducable to power of primitive basis and fruitfulness

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[12]Rudner, Philosophy of Social Science, 45-46

[13]Nelson Goodman, "The Test of Simplicity," Science, CXXVIII (1958), 1064

of a formulation, these characteristics are often sought under the rubric of "explanatory power." Scientists feel that they increase the explanatory power of a formulation when they systematize or bring together a number of formerly discrete or logically disconnected laws or generalizations. The Newtonian physics for example was thought to have greatly increased the explanatory power of extant physical laws by tying them together logically. What the Newtonian formulation accomplished probably increased the heuristic value--or said another way, it surely made the physical world more intelligible, and it probably made physics more "learnable." Suffice to say, systematicity is a primary desiderata of science.

It is upon this basis that Professor Rudner sees simplicity as important to a general logic of induction. Simplicity is also important by default, since other criteria considered are inadequate. Clarity is commonly thought to be important by scientists, but Rudner rejects this criterion as ultimately important on the grounds that it is subjective, since it is relative to person, place, time and even mood. Obviously a set of predicates or hypotheses might well be clear to their inventor, and yet be quite unclear to others.

It would certainly seem that there is a legitimate sense in which the term clarity might be

attributed to a formulation. Surely we might say that a classificational schema is logically clear if it is made up of a set of mutually exclusive and jointly exhaustive categories, rather than a set of categories that are indeterminant in extension, or worse, of indeterminable extension. In empirical formulations there is a second sense in which one formulation might be said to be more clear than another. An empirical formulation that employs predicates that have direct empirical reference rather than reference to "the world" through theoretical constructs might be said to be more clear. For instance a classificational schema for members of a community based upon skin color might be said to be more clear than one based upon national origin of the parents of the individual members, or the marital status of the individual members.

Another criterion, theoretic fruitfulness, defined as the number and scope of empirical laws generated by a formulation, is also a most important criterion but obviously since it cannot be applied to formulations until they have been fully elaborated, its usefulness is restricted in two ways: (1) it cannot be applied to nontheoretic formulations at all, (2) nor can it be applied to theoretic formulations until they are well developed.

A third criterion, power of primitive base, that is, the scope of the extension of the primitive terms, is also important, but again, by itself power is not adequate since it cannot be used to choose between equally powerful bases. For example, one might look at attempts to axiomatize arithematic. Of the two major attempts, both formulations have equally powerful bases, since they both are adequate bases for the system.

It should be noted that no criterion is sufficient on its own, but becomes adequate when used at a given time, at a given stage of development. For instance, in the early stages of the development of a particular formulation a scientist is often more interested in the intuitive clarity of the formulation than he is in the precision of the statements generated. Later, the criterion of confirmability will ascend the throne of the most crucial criterion. At another stage the scientist will be interested in the coherence with the rest of science manifested by his formulation. An example that is often used in science is the rejection of certain approaches to "psychic phenomena" on the grounds that those approaches do not "fit" modern science. The approach might well be clear, and possibly even confirmable, but it is rejected on the grounds of lack of coherence with psychology and

other basic concepts of modern science.

For example, scientists who would study the phenomenon of clairvoyance are in general shunned in the scientific community because the possibility of anyone knowing future events is inconsistent with present psychological conceptualizations of learning and beyond that it violates the notion of time that is pretty well accepted by the scientific community. To say that Jean Dixon sometimes makes remarkably accurate predictions about the future is to say one thing. Social scientists predict election results and riots too. But to say that Miss Dixon in some way "sees" the future violates a notion of time and relations basic to modern science. To "see" the future requires that a future state exist in the present and this somehow destroys the distinction between present and future. In other words to admit certain formulations or even certain approaches to studying phenomena demands a rejection of the present structure of modern science; and most scientists are unwilling to do this.

It ought also to be noted that there is no guarantee that all criteria that play an important role in scientific decision making are compatible. Mario Bunge eloquently points out that a scientist

might seek simplicity to the loss of "transcendent" terms.[14]

The second point is that simplicity may be important in selecting nontheoretic formulations. If it is, then simplicity is especially important for the social sciences, since they are poor in theory and rich in nontheoretic formulations. Professor Rudner makes a definite point of this in the following statement:

> "Now, empirical theories are assessed for their acceptability on the basis of being confirmed or disconfirmed by experimental and other tests. But this sort of assessment is precisely what is logically unavailable for nontheoretic formulations."[15]

Due to the special weakness of other criteria, confirmability being the singularly most important, in the area of assessment of nontheoretic formulations, simplicity takes on added importance.

An important question, one that Rudner did not adequately treat, is now beginning to emerge. It might go something like this: What is expected of a criterion that is to be used in selecting nontheoretic formulations. Said another way, what is to be admitted as evidence that simplicity is a "valid" or

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[14]Mario Bunge, "The Weight of Simplicity in the Construction and Assaying of Scientific Theories," Philosophy of Science, XXVIII, No. 2 (April, 1961), 122.

[15]Rudner, Philosophy of Social Science, 23

"good" criterion in such decision situations. Since this dissertation sets out to define the role of simplicity in the development of formulations in sociology of education, this question is of central importance to its logical development.

Rudner suggests certain criteria in his discussion of clarity, power and fruitfulness. It has already been noted that clarity is not "objective," power is not "effective" and fruitfulness is not "appropriate." This gives a hint of some of the criteria that might be seen as relevant, and will be used as the core of a list of criteria by which a criterion might be selected or rejected.[16]

2.3 Some Problems in Using Simplicity

Even though the calculus of simplicity holds some promise for evaluation of nontheoretic formulations in the social sciences, the calculus is applicable only to theories that have been at least sufficiently formalized to enable discrimination of their primitive predicates. Its utility as a factor in assessing the acceptability of formulations in the social sciences is severly limited by the fact that there are few

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[16]The criteria to be used in selecting criteria is discussed more fully in Chapter IV.

formulations that make the primitives explicit.[17] Rudner suggests that this situation would be alleviated if some means could be found either to bring those formulations to a degree of formalization that allowed the calculus to be applied, or if some modification of the calculus could be made to make it applicable to less than fully-formalized systems.

Professor Rudner sketches an outline of what a relevant partial formalization of formulations would involve. He also suggests some problems that might be presented when such a partial formalization was attempted. For Rudner, a partial formalization is one of "those negligibly formalized systems exhibiting even one supposedly deductive connection among its statements, or which determine explicitly the usage of even one constituent concept."[18] Anything less than full formalization would be partial formalization, (with the exception of formulations excluded by the above statement). Since there is such a wide range of partial formalization, the question, what aspects of formalization are relevant to an assessment of

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[17]Sanford Dornbusch is almost apologetic for even considering formalization as a technique for improving theory in sociology in his introduction to the recent book Types of Formalization in Small-Group Research (Boston: Houghton Mifflin Co., 1962). This seems to reflect a general distrust of logical techniques in sociological research.

[18]Rudner, Philosophy of Social Science, 47

simplicity arises.

A hint at just what aspects of partial formalization might be important can be taken from Goodman's system of measuring simplicity. What is lacking in most partial formalizations is knowledge of what concepts are to be counted as primitive in a future formalization. Thus what is needed is a method of making sound projections about the logical character of such future formalizations on the basis of information available. This suggests to Rudner the study of systematic presuppositions in theories. He defines systematic presupposition as the "implicit presupposition of large segments of a field or discipline other than that to which the theory being constructed is indigenous."[19]

Since the technical terms of any formulation are either defined or undefined in the system, it follows that any term not defined in the system must either be a primitive of the system or be nonindigenous. Rudner points out that concepts that are indigenous to a theory, may be given the status of tentative primitive. "Concepts not indigenous to the theory . . . may have a distinctive status still to be determined."[20]

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[19]Rudner, Philosophy of Social Science, 48

[20]Rudner, Philosophy of Social Science, 48

An example of the use of nonindigenous terms in a formulation from sociology of education is seen in a brief look at Wilbur Brookover's work on self-concept of academic ability.[21] In a footnote Brookover notes.

> "We use the term significant others, as proposed by George H. Mead, to refer to other persons whose role a given individual takes in appraising himself in a particular role performance. See G. H. Mead, Mind, Self and Society (Chicago: University of Chicago Press, 1934).[22]

Here Brookover has taken a concept from a psychological formulation, or a social-psychological formulation and included in his own. He might later define the term explicitly and hence make it a defined term or he might designate the term a primitive and assign it a meaning in some other way than alluding to its meaning in Mead's conceptualization.

The obvious import of focusing upon nonindigenous terms in a partially formalized formulation rests in the fact that some portion of the results of some other discipline or area is being presupposed in the theory. This is important in that a wholly explicit deduction of testable hypotheses mentioning any of the nonindigenous terms would involve the explicit use of laws from the donor discipline. The important

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[21]Brookover, A Sociology of Education, chapter 2 and 16.

[22]Brookover, A Sociology of Education, 455

aspect of presupposition is that if a scientist is ignorant of those presuppositions, they will be unexamined and unevaluated; and to the extent that they are unevaluated, confidence in the theory's adequacy must be qualified. When the presuppositions are taken from a relatively well confirmed and clear formulation, the risk tends to be minimal, however, when the presuppositions are taken from so-called "common sense" language, the risk may be too great to be tolerated.

The inclusion of nonindigenous materials in a formulation is often done through what Rudner calls quasi-deduction. He states: "We shall designate as quasi-deduction any putative inference in a theory that purports to be deductively elaborating such theories . . . but that fails to meet the requirements for being a deduction. . . . Quasi-deduction in a theory is not confined solely to the implicit assumption of nonindigenous material as premises. It is frequently the case that the statements omitted in quasi-deductive inferences are ones indigenous to the theory."[23]

Under the rubric "relative primitives" Professor Rudner discusses briefly the rationale or justification of the concepts that occur in a

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[23]Rudner, Philosophy of Social Science, 50

partially formalized theory. In this discussion he presents three modes of concept presentation or concept introduction:

> "1) Concepts may be introduced by explicit definition or some equivalent of explicit definition.
> 2) Concepts may be introduced through some specification in the theory, that yields a sufficient condition for their application.
> 3) Concepts may be presented, not explicated in the modes of 1 and 2, as relative primitives."[24]

Explicit definition will differ in partial formalizations from fully formalized formulations only in that some or all of the primitives are not explicit in the partial formalization.

Statements of a theory that specify a sufficient condition for something's being a thing of given kind, also yield a sufficient condition for the application of the term or concept that indicates the kind. Thus, the statement 'If an animal suckles its young then it is a mammal' not only specifies a sufficient condition for something being a mammal, but also furnishes a criterion sufficient for correct application of the term 'mammal'.

Professor Rudner notes that specification of sufficient conditions for the application of a term does not give the full meaning of that term. Any theory might give a number of sufficient conditions for a term, thus a theory might contain the statement,

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[24]Rudner, Philosophy of Social Science, 50

'If an organism has a backbone it is an animal,' and also, 'If an organism is warmblooded, it is an animal.' Each of the statements partially determine the use of meaning of the term, and taken together they more fully determine the usage of the term, but neither separately nor together do they fully specify the meaning of the term. The temptation is of course to designate such terms ultimate primitives. This is risky though, for there is promise that the term will get explicit definition in the theory eventually.

Rudner notes that "finally, there will usually occur in partially formalized theories, terms that are not introduced in either of the two ways just mentioned."[25] These will be the terms that will be labeled relative primitives. These terms do not have unknown meanings, on the contrary, some sufficient condition for the application of the term might be available, or the term might have sufficient antecedent clarity from "ordinary usage."

It is important to note that in a theory that has not been fully formalized, the status of terms not introduced by explicit definition, or some specification of conditions for application, are not automatically that of primitives. Such terms may only be counted as presumptively, or tenatively primitive.

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[25]Rudner, Philosophy of Social Science, 51

Formulations are being changed constantly, hence a term or set of terms that are today thought to be primitive, might with the acquisition of new knowledge, be judged derivitive of other terms. Hence the tentative primitive might lose its status as primitive. This means that any assessment of simplicity made upon the basis of tentative primitives, will also be tentative.

2.4 Some Observations Concerning the Usefulness of Rudner's Suggestions to the Sociology of Education

Even though Rudner's suggestions are discussed and tested for their plausibility in Chapter IV, some preliminary comments concerning them seem appropriate here. That being the case, several observations of a general sort are made here. There are four types of observations: (1) those concerned with the appropriateness of Rudner's purpose and general frame of reference, (2) those dealing with his more specific suggestions concerning the use of simplicity as a criterion to evaluate nontheoretic formulations, (3) those concerning a program for partial formalization, and finally (4) those observations dealing with Rudner's suggestions that Goodman's explication of formal simplicity be reformulated to be applied to nonformalized formulations.

Before any appraisal of Professor Rudner's suggestions can be made, a few observations concerning his purposes and his general frame of reference should be made. It is to be remembered that Professor Rudner is a philosopher of social science rather than a social scientist, and for that reason his professional and intellectual orientation is somewhat different from that of the social scientist. For Rudner the philosophy of social science is to be construed as a branch of epistemology and is interested, "not with the substance of any social theory nor with a view of what makes a good society, but with the logic of any theory construction in social science and with the logic of justification of (any) social-science theory."[26] It is to be noticed that his interest is in methodology rather than content, and this allows him to make a number of distinctions that may bring clarity to the methodological issues discussed, but which are difficult to apply to the process of theory building. The distinctions are quite useful in the area of philosophy, where clarification is at stake, but they may be less useful when applied to the task of building a theory. His interests are also quite different from those of an educator who relies upon theoretic knowledge in his day to day decisions. The educator is in effect

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[26]Rudner, Philosophy of Social Science, 3

"processing" with a "product."

Professor Rudner distinguishes between the "context of discovery" and the "context of validation," and between "science as a process" and "science as a product." He then proceeds to discuss "science as a product" in the "context of validation." The very fact that Rudner makes these distinctions indicates that the kind of thing done by the philosopher is quite different from that done by the scientist. The question that first appears is in what ways can knowledge or insight gained in viewing science as Rudner does as static and complete, be applied to the process of building and using scientific theory. It seem that the scientist is engaged in what Kaplan calls the "logic-in-use"[27] which is essentially a process that involves continually moving from the "context of discovery" to the "context of validation" and back again. The scientist does not simply "latch on to a good hypothesis" in the context of discovery and then confirm or disconfirm that hypothesis, but he constantly revises and refines a hypothesis on the basis of information gained when attempting to confirm the hypothesis.

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[27]Abraham Kaplan, The Conduct of Inquiry (San Francisco: Chandler Publishing Company, 1964), pp. 6-11

Kaplan strikes a blow for the scientist in the following:

> "A great deal hinges on whether science is viewed as a body of propositions or as the enterprise in which they are generated, as product or as process. An account of the norms bearing on the finished report of an investigation might well be expected to differ from one concerned with the conduct of the investigation itself."[28]

Had Kaplan been writing on the question of selecting a formulation to be used the way an educator might use a study of social stratification in his community, he might well have added that while the philosopher of science is interested in system and the social scientist is interested in explanation and prediction the educator is interested in control. Each of these interests overlaps to some degree, but the fact remains the interests <u>are</u> different.

Rudner might well respond that even though these interests are different, the educator's concern with control pre-supposes the sociologist's concern for explanation and prediction which, in turn, pre-supposes the philosopher of social science's system. This analysis holds only if one defines scientific explanation as subsumption of particular phenomena under general laws, and defines system as a set of deductively related set of statements. It might be the case, however, that the sociologist views explanation in a different light

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[28]Kaplan, <u>The Conduct of Inquiry</u>, 7

than does the philosopher of social science. And it is surely the case that the sociologist would view the notion of systematicity in a different light insofar as he would include statements of empirical correlation as one non-deductive method of systematizing concepts and statements.

It would seem that the sociologist in his adherence to "functional analysis" is assuming a notion of explanation and of system that is more in line with Scriven's explication of the key feature of explanation as, "The production of understanding; this often amounts to the reduction of the incomprehensible to the comprehensible,"[29] than it is in line with the Hempelian notion of explanation as subsumption under general laws. Scriven goes on to elaborate his notion of explanation:

> "Explaining consists of exhibiting the not understood as a combination, of an understood kind, of understood components.
>
> Now this notion of the reduction of a phenomenon into acceptable components is very closely connected, where the concept of a model is relevant, to perception of the phenomenon in terms of a familiar, i.e., understood, model. The crucual point about a model is that it has familiar component parts, and the relationships between these parts is understood. (I am using the term "model" in the sense in which it is overextended to include mere mathematical descriptions.)"[30]

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[29]Michael Scriven, "The Contribution of Philosophy of the Social Sciences to Educational Development," Philosophy and Educational Development, ed. George Barnett (New York: Houghton Mifflin Co., 1966), p. 58.

[30]Scriven, "The Contribution of Philosophy of the Social Sciences to Educational Development," 59

It also seems that the sociologist uses nontheoretic formulations as a model in Scriven's sense, and that Rudner's emphasis upon nontheoretic formulations as mere pre-theoretic formulations is misplaced. It is clear that the sociologist looks upon a stratification formulation as a model through which certain social phenomena manifest by a community might be "explained," while the philosopher of social science would not admit that explanation results from the application of such a formulation.

In short then, it would seem that the logical system demanded or at least prescribed by the philosopher is little more than a sufficient condition for one kind of explanation, but not sufficient for all kinds of explanation appropriate to sociology.

Without belaboring the point, it is enough to say that consideration of simplicity only in the "context of validation" gives no direct knowledge of simplicity in relation to "science as process." On the other hand, "science as process" is not entirely unrelated to "science as a product" since the process can be conceived as being made up of steps; a very important one of which is validation.

Rudner's use of the "context of validation" is

misleading insofar as it is defined as the context within which the question of selecting or rejecting a formulation is raised. It seems that a further distinction must be made to deal with the question of selection and rejection of formulations by different people for different reasons. The context within which a sociologist selects a formulation is different from the context in which the educator selects one.

Rudner suggests that aside from being important to a logic of induction, simplicity might be very important to social science theorizing on the grounds that it might be useful in the task of assessing and selecting nontheoretic formulations. One comment must be made concerning the use of nontheoretic formulations in sociology of education. Nontheoretic formulations play a very important role in sociology of education. It seems that much of what educators and sociologists are doing today boils down to comparing school districts, communities, cities and even countries on a multitude of points ranging from racial composition to methods of instruction and reporting the facts issueing out of those comparisons. Classificational schema and typologies are the vehicles of those comparisons, and it will be through those formulations that significant differences will be discovered and documented. Whether simplicity is

a significant aspect of the desirability of those formulations is another question.

Professor Rudner suggests that perhaps a tentative assessment of simplicity for nonformalized theories can be achieved by partially formalizing the theory in such a way that relative primitives can be designated. In order to accomplish the task of designating some terms as relative primitives, he suggests that the formulations in question be analyzed to determine what presuppositions are being made, and when the formulations are elaborated on the basis of "quasi-deduction." It is well to note that the kind of partial-formalization recommended by Rudner will by its very nature have implications that go beyond the mere assessment of simplicity. It is also to be noted that several questions are raised, such as at what point in the development of a formulation should the theoretician formalize, and when can the scientist afford to formalize a formulation.[31]

Finally Rudner suggests that Goodman's explication of simplicity might be reformulated in

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[31]Constantine Politis noted some of the limitations of formalizations in a paper contributed to the 1964 International Congress of Logic, Methodology and Philosophy of Science. This was later published as "Limitations of Formalization," Philosophy of Science, XXXII, No. 4 (1965), 356-360.

such a way as to be applicable to nonformalized formulations, but he does not suggest what form such a reformulation might take. If Goodman's explication can be so reformulated it will be far more valuable. It seems that there are a number of forms that a reformulation might take. First, the calculus might be construed as a general "rule of thumb" for the theoretician and go something like this: Nonlogical predicates should be explicitly defined whenever possible. This "rule of thumb" or a number of such rules might be devised with varying degrees of strength and generality.

A second approach would be to draw directly upon the calculus for specific rules calculated to direct the theoretician to construct predicates of certain kinds deemed preferable in choice situations. If this approach were taken, the rules would tend to be more precise and certainly would be more restrictive. The two approaches are taken up in chapter IV.

2.5 Summary of Chapter II

Richard Rudner's writings on simplicity are important to this dissertation because Rudner has made an attempt to classify and evaluate various attempts to explicate the term simplicity. Rudner first divides all attempts at explication into two

categories, Ontological Simplicity and Descriptive or Linguistic Simplicity. Ontological Simplicity would be applied to those explications of simplicity that presume to predicate something of the universe or of the way we perceive the universe, while Descriptive or Linguistic Simplicity would be applied to those explications conceived to be predicated of man's descriptions of the universe. Rudner rejects the notion of Ontological Simplicity as fundamentally obscure and irrelevant to the tasks of science. He selects as relevant to the tasks of science the subdivision of Descriptional Simplicity called Objective-Logical Simplicity, and notes that of two approaches to the explication of that notion, Nelson Goodman's approach is most promising. Goodman has devised a calculus of simplicity, the application of which to a formalized formulation will yield a simplicity value based upon the number and relevant kind of the extralogical primitive predicates.

Professor Rudner notes that the empirical test of confirmation does not apply to all scientific formulations and points out that among other criteria (clarity, power, theoretic fruitfulness) simplicity is the most promising for evaluations of nontheoretic formulations, and since the social sciences use a large number of nontheoretic formulations, simplicity

shows promise of being an important criterion there.

The immediate promise of simplicity as a criterion in the social sciences is dimmed by the fact that Goodman's calculus of simplicity can be applied only to formalized formulations, and there are few such formulations in the social sciences. To remedy this situation, Rudner suggests that formulations might be partially formalized and an assessment of simplicity be made on the basis of relative primitives, and suggests some problems that are met in attempts to partially-formalize formulations.

Some comments were offered concerning the usefulness of Rudner's suggestions concerning simplicity and social science formulations in relation to sociology of education. It was specifically noted that present weaknesses in theory in sociology of education are related to problems of assessing formulations. Several areas of sociology of education are quite concerned with the use of nontheoretic formulations. It was noted that the concerns and perspective of a philosopher of Social Science might well differ significantly from those of either a social scientist or of an educator. It was also noted that the program for partial-formalization outlined by Rudner shows some promise of being

valuable in each of these tasks. Rudner's suggestions in somewhat modified form were seen as promising in general then, and will be tested further by application to specific formulations in Chapter IV.

Chapter III is a review of Goodman's explication of simplicity with particular attention to Goodman's arguments for the importance of simplicity and to his determination of the context within which formal simplicity is useful.

CHAPTER III

A REVIEW OF GOODMAN'S EXPLICATION OF SIMPLICITY

Since the stated purpose of this dissertation is to investigate the relation of Nelson Goodman's notion of simplicity to the field of sociology of education, any review of literature must be a review of Goodman's writings on simplicity. This chapter includes a review of those writings and some general comments concerning the appropriateness of Goodman's frame of reference to some problems in the sociology of education.

The first section of Chapter III is little more than an integrated paraphrase of Goodman's exposition of the calculus of simplicity. Since the purpose of the dissertation is to determine whether Goodman's calculus of simplicity can profitably be applied to certain decision problems in the sociology of education, the paraphrase is focused primarily upon Goodman's introduction and definition of the situation in which the calculus can be applied. When the calculus proper is quoted however, it will be

quoted directly rather than paraphrased.[1]

3.1 Goodman on the Use of Simplicity

The development of Goodman's thoughts on simplicity can be traced through a series of articles first published in the Journal of Symbolic Logic, but such a tracing would be a wasted effort, since his later articles contain a clearer and more fully developed elaboration of his calculus. For that reason, the calculus will be presented as it presently stands and is elaborated in the second edition of his book, The Structure of Appearance. In that book Goodman states: "In Chapter III, old Sections 3 through 7 have been replaced by the new Sections 3 through 10, incorporating results of the continuing investigation of structural simplicity."[2] Even though the calculus is complete in Goodman's latest work, a complete understanding of the development of the problem addressed by the calculus may depend upon material

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[1]This is not the first paraphrase of Goodman's work. Others with their own emphasis have been offered by the following: Rudner, Philosophy of Social Science, 44-47; Donald Hillman, "The Measurement of Simplicity," Philosophy of Science, XXIX, No. 3 (July, 1962), 225-252; Robert Ackermann, Simplicity and the Acceptability of Scientific Theories, dissertation, Michigan State University; and Lars Svenonius, "Definability and Simplicity," The Journal of Symbolic Logic, XX (1955), 235-250.

[2]Nelson Goodman, The Structure of Appearance, (2nd ed. rev.; New York: The Bobbs-Merrill Company, Inc., 1966), p. vii.

taken from the earlier articles. In that case materials from them is integrated into the paraphrase where it seems appropriate.

The calculus of simplicity itself will not be presented as a formal system, but will be treated informally. This seems in keeping with the general purpose of the dissertation.

The first three chapters of The Structure of Appearance discuss Goodman's notion of system. For him system plays a central role in science and in fact is tantamount to both science and philosophy. This follows from the fact that the purpose of science is to render precise the relationships it explains in order to be able to make precise analyses and predictions, and from the fact that a system, being a deductively related body of statements, does this best. Formalization or systematization is the best way to make explicity the logical structure of a system and hence make precise the relations between terms. And beyond that simplicity is not only tantamount to systematicity, but is also "inextricably involved in the selection of what is regarded as a true system."[3]

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[3]Nelson Goodman, "Axiomstic Measurement of Simplicity," The Journal of Philosophy, LII (1955), 709-722.

Formalization is usually thought of as a method of making the logical structure of a theory explicit and deals with the common logic of theories. Goodman explicates simplicity in terms of formalized theories. The result is that his explication of simplicity is directly applicable to formalized theories.

Structural or formal simplicity is a characteristic of, or is predicated of the extralogical base of a formalized theory. The extralogical basis of a system is discerned in its postulates, and consists of all the terms that are not included in the list of basic "logical terms". These are the terms peculiar to a given system. The extralogical terms are not unique to one system and some of the terms might overlap or "belong" to more than one system. For example the term "electron" might "belong" to both physics and chemistry. The extralogical terms are the "substance" of a system and are the terms that are assigned meanings in an interpreted system.

Goodman focuses upon certain formal aspects of the extralogical basis, and for him simplicity is a measure those formal characteristics of extralogical predicate bases.

The adoption of a term as a primitive in the extralogical base of a system is to introduce it into a system without defining it explicitly within

the system.[4] And insofar as the primitive is not clear, an explanation of it might be provided in a metalanguage. For instance, in a system of geometry the term "line" might be taken as primitive and defined or explained in common language. It would not be defined exclusively in terms of the extralogical base of the system.

For Goodman all that is demanded for the interpretation of a primitive predicate is a determination of its range of application; and in explaining a primitive, we may use an enumeration or a listing of individuals belonging to the extension of that primitive wherever that is convenient. In most cases however such a list is not available and the meaning is conveyed by explanation.

Goodman points out that when considering alternate formalizations of a theory there may be alternate sets of primitives within the given extralogical base and asks what decision procedure is needed for the selection of one set of terms over another. It is within this frame of reference that he explicates simplicity.

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[4]Goodman has conceived of a theory with only primitive and nonprimitive terms in its extralogical basis where the nonprimitive terms are explicitly defined in terms of the primitives. This is consistent with his assumption of formalization. It will be remembered that Rudner made a further distinction between indigenous and nonindigenous terms.

In a given system, a term is indefinable because it is taken as primitive, not because it is indefinable in some absolute sense. Goodman would hold that no term is absolutely indefinable even within a system. As in the case of geometry given above, the term "line" might be taken as primitive and "point," "triangle" and "angle," be defined in terms of "point," and so forth. Whatever is taken as primitive is then defined or explained outside of the system in a metalanguage.

The indefinability of a term in a system due to its primitive status is not to be taken as incomprehensibility. Incomprehensibility has no place in a system. On the contrary it is usually the case that an indefinable term in one system is quite definable in another system, and the terms taken as primitives (indefinables in a system) come with a high antecedent clarity. In Goodman's view then, primitiveness is attributed to a term on the basis of its definitional relation to tother terms in the extralogical base of a given system. There is no absolute set of primitives for a given system.

At this point it might be well to ask just why it is important to designate primitive terms at all, since all terms have to be defined or explained in some language somewhere. What is the difference

whether a term is defined within a system or outside it? This question is probably best answered by considering the purpose of building a system. A system is built to clarify terms, to make explicit the relations between terms or to facilitate the manipulation of concepts by developing rules of replacement. System itself is achieved when explicit (definitional) relations between terms and statements are determined, and any term that is explicitly defined is guaranteed precision and clarity, at least insofar as the primitive terms are precise and clear. Beyond that, the manipulability of any system is increased by an increase in the degree of replaceability among terms. This replaceability is present only when explicit definitions are available. On the other hand a "system" made up of only primitive terms, and hence no explicit definitions, is no system at all, and insofar as the relations between terms are not explicit, clarity and precision are unknown. Systematization increases the number of explicit relations while at the same time it reduces the number of unexplicated or "uncontrolled" terms (the primitives).

The fact that primitives are not absolute to a given system and hence alternative arrangements are possible raises the question of what criteria will be used to select the primitives. It must be noted here

that the criteria for the selection of a criterion needed to make decisions concerning alternate sets of primitives are not specified by Goodman. From what Goodman says it can be inferred that the criteria to be applied to primitives should at least be "objective" and "effective." "Objectivity" here meaning free from the influence of such variables as person, time and mood, while "effectiveness" means being able to make a definite choice in each decision situation. Goodman does not specify any criteria however.

Goodman points out that some of the criteria by which a scientist or philosopher chooses primitives are obvious. For instance, contradictory and incomprehensible predicates are never satisfactory primitives within a system. Obviously a predicate like ". . . is circular and not circular" cannot be included in a system without logical disaster. The criterion of noncontradictoriness is both objective and effective.

Goodman goes on to point out that fundamentally obscure or incomprehensible predicates are unsatisfactory choices as primitives. An example of such unsatisfactory predicates would be "predisposed to telepathic communication with supernatural aid."[5] Goodman does not make an attempt to elaborate the

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[5]Goodman, Structure of Appearance, 65

meaning of "obscurity" and "incomprehensibility" hence some question arises concerning whether one speaks of obscurity and incomprehensibility in relation to a linguistic entity or of the interpretation of a linguistic entity. It seems that Goodman would reject comprehensibility as somewhat less objective than non-contradictoriness. It would seem that it falls further into the realm of psychological criteria.

Goodman goes on to say that clarity is commonly thought to be the most important criteria for the selection of primitives, but in fact a scientist often takes an unfamiliar term, or even coins a new term and includes it as a primitive. Goodman points out that any term that is selected must be made clear, but this is quite different from selecting a term on the basis of antecedent clarity. Take an example of the "theoretical" term in science. The theoretical term is part of a logical construct and is in principle an unobservable. Hence theoretical terms are never clear in the sense there is clearly something in the world that corresponds to them. They must however be precise, in the sense that an explanation of their meaning can be given. Some terms are unsuitable for primitives because of their presystematic use. A term such as "ectoplasmic" defies clarification even in common parlance and would be unsatisfactory for that reason.

Clarity then for Goodman might mean ease of explanation of the term rather than the ratio of decided to undecided cases belonging to the extension of the term.[6] This ease of explanation is important since any misuse of a primitive that might result from the lack of clarity would infect the whole system and any clarity might be reflected in the system. Clarity is a rather elusive criterion, since it is relative to person, time, situation and even moods. For that reason, as important as clarity may seem to be, it does not provide a criterion that can be reliably applied. Clarity is neither an objective, nor an effective criterion.

The purpose for which a system is constructed has much to do with the selection of primitives. Surely when a system is constructed to say something about geometry the primitives must be relevant to geometric questions. Mass and force would not be appropriate to such a system. Limitations are imposed on the choice of primitives by the very problem or set of problems addressed. On some occasions there will be no choice of primitives, but in general the

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[6]Goodman's notion of "ease of explanation" needs some work. Perhaps Rudner's distinction between indigenous and nonindigenous terms may be helpful. It would seem that a term taken from another formulation might well be easily explained while a coined term or one taken from common parlance would not be easily explained.

set will not be uniquely determined by the problem addressed.[7] The problem will usually only circumscribe a sphere of possible primitives. This is exemplified in various attempts to axiomatize geometry and arithmetic. Relevance therefore seems to be an objective but not an effective criterion for the selection of primitives.

An added limitation on the choice of primitives is imposed by the fact that primitives chosen must form an adequate basis for all of the definitions required; but adequacy, insofar as it is attainable, could be achieved by adopting all predicates, other than those excluded by the problem, as primitives. Hence adequacy is objective and effective but in science, since systematicity is sought, what the scientist seeks is not only the adequate basis, but the simplest adequate basis. It is in this respect that Goodman sees simplicity important to science. For Goodman then simplicity promises to be a criterion that can objectively, effectively and uniquely determine the most satisfactory primitive basis among

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[7]It will be argued in chapter IV that the educator's choice of formulations is most often dictated by the purposes he holds. If he is trying to comply with civil rights legislation he will choose one formulation, if he is trying to please a particular community he will choose another, and when he is trying to maximize learning or do all three things he will choose another.

alternate bases available.

Goodman asserts that since the primary purpose of constructing a system is to interrelate its predicates, that purpose is also directly served by reducing the number of primitives in the extralogical basis. This is done by explicitly defining some of the terms in the extralogical basis in terms of the others. But again, there are alternate ways of reducing the number of primitives. Every definition within the basis both increases the coherence of the system, and diminishes the number of primitives.

Goodman points out that the replacement of one basis for a system by another basis effects no genuine economy if the replacement is purely routine. He then asks why no real economy is achieved if a basis B_1 consisting of two one-place predicates, is replaced by a basis B_2, consisting of one two-place predicate. Intuitively the answer is that there is no real savings because it can always be done without effecting the number of "entities" in a theory. On the other hand, economy might be achieved by subtracting a primitive from a system, but economy can never be attained by adding a primitive. Again this is true because a primitive can always be added, but not always be subtracted without destroying the adequacy of a basis. This also means that replacing a primitive by one that

has more places effects no saving, since a predicate can always be traded for one having more places. Intuitively this reduces the economy (simplicity) of the basis. With this in mind it is becoming clear that for Goodman a measure of simplicity must be based upon the assignment of values to some predicates that are known to be simple, such as one-place predicates, and then defining a clear set of equivalence or substitution rules for manipulations that are other than routine manipulations.

3.2 The Calculus of Simplicity

Goodman starts by making a general rule that if every basis of a given kind can be replaced by some basis of a second kind, then no basis of the first kind is more complex than every basis of the second kind. Professor Goodman holds that only structural characteristics are admissible in determining appropriate kinds, but not all structural characteristics can be admitted as relevant. It has already been pointed out that structural characteristics which enter into only routine replacement are not relevant. He finds that the relevant specifications are those pertaining to the number of predicates in a basis, the number of places in each predicate in a basis, and reflexivity, symmetry, and self-completeness. Such

statements as "consists of one two-place predicate" is a relevant specification; and so also is "consists of one two-place symmetric predicate". Note that "consists of one two-place predicate" is a relevant specification because it limits the kinds of bases that can be substituted which will still be an adequate basis for the system in question. On the other hand the number of words in the predicates of alternate bases is not a relevant specification since the number of words does not limit the set of possible replacing bases. Also any conjunction or disjunction of relevant specifications is itself a relevant specification. On that basis if K and L are relevant specifications, then KL is a relevant subspecification of each, as each is of L-or-K.

Professor Goodman then summarizes as follows:

> "Now replacement is routine when, given only elementary logic including identity together with the information that a basis b answers relevant specification K, we can define a basis b', answering relevant specification L, and can redefine b from b'. Where finding a b' or recovering b requires anything more, replacement is not routine. In what follows, the replacement under discussion is always routine replacement unless otherwise indicated."[8]

The rest of the discussion of Goodman's calculus is simply an elaboration of the calculus of simplicity. It is not here set up as a fully-formalized deductive system. It is presented only in such

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[8]Goodman, Structure of Appearance, 71

detail as the purposes of the dissertation warrant. Since the theory is not presented as a formal deductive system, it would seem inappropriate to ask metatheoretical questions about consistency and completeness. That task is left to the Logician.

The symbols employed here are not formal marks, but are signs with their customary interpretations from logic and mathematics. Proofs for the theorems are available, but will not be offered here and any question of the specification of proof procedure is waived.

The logical and mathematical framework supporting Goodman's theory is the first order logic with identity. The primitive symbols in the theory have their meaning from logic. Predicates are defined extensionally in terms of individuals or names. Hence a one-place predicate is defined in terms of the individuals to which it can be applied. The two-place predicate is defined in terms of pairs of individuals, and the three-place predicate is defined in terms of the triples to which it applies. The sequences alluded to in the theory are those ordered groups of individuals, pairs, triples etc. to which the predicate in question is applicable. The structural properties of predicates discussed, reflexivity, self-completeness,

and symmetry and their refinements, are defined by the sequences of individuals belonging to the extensions of the predicates. For example, a two-place predicate is symmetric if the reverse of each of its pairs is also among its pairs. Further, the pairs of the predicate S, . . . is the sibling of . . ., are all the pairs of individuals that might belong to the extensions of the predicate. The predicate is symmetric because for all x and y that belong to the extension of S, if Sxy, then Syx.

The systems to which the theory is applicable are first-order predicate calculi, which for the purposes of this dissertation may be regarded as formalized theories, or as interpreted calculi.

The understanding of Goodman's theory is dependent upon the understanding of certain refinements of logical structure. Those refinements are introduced by Goodman through definitions in the calculus.

Professor Goodman also uses certain abbreviations that must be understood in order to understand his elaboration of the theory:

> "I shall use "vb" as short for the "complexity value of the basis b". Again, "vK" likewise reads "the complexity-value of the relevant specification K," but since complexity-values are initially assigned to bases rather than specifications, a further ellipsis is involved here: vK, the number associated with the relevant specification of K, is the

> lowest number such that under the postulates of our calculus, K guarantees that no basis answering K has a higher value."[9]

Goodman's overall strategy is to develop a way of comparing all extralogical primitive terms in a way that will produce a simplicity ordering. He does not establish a measure for all systems, but only for systems that have first-order predicate calculus for their logical calculus. With respect to scientific theories that are formalized, the predicates refer to individuals which might refer to any concepts that can be made clear in observational terms. Predicates are then compared by noting the way in which they divide up the range of individual names corresponding to the individuals which comprise their extension. With these preliminary remarks in mind, the theorems, postulates and definitions of Goodman's system will follow. The fundamental postulate of Goodman's system is:

> P3.31 <u>If every basis answering a relevant specification K can be replaced by some basis answering a relevant specification L, then vK ≦vL</u>.
>
> A few elementary theorems that follow obviously from the first postulate or from the definitions of "vb" and "vK" are:
>
> 3.311 If every basis answering relevant specification K can be replaced by some basis answering relevant specification L, and every basis answering L can be replaced by some basis answering K, then vK = vL.

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[9]Goodman, <u>Structure of Appearance</u>, 71

3.312 If a basis b answers relevant specification K, then vb $\trianglelefteq$ vK.
3.313 vK $\trianglelefteq$ v(K-or-L)
3.314 v(KL) $\trianglelefteq$ vK
3.315 vK $\prec$ vL $\supset$ vL = v(L-not-K) (called subtraction)
3.316 vK $\trianglelefteq$ vL $\supset$ (K-or-L) = vL (called summation)
3.317 vK $\prec$ v(K-or-L) $\supset$ v(K-or-L) = vL.

Also since every specification of 1-place extralogical predicates that is to be admitted as relevant is satisfied by the same predicates as any other, 3.311 will also yield:

3.318 All extralogical 1-place predicates have the same complexity-value."[10]

A second postulate is necessary for the derivation of further theorems:

"P3.32 The complexity-value of every extralogical predicate is a positive integer; and the complexity value of a basis is the sum of the values of the extralogical predicates in it.

A predicate is extralogical unless definable soley in terms of elementary logic including identity. Only extralogical predicates are counted as contributing to the complexity-value of a basis; for the logical apparatus may be regarded as constant for all the systems in question. Thus a basis consisting soley of logical predicates has the value 0. Justification for the limitation to integral values is evident enough. The number of predicates in a basis, the number of places in a predicate, the number of different sequential patterns exhibited by the arguments of a predicate, and the number of places or place-sequences with respect to which a predicate is reflexive, symmetric, etc. are all integral. No intermediate numbers are needed; and our eventual assignments of values can be such as to leave no gaps-that is, where vK = n, there will be for every i less than n some

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[10]Goodman, Structure of Appearance, 72-73

subspecification $\underline{L}$ of $\underline{K}$ such that $v\underline{L} = \underline{i}$. . . .

A useful immediate consequence of P3.32 is:

3.321 If the extralogical predicates in a basis $\underline{b}$ are some but not all of the extralogical predicates in a basis $\underline{b}'$, then $vb < vb'$.[11]

Goodman introduces some more abbreviations:

"In what follows, use of square brackets will result in a name for the relevant specification abbreviated within them. Thus the full reading of " [2-pl. irref.; two 1-pl.] " is "the relevant specification 'basis consisting of one 2-place irreflexive predicate and two 1-place predicates'"; and the full reading of "v [2-pl. sym.] " is "the complexity-value associated with the relevant specification 'basis consisting of one 2-place symmetric predicate'". But I shall normally give much less combersom elliptical readings such as, for the first case, "basis consisting of one 2-place irreflexive and two 1-place predicates"; and, for the second case, "the complexity-value of a basis consisting of one 2-place symmetric predicate"--or even just "the complexity-value of 2-place symmetric predicates". Where "$\underline{m}$", "$\underline{n}$", etc. occur within the square brackets, we have in effect a specification-schema that becomes a specification when these letters are supplanted by integers. By way of illustration, consider such elementary theorem schemata as:

3.322 If $\underline{n} \leqq \underline{m}$, then $v[\underline{n}\text{-pl.}] \leqq v[\text{m-pl.}]$

3.323 If $\underline{n} \leqq \underline{m}$, then $v[\underline{n}\text{ preds.}] \leqq v[\text{m preds.}]$.

The consequent of the former reads: "the complexity-value associated with the relevant specification-schema 'basis consisting of an n-place predicate' is no higher than the complexity-value associated with the relevant schema 'basis consisting of an m-place predicate'"; or elliptically, "the value of n-place predicates is no higher than the

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[11] Goodman, The Structure of Appearance, 74

value of m-place predicates".[12]

Since all extralogical 1-place predicates have equal value as seen in 3.318, 1-place logical predicates have the value 0, the lowest value is assigned to 1-place predicates in the third postulate:

"P3.33 v [1-pl.] = 1.".[13]

This puts the 1-place predicate at the low end of the complexity scale.

The consequence of 3.33 are:

"3.331 If a basis b contains any extralogical predicate, then v [1-pl.] $\leq$ vb.

3.332 Unless K guarantees that all predicates in every basis answering it are logical, then v [1-pl.] $\leq$ vK."[14]

With the general theorems and postulates stated, Goodman goes on to analyze the properties of predicates which explain purely mechanical replacement of one predicate by another. The first property to be analyzed is that of reflexivity. "Reflexivity has to do with the occurrence of repetitions within the sequences (belonging to the extensions) of a predicate."[15] Goodman makes a number of distinctions to refine the notion of reflexivity. He says:

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[12]Goodman, The Structure of Appearance, 75

[13]Goodman, The Structure of Appearance, 75

[14]Goodman, Structure of Appearance, 75

[15]Goodman, Structure of Appearance, 76

> "Every pair of elements is either an identity-pair or a diversity-pair. The important properties of reflexivity depend upon the relationship between the given predicate and the logical predicates "=" and "=", and between the identity-pairs and diversity-pairs of the predicate itself. If all pairs of a predicate are diversity-pairs, the predicate is <u>irreflexive</u>; if all are identity-pairs, it may be called <u>redundant</u>. A predicate having at least one identity-pair and one diversity-pair is <u>composite</u>. If all identity-pairs are pairs of a predicate, it is <u>totally reflexive</u>; if all diversity-are pairs of a predicate, it may be called <u>totally diversive</u>."

Professor Goodman goes on to point out that:

> "A 2-place predicate that is both redundant and totally reflexive is co-extensive with "="; and a 2-place predicate that is both irreflexive and totally diversive is co-extensive with "=". Thus the complexity-value of such a predicate is 0 and we have the theorems:

3.411 $v\,[\text{2-pl.t.r., red.}] = 0.$

3.412 $v\,[\text{2-pl.t.d., irref.}] = 0.$

> Again, only imapplicable 2-place predicates--those with null extensions--are both redundant and irreflexive; and only universal 2-place predicates are both totally reflexive and totally diversive. Specification of either combination of properties thus results in logical difinability, and hence:

3.413 $v\,[\text{2-pl.red., irref.}] = 0.$

3.414 $v\,[\text{2-pl.t.r., t.d.}] = 0$

> A 2-place predicate having no or all diversity-pairs in its extension can always be replaced by a 1-place predicate; and conversely, a 1-place predicate can always be replaced by such a 2-place predicate. Hence:

3.415 $v\left[\text{2-pl.red.}\right] = 1$

3.416 $v\left[\text{2-pl.t.d.}\right] = 1$."[16]

Goodman then goes on to deduce a number of theorems:

"3.417 $v\left[\text{2-pl.irref.}\right] = v\left[\text{2-pl.t.r.}\right]$

3.418 $v\left[\text{2-pl.red., t.r.}\right] = 1$

3.419 $v\left[\text{2-pl.-red.-or-2-pl.-t.d.}\right] = 1$

3.421 $v\left[\text{2-pl.non-comp.}\right] = v\left[\text{2-pl.irref.}\right]$

3.422 $v\left[\text{2-pl.comp.}\right] = v\left[\text{2-pl.irref.}\right] + 1.$

3.422 $v\left[\text{2-pl.}\right] = v\left[\text{2-pl.irref.;1-pl.}\right] =$

$v\left[\text{2-pl.irref.}\right] + 1$"[17]

Professor Goodman adds some further refinements and goes on to make other theorems:

> "For example, suppose that the identity pairs contain all and only those elements that occur in the diversity-pairs. We may call such a predicate join-reflexive; and, admitting this as a relevant specification, we have the theorem:
>
> 3.424 $v\left[\text{2-pl.j.r.}\right] = v\left[\text{2-pl.irref.}\right]$.
>
> Likewise, we may admit as relevantly specifiable; meet-reflexivity, where an element occurs in an identity-sequence of the predicate if and only if that element occurs as left component of at least one of the diversity-sequences and as right component of another; left-reflexivity, where an element occurs in one of the identity-sequences if and only if it occurs as left component of at least one of the diversity-sequences; and right-reflexivity, analogously defined. Then:

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[16]Goodman, Structure of Appearance, 76

[17]Goodman, Structure of Appearance, 77

3.425 $v\left[\text{2-pl.m.r.}\right] = v\left[\text{2-pl.irref.}\right]$

3.426 $v\left[\text{2-pl.l.r.}\right] = v\left[\text{2-pl.irref.}\right]$

3.427 $v\left[\text{2-pl.rr.}\right] = v\left[\text{2-pl.irref.}\right]$

Where any of the above relevant specifications for a basis consisting of a 2-place predicate has a value less than $v\left[\text{2-pl.irref.;1-pl.}\right]$, we call such a basis regular. Regularity thus enters as relevant by definition as the disjunction of total reflexivity, irreflexivity, redundancy, total diversification, meet-reflexivity, join-reflexivity, left-reflexivity, and right-reflexivity. And by summation:

3.428 $v\left[\text{2-pl.reg.}\right] = v\left[\text{2-pl.irref.}\right]$."[18]

Professor Goodman expands the theorems to a general scheme including n-place predicates:

"The general schema is:

3.437 $v\left[\text{n-pl.}\right] = v\left[\text{n-pl.irref.;}h_1\ \text{n - 1-pl.irref.;} \ldots h_{n-2}\ \text{2-pl.irref.}\right] + 1,$

where for each j, the number h_j of n - j-pl. irreflexive predicates is

$$\sum_{r=0}^{n-j} (-1)^r \frac{(n-j-r)^n}{(n-j-r)!\ r!}$$

For any n-place predicate that is regular in one way or another, some predicates can be dropped from the equivalent set of irreflexive predicates. But the value of any relevant specification can be equated with the value of some specification of bases consisting entirely of irreflexive predicates. Hence if values are determined for irreflexive predicates of all kinds, the value of any basis may be computed. Let us therefore confine our attention for a time to irreflexive predicates."[19]

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[18]Goodman, Structure of Appearance, 78

[19]Goodman, Structure of Appearance, 83

The second structural characteristic considered by Goodman is that of transitivity. His discussion of transitivity includes a number of refinements upon which are based a number of theorems. Transitivity itself is found to effect complexity but it is similar to the structural characteristic called self-completeness. Goodman has this to say:

> "A 2-place predicate R is transitive in the usual sense if and only if it satisfies the condition:
>
> (x) (y) (z) (Rx,y . Ry,z.⊃ Rx,z).
>
> This property does not affect complexity, and so is not relevantly specifiable. But a kindred property is highly relevant. We remove the requirement that the first two pairs be linked, and akk the requirement that all three be diversity-pairs. Predicates answering the resulting specification:
>
> (x) (y) (z) (w) (Rx,y.Rw,z. x≠y.w≠z. x=z.⊃ Rx,z),
>
> may be called <u>self-complete</u>. Where the "=" clauses omitted, only meet-reflexive predicates would be self-complete. With them inserted, we can ignore identity-pairs in determining self-completeness, which is thus rendered largely independent of reflexivity-properties. In particular, an irreflexive predicate may be self-complete even though the first components of some of its pairs are the second components of others."[20]

Professor Goodman has derived the following theorems concerning self-completeness:

> "3.511 v [2-pl.irref.,s.c.] = 2
>
> 3.512 2 = v [2-pl.reg.,s.c.]

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[20]Goodman, <u>Structure of Appearance</u>, 83

3.513 $v[\text{2-pl.irref.,s.c.}] = v[\text{2-pl.reg.,s.c.}]$

3.514 $2 \leq v[\text{2-pl.irref.,s.c.}]$

. . . from 3.511 and 3.514 we arrive at the wanted equation:

3.515 $v[\text{2-pl.irref.,s.c.}] = 2$

3.516 $v[\text{n-pl.irref.,s.c.}] = n$

To generalize further upon 3.516, an n-place irreflexive predicate has the same value as a set of irreflexive predicates corresponding to the minimal partitions of the predicate--asset, that is, containing for each minimal partition an irreflexive predicate of the same number of places as that partition:

3.517 $v[\text{n-pl.irref. with minimal partitions of k,k', etc. places}] = v[\text{k-pl. irref.; k'-pl.irref,; etc.}]$."[21]

Professor Goodman defines the degree of self-completeness, s.c, of a predicate as "simply the number of divisions between minimal partitions--or the number of minimal partitions minus 1. All one-partition predicates, hence all 1-place predicates, have sc = 0."[22] He goes on to point out that a 3-place predicate has sc = 1 if it has a 1-place and a 2-place minimal partitions and sc = 2 if it has three one-place partitions. The maximum degree of self-completeness for an n-place predicate is of course n - 1.

The effect of the theorems on reflexivity and self-completeness is that the theoretician is able

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[21]Goodman, Structure of Appearance, 84-87

[22]Goodman, Structure of Appearance, 88

"in effect to take apart and put together again certain predicates and so equate them in complexity value with sets of other predicates."[23] Any reflexive predicate can be replaced by a set of irreflexive predicates. For any irreflexive self-complete predicate an equivalent set of shorter irreflexive predicates can be found.

The third characteristic of importance in calculating simplicity is that of symmetry. A 2-place predicate is symmetric if the reverse of each of its pairs is also among its pairs. In general, an n-place predicate is symmetric if every permutation of each of its sequences is also among its sequences.

Goodman points out that an n-place predicate may, however, be symmetric with respect to some rather than all its places. "For example, a 3-place predicate "Q" such that

$$(x)\ (z)\ (z)\ \ (Qx,y,z \supset Qx,z,y)$$

is symmetric with respect to its second and third places--or briefly, (2) (3) symmetric--but not necessarily with respect to all."[24]

In order to deal with this contingency, Professor Goodman introduces the notion of degree of symmetry:

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[23]Goodman, Structure of Appearance, 88

[24]Goodman, Structure of Appearance, 89

> "The degree of symmetry, sy, of an n-place predicate symmetric with respect to k of its places is k-1; thus the maximum degree of symmetry is n-1. For 2-place symmetric predicated, sy=1; for 3-place symmetric predicates, sy=2; and for partially symmetric 3-place predicates (e.g., "Q" just above), sy=1. A 3-place predicate symmetric with respect to each of two pairs of places is symmetric with respect to all three places, and has sy=2. A 1-place predicate is degenerately symmetric with respect to its only place, thus having sy=0.
>
> A predicate of more than three places may be symmetric with respect to each of two or more disjoint sets of its places. The degree of symmetry for each such symmetric subset of k places is k-1; and the degree of symmetry for the whole predicate is the sum of its maximal symmetric subsets-i.e., those contained in no others. For example, a 4-place predicate may be (1) (2) and (3) (4) symmetric without being symmetric with respect to all or to any three or to any other two of its places, here sy= 1+1=2. An asymmetric n-place predicate is in effect symmetric only with respect to each of its places taken singly; and has sy=n(1-1)=0."[25]

Goodman concludes that the degree of symmetry of an n-place predicate with k segments is then n-k. He goes on to point out that a predicate might embrace both lower-level and higher level symmetries at the same time and has this to say:

> "Some predicate embrace lower-level symmetries within higher-level ones. The degree of symmetry of a 4-place predicate that is (1) (2) and (3) (4) and (1,2) (3,4) symmetric is not the sum (1+1+2) of these three symmetries. Rather, since the specification of this layered symmetry guarantees all four places coextensive, the predicate has but one segment, and sy=4-1=3."[26]

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[25] Goodman, Structure of Appearance, 90

[26] Goodman, Structure of Appearance, 93

With these definitions, and the formula that have already been developed Goodman derives the following theorems:

3.611 v [2-pl.irref.,s.c.,sym.] = 1

3.612 v [n-pl.irref.,s.c.,sym.] = 1

3.613 v [n-pl.irref.,s.c.,] - v [n-pl.irref.,s.c.,sy=k] = k

3.614 v [n-pl.irref.,s.c.,sy=h] -v [n-pl.irref.,s.c.,sy=k] = k - h.

3.615 v [n-pl.irref.,sym. with respect to k disjoint h-valued partitions] = h."[27]

With these postulates and theorems, some of which make complexity assignments and others of which act as rules of replacement, Goodman devises a final formula for the assessment of the complexity value of any set of primitive predicates.

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[27]Goodman, Structure of Appearance, 88-93

3.3 Some Observations Concerning Goodman's Explication of Simplicity and the Sociology of Education

After a look at Goodman's explication of simplicity it seems apparent that Rudner's commendations and cautions concerning it are well placed. As Goodman explicates the term, it is an objective criterion when applied to possible alternate formalizations of a given theory, and since it is applied to the predicate base it can be applied regardless of the number of empirical generalizations a formulation generates. On the face of it, then it might be applied to nontheoretic formulations. Finally, it has become apparent that the calculus cannot be applied to nonformalized formulations, at least as it presently stands.

It also appears that the criticisms that were leveled at Rudner might also be leveled at Goodman. One of the major criticisms of Rudner's work was that the particular frame of reference that he selected, in treating only "science as product" in the "context of validation," was inappropriate to the needs of the scientist and the applied scientist. The second criticism of Rudner concerned his rejection of certain other criteria. It was pointed out, for instance, that clarity might in some sense be objective rather than simply psychological. A similar criticism is to be

made of Goodman's work. Goodman argues the inadequacy of other criteria in his context, but insofar as his context is seen as inadequate to the needs of the scientist proper and the applied scientist his rejection of other criteria must be reevaluated. It will be argued that the contexts within which the scientist and the applied scientist work is different from that of the philosopher of science and for that reason the relative weight attached to each criterion varies. Finally, it was pointed out that Rudner's treatment of just how one is to evaluate a criteria such as clarity or simplicity was inadequate. This criticism stands against Goodman also.

It will be the task of chapter IV to inquire into four questions that arise from these considerations. First, what are the relevant differences in the contexts faced by the philosopher of science, the sociologist of education, and the educator. Second, how does one rationalize the selection or rejection of criteria such as clarity and comprehensibility in the selection of primitives (and by that, formulations) in the different contexts. And closely associated with this is question three, the question of whether Goodman's arguments for the centrality of simplicity hold in the other contexts. The final question asks

what the role of Goodman's explication of simplicity will be in the sociologist's context of open inquiry and the educator's context of use.

3.4 Summary of Chapter III

In chapter three Nelson Goodman's explication of simplicity was reviewed. It was found that Professor Goodman's explication of simplicity turns on a particular notion of system, one that Goodman explicates earlier. For Goodman a system is a specialized language that is constructed within a larger language. A system is cnnstructed within a larger language. A system is contrived by scientists for some special purpose. Within a system the terms are precise in extension, the relations between terms are, where possible, explicit through definition and the logical mechanisms for relating propositions are explicit. The system has two kinds of nonlogical terms: primitives which are explained by metalinguistic devices in the metalanguage, and nonprimitives which are defined explicitly within the system. When a theory is formalized, that is, systematized in the prior sense, a decision problem concerning the selection of primitives arises. Goodman's central argument for simplicity was that the most powerful formulation with the least possible primitives is always desirable. Given formulations of equal power, as would be the case when selecting alternate formalizations for a

given theory, the most economical formulation is the simplest formulation, that is, the alternative with the fewest primitive terms.

Professor Goodman goes on to point out that the number of primitives in a given system can be reduced by various means, some of which are counted as spurious, and others of which are counted as legitimate simplifications. He argues that the relevant characteristics of predicates in the assessment of simplicity are the number of predicates in a base, the number of predicate places in a base, and the characteristics of reflexivity, self-completeness, and symmetry.

Other arguments for simplicity turned upon the rejection of other criteria for the selection of primitives. It was noted however that the context named as appropriate for the application of simplicity is far more restricted than the context within which the theory builder or the user of theory works. This raised the question of the weight of Goodman's arguments for the rejection of other criteria in those other contexts. It was finally argued that four questions remain to be taken up in Chapter IV: (1) What are the relevant differences in the contexts faced by the philosopher of science, the sociologist of education and the educator in relation to the use of simplicity? (2) How does one rationalize the

selection of rejection of criteria such as clarity, comprehensibility and simplicity in the three contexts? (3) Do Goodman's arguments for centrality of simplicity hold in all three contexts? (4) What is the role of simplicity in each of the contexts?

CHAPTER IV

SIMPLICITY AND THE SELECTION OF FORMULATIONS IN THE SOCIOLOGY OF EDUCATION

Chapter IV is addressed to the tasks of: (1) making distinctions between the contexts within which the educator, the sociologist of education and the philosopher of social science select or reject formulations, (2) drawing up some systematic means of evaluating a criterion such as simplicity, (3) testing Goodman's arguments for the centrality of simplicity in the context of the educator and the sociologist, and (4) evaluating the role of simplicity in the selection and rejection of formulation in the sociology of education.

4.1 The problem of different contexts

The question addressed in this section is: what are the relevant differences in the contexts faced by the philosopher of science, the sociologist of education and the educator in relation to the use of simplicity as a criterion in the selection of

formulations.[1] It was pointed out earlier that formal or structural simplicity might relate differently to decisions by sociologists and educators than it does to the decisions of the philosopher of science. An adequate differentiation of the contexts within which the sociologist, the educator and the philosopher of science make choices is necessary prior to the determination of the role of simplicity in each of those contexts.

The task of this sub-section is to differentiate between the contexts. The inquiry will be pursued by seeking answers to the following questions: (1) What questions are central to each context, and (2) do the central questions bear directly upon the selection of criteria for the selection of formulations.

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[1] The notion of "context" is not absolutely clear at this point. Several factors might be included under this rubric, ranging from the goals and interests of the members of the community, through the traditions and practices of a field of inquiry, to the conceptual frame of reference common to the field of inquiry. Here the term will be used as a rubric to cover the central question asked by a particular community of interests. It will be assumed that educators, sociologists of education, and philosophers make up such communities on interests. It will, to that extent be an empirical question. To say that the educator's decision context is different from that of the sociologist or the philosopher is to say that the educator asks different questions about social phenomena than does the sociologist or philosopher. It is this that makes the sociologist interested in education different from the educator interested in social phenomena.

Problems are immediately evident when an attempt is made to pin down the contexts. A brief look at the present state of sociology of education shows the difficulty of coming to any authoritative definition of sociology of education or any authoritative stipulation of the legitimate goals and subject-matter of sociology of education. This vagueness makes the task of defining or delimiting the sociologist's context a hazardous undertaking, but some knowledge of the central question asked by the sociologist can be gathered by looking at the way sociologists define sociology of education.

Emile Durkheim gave sociology of education its initial impetus. He considered education "to be something essentially social in character, in its origins and its functions, and that as a result the theory of education relates more closely to sociology than any other science."[2] Durkheim went on to specify the appropriate areas of research for the sociologist of education:

> "1. Identification of the current social facts of education and their sociological function.
> 2. Identification of the relationship between education and social and cultural change.
> 3. Cross cultural and comparative research in various types of educational systems.

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[2]Emile Durkhaim, Education and Sociology (New York: Free Press, 1956).

4. Investigation of the classroom and school as an ongoing social system."[3]

Since Durkheim's time sociology of education has been defined in many ways, ranging from "a study of the structural elements of the educational system,"[4] through a "focus of sociological perspective on educators, schools and educational institutions in social and cultural contexts,"[5] to "the scientific analysis of social processes and social patterns involved in the educational system."[6]

After citing some 21 statements by various sociologists and sociologists of education Brookover concluded: "It becomes apparent that there has been little consensus among sociologists and educators as to what the proper dimensions of this field should be."[7] It seems, then, that the vagueness of the field of sociology of education is substantiated in the literature, but even with this vagueness, it seems that there is a common attempt to make intelligible the range of

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[3]Brookover, A Sociology of Education, 4

[4]B. V. Shah, "Sociology of Education--An Attempt at Definition and Scope," Sociological Bulletin, XIV (September, 1965), 64-69.

[5]Donald Hansen, "The Responsibility of the Sociologist to Education," Harvard Educational Review, XXXIII (Summer, 1963), 312-325.

[6]Brookover, A Sociology of Education, 11

[7]Brookover, A Sociology of Education, 10

social phenomena that surrounds the educational enterprise. The sociologist of education focuses upon the central question of how one might best describe and, in a broad sense, explain a set of changing social phenomena.

There is evidence that educators ask different questions than sociologists even when treating the same discipline. This is manifest in the fact that sociologists choose different topics for treatment in sociology of education than educators. Richard Hoyme reports that a sample of 40 sociologists and 128 professors of education, all of whom were teaching a beginning graduate course in educational sociology, were asked to list, in order of importance, the ten topics most appropriate to the field of educational sociology. Two quite different lists were proposed by the two groups. The sociologists listed the following ten topics as appropriate to a beginning graduate course in sociology of education:

"1. Social status
2. Social mobility
3. Social change and social conflict
4. Social class structure
5. The school and its social implications
6. Social roles, ascribed and achieved
7. The community
8. The American Society
9. Classical sociological studies

10. School-community relations."[8]

On the other hand the professors of education named the following topics most appropriate to such a course:

"1. Social class structure
2. Democracy in education
3. Race relations
4. Social status
5. Social roles, ascribed and achieved
6. Social objectives of education
7. The teacher as a social being
8. Teacher-student relations
9. Teacher-administrator relations
10. The community."[9]

Since only four topics are common to both lists, and since the order of importance was different, there seems to be a significant difference between the educator's central question and that of the sociologist.

The educator probably assumes that the goals of the philosopher and sociologist are good and legitimate, but where the philosopher focuses upon the quest for clarity and the sociologist seeks insight, the educator seeks both clarity and insight for realizing some purposes. The educator seeks to understand social phenomena so that he might have power over a situation, and in order to gain that power the educator must understand not only social phenomena, but also cultural and individual psychological phenomena. The educator's

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[8]Hoyme, "The Current Status of Educational Sociology," 130

[9]Hoyme, "The Current Status of Educational Sociology," 130

central question is then: How can I most effectively achieve the goals of American Education.

This leads to the statement of a criterion that is to be used in the educator's evaluation and selection of formulations from the sociology of education. That criterion will be called "functional adequacy". Very briefly, the functionally adequate formulation will define and make explicit the relations of the elements of a domain in such a way that it will conceive and comprehend the significant elements, variables, and relations necessary for the realization of an end. For example, a doctor seeks to realize health, and to accomplish this he needs to know not only physiology but also psychology and the relationships between physical and emotional phenomena. He must know how, why and when physical malfunction is related to emotional problems and vice versa. To be totally effective he must go beyond physiology and psychology because either or both are functionally inadequate for his purposes.

The educator seeks to change individuals, and in order to do so he needs functionally adequate knowledge. For him that means knowledge of what man <u>is</u> in his present socio-cultural environment, what man can become, and some value assumptions about what man ought to be. For the educator, functional adequacy cannot be predicated of knowledge from one discipline.

complexity of his task, the educator needs information that can come only from a number of disciplines, as they are presently conceived.

Functional adequacy is differentiated from power by its link with the realization of some end. The term power is usually attributed to formalizations that have large extensions, that is, to formulations which explain a broad range of phenomena without reference to a specific concrete end. One might speak of a powerful psychological formulation, but for the educator's purposes such a formulation will not be functionally adequate. The term functional adequacy is used here to overcome the notion that science, conceived as a set of discrete disciplines each of which seeks to explain a rather well defined set of phenomena, is adequate for the applied scientist's purposes. The applied scientist such as the doctor or educator is eclectic insofar as he draws upon a number of disciplines. Ideally he would synthesize knowledge from each discipline. Since he cannot, he seeks formulations from each discipline that can be related to formulations from others.

Some formulations descriptive of man can be be related to the socio-cultural reality only with great pain, while others are conceived with these relations in mind. The latter kind of formulation is more

desirable on the grounds that it can become part of a functionally adequate formulation eventually. A conceptualization that describes man, his potential, and the "good man" through a list of virtues such as "truthful," "trustworthy," "patriotic" and so forth carries with it implicit assumptions concerning the relation of man to the socio-cultural reality, and is not easily related to formulations that comprehend social structure, social activity, and social processes. Because of the difficulty in relating the traditional concepts of virtue to a set of manipulable social circumstances, those concepts are functionally inadequate for the educator's purposes. Take as an example a third grade teacher trying to "educate" a seven year old student who habitually lies. If she views him simply as a liar, that is, one who is inherently bad or evil, she can do little in a reliable way to solve the problem. Since she conceives the act of lying as an act of a bad will her common sense tells her that a boy who lies should be punished. But punishment might merely aggravate an emotional problem of fear or insecurity which moved the boy to lie in the first place. In general it is difficult to build a teaching strategy, or a set of social relations and processes that will minimize such problems, if human behavior is analyzed in terms of such concepts as the traditional virtues.

If on the other hand an educator selects a conceptualization that defines man, his potential and the "good man," in social-psychological terms which relate what man is to socio-cultural phenomena rather than some notion of free will, he then can build an effective strategy aimed at the creation of the "good man." In that case the educator can conceive of a seven year old boy's lies as a mode of accomodation to a socio-cultural context and see that certain situations tend to encourage lying and certain others tend to be accomodated to in other, happier ways.

A psychological or a sociological formulation can never in itself be functionally adequate for the purposes of the educator, but some formulations are cast in terms which allow them to be related logically to the other formulations used by the educator. Take as an example the area of social stratification. It is conceivable that the sociologist will be happy with an adequate description of a stratified society. The educator is not so much interested in the "facts" of social stratification as he is in the psychological differences of classes, the institutional response to different classes and how the social situation in the school can be altered to encourage appropriate modes of accommodation.

In brief then the sociologist asks how he can describe and explain social phenomena, while the educator asks how he can manipulate the social context of education in order to encourage certain changes in students. Upon examination it appears that the differences between the contexts of the sociologist and the educator is no greater than those between either the sociologist and the philosopher or the educator and the philosopher. It might be said that the community of philosophers of social science to which Goodman and Rudner belong have the central purpose of clarifying certain logical and methodological issues surrounding the social sciences.[10] Rudner's work, as reviewed, can well be viewed as an attempt to clarify and solve certain issues that surround the "logic of induction" of the social sciences. Since clarification of logical issues is both Rudner's and Goodman's avowed purpose, their central question might be: What is the best form to use in expressing a set of concepts. The sociologist shares these purposes with the philosopher, but he also ascribes to a much larger set of goals. The sociologist is interested in developing concepts, formulations and techniques through which certain social phenomena can be made intelligible by providing an

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[10]See Rudner, Philosophy of Social Science, VII and Goodman, The Structure of Appearance, XVII.

explanation and prediction of further phenomena. The sociologist is interested in making social phenomena comprehensible, that is, in making explicit the relations between diverse phenomena. This means that he is indeed interested inlogic, but also much more, he is interested in the content of his formulation.

One of the main differences between philosophers of science, such as Rudner and Goodman, and sociologists is that, due to their interest in form, the philosophers focus upon an instantaneous or terminal stage of scientific inquiry, and must necessarily do so when talking about the formalization of formulations. Philosophers of this bent assume that the meanings and relations of terms to be used in a formulation are relatively precise and stable, while the sociologist, in his interest with content, questions whether the phenomenon is stable. Constantine Politis draws the reader's attention to problems of using axiomatization or formalization:

> "It should be noted that the axiomatic form constitutes a representation of a logical or mathematical field in its final expository form and should be clearly distinguished from the exploratory form of a field in the process of being developed, so that axiomatization does not reflect the process of mathematical discovery but the conventional form of communicating or stating mathematical results."[11]

Abraham Kaplan indirectly argues that the contexts are different on three grounds. First, he argues

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[11]Politis, "Limitations of Formalization," 356

that there are in principle no terminal contexts in inquiry:

> "New problems always arise, confronting us with unforeseen issues of both meaning and truth. The penumbra of vagueness is not a "surplus meaning," scientifically expendable. Because meanings are open, our conceptualizations can reach out for a firmer grip on reality."[12]

Kurt Mayer seems to speak to the same point when discussing stratification concepts:

> "The need for continuous conceptual clarification and theoretical reassessment arises in a large part from the increasing complexity of modern social structures and their rapid changes. By the time we have fashioned some conceptual tools to analyze our stratification system and tested them in empirical research, the underlying social reality has already become distorted."[13]

Kaplan's second attack centers on the question of whether or not the formalistic approach is contradicted by scientific practices:

> "Now the logic of science is not properly restricted to an analysis of instantaneous states of knowledge. . . We are interested not only in the timeless relations of entailment among abstract propositions but also in the processes by which in time one concrete scientific assertion gives way to another, and usually an assertion making use of new, or at least modified, concepts.
>
> The point is that we cannot accommodate these facts about the norms of scientific usage without providing for openness of meaning.

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[12] Kaplan, The Conduct of Inquiry, 70

[13] Kurt B. Mayer, "The Changing Shape of the American Class Structure," Social Research, 1963, XXX, 458-68.

> If meanings are taken to be always wholly fixed, logically speaking, relations between an old concept and new ones can be described only as overlap, inclusion, or complete replacement. The details of the process of change, its intermediate steps, its locus and justification--all remain unspoken."[14]

Finally Kaplan argues that the specification of meaning of terms is a complex task. A term like "bald" can be explained by itself while terms like "the" have sentential meanings, that is, they can be explained only in the context of a sentence. Kaplan goes on to add a third point.

> "That point is that there are terms which require for a specification of their meaning not one sentential context but the context of the whole set of sentences in which they appear. Such meanings I have previously called "systemic meanings". Each sentential occurrence is a partial determination of the meaning, but only as we encounter the term in more and more contexts of varying sorts do we come to understand it more fully."[15]

One might conclude that as new sentences are added to a formulation, new or further meanings emerge. This also would tend to argue against the relevance of terminal stages of inquiry for the sociologists purposes.

Berger et al note that the accretion of a theoretical tradition "does not consist of the addition of endless numbers of ad hoc findings to the mounting

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[14]Kaplan, The Conduct of Inquiry, 69-70

[15]Kaplan, The Conduct of Inquiry, 64

stock of knowledge, but of the continual modification of the systematic structure of definitions and assumptions that is called a theory."[16] What is of importance here is that he notes the need for continual modification of formulations.

The question of a theoretic tradition and problems associated with the choice between development of new formulations and the reformulation of traditional formulations does not arise in the philosophic context. It was pointed out earlier that sociologists teaching graduate courses in sociology of education chose topics related to the traditional areas of sociological investigation, while professors of education teaching similar courses chose topics that were more directly relevant to the problems faced by teachers and educational administrators. This seems to indicate that the sociologist is interested in developing a body of theory from traditions already existing, and would place more emphasis upon coherence of formulations with the tradition in their selection of formulations than would the philosopher.

Professor George McKee notes that American Sociologists tend to select topics or content areas on the basis of their relevance to social problems than do

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[16]Berger, et al, Sociological Theories in Progress, x

European Sociologists. He points out however that even the Americans view the selection of appropriate subject matter as being tied to previously developed conceptualizations.[17]

The philosopher of social science places a good deal of emphasis upon the development of precise local theories. The sociologist is more interested in the adjustment of various formulations so that they might be integrated into new and more powerful conceptualizations. The possibility of integration of theories is to a great extent linked to the openness of the conceptualization, or better said, to the systematic vagueness of the terms. For example the sociologist is not only interested in developing an accurate and precise stratification theory, and a theory of motivation, but he is interested in integrating both such formulations into one conceptualization so that he can talk about social class and level of aspiration. This goes a step beyond the work of philosophy of science and makes other demands upon the sociologist. As was pointed out earlier the educator has broader interests yet.

In sum then the sociologist asks how he can best describe and explain a set of changing social phenomena, and he evaluates formulations on the basis of their

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[17]From an unpublished lecture in History of Sociological Theory, given at Michigan State University, January, 1967.

systematic openness, their coherence with a tradition, power, clarity, and fruitfulness. The educator asks how he can change individuals by manipulating the social context, and judges formulations first in the light of their functional adequacy and then asks questions about simplicity, precision and so forth. The philosopher of social science asks what is the best form for the elaboration of a set of concepts, and in asking this question selects formulations on the basis of their logical characteristics. Hence he is more interested in logical precision, simplicity, and completeness than other criteria.

4.2 The problem of evaluating criteria

The question addressed in this section is: how does one rationalize the selection or rejection of a criterion such as clarity, functional adequacy, or simplicity. It has already been pointed out that there are a number of criteria that might be used in the selection or rejection of formulations. But since it takes a set of criteria to select, order, and attach weights to other criteria, the question remains as to what criteria might be used for that purpose. Both Goodman and Rudner reject certain criteria for the selection of primitive terms and formulations, but neither explicitly treats the criteria used in that selection. For that reason the topic of criteria for

the selection of criteria must be discussed briefly.

In the interest of clarity a distinction will be made between criteria used to select formulations, and criteria used to select and order those criteria. Criteria used directly to select primitives and formulations such as confirmedness, simplicity and clarity will be called "first order criteria." Criteria used to select first order criteria will be called "second order criteria." The question at hand then is: How are decisions concerning the selection of formulations made in each of the contexts? It is obvious at the outset that scientists and educators use a number of criteria in the selection of alternate formulations. There is however no precisely defined decision procedure, that is, given a decision problem in the two contexts, there is no precise set of criteria available nor is there a definite sequence of application or a calculus of weights for each of the possible criteria. The task of this subsection is the specification of a model of such a procedure and set of criteria.

In the decision procedures being questioned here, there is no adequate reconstructed logic.[18] And even though this dissertation is not an attempt to

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[18]Kaplan, The Conduct of Inquiry, Chapter 1.

construct such a logic, it must be concerned with clarification of some of the variables that must be considered in order to understand the place or legitimate role of simplicity in the decision procedure.

Perhaps a discussion of some of the factors that influence the sequence of application of criteria, and the weight attached to each of them will help clarify the preceeding point. If one were to ask a sociologist or educator what first order criterion is of primary importance in selecting primitives and formulations, he might well get an answer like: "That depends on a lot of things." The chances are that the sociologist or educator would add that the selection of criteria, the weight to be attached to each of them, and the sequence in which they are to be applied is determined by some of the following factors:

1. <u>The stage of development of the formulations in question is relevant</u>. For instance, in selecting formulations in the early stages of development a sociologist might well select a formulation on the basis of clarity or intuitive plausibility, while in the selection of well-developed formulations he might be looking for a large backlog of confirming evidence. At the same time the educator might well choose between formulations in the early stages of

development on the basis of its relevance to the educational task at hand, or its close relation to other relevant formulations, such as psychology. In choosing between more fully developed formulations he too might look for much confirming evidence.

2. The state of development of related disciplines is one relevant aspect. For instance, if the sociologist is dealing with formulations concerning socialization, he might reject off hand a formulation that contradicted certain well-confirmed learning principles from psychology. The educator might well accept or reject a formulation on similar grounds.

3. The logical status of a formulation is relevant to the choice being made. If an educator is choosing between empirical theories, his first move will be to some pragmatic criterion of truth. He would ask which theory is most well confirmed. On the other hand, if an educator is choosing between two classificational schemata, he will likely not raise a question of confirmation, but will look to the structure of the formulations and ask whether the classificational terms are clear, or relevant to his task.

4. The purposes of the persons or community selecting a formulation will have a direct influence upon the selection of criteria. The educator will likely have a different set of purposes in the

selection of topics and formulations in sociology of education as has already been pointed out.

5. The philosophic, theological or ideological assumptions that the selector makes might often have an influence on the criteria that he invokes. For instance, a realist might reject a formulation cast in phenomenalistic terms. It is to be noted that Russian sociologists tend toward conflict models in sociology while American sociologists more often choose equilibrium models.[19] It is difficult indeed to definitely locate the source of these differences, but it seems reasonable to assume that ideological difference play some role in this instance.

6. The effectiveness of other criteria previously employed influences the selection and appropriateness of other criteria. For instance, if a sociologist were making a choice between theoretic formulations, and had already found that theories in question were about equally well confirmed he might make the decision of the basis of clarity, or some other criteria. But if he were choosing between formulations not equally well confirmed he would probably place greatest trust in the more well confirmed

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[19]This idea was presented in an unpublished lecture by Charles Loomis in February, 1967 at Michigan State University.

formulation even though it was not as clear as the unconfirmed formulation.

Take the following case as an example of the contextual nature of first order criterion selection: If an educator were attempting to build an effective community relations program and were trying to decide what course of development he should follow in the early stages of development of a classificational schemata in sociology, one which he intends to use in the comparison of structural characteristics of American Society relevant to Negro poverty, and had made the assumption that poverty is not desirable or necessary due to some inexorable laws of theology, psychology or economics, and that man does not have "free will" in the traditional sense, he would probably select a broad range of categories and try them in an attempt to identify significant variables. The Coleman Report Equality of Educational Opportunity seems to uphold this thesis. This report is essentially an attempt to identify the significant factors influencing equality of educational opportunity and is a study of a broad range of factors, rather than an in-depth study of a few factors.

The educator will also be interested in the functional adequacy of the formulation, but in the early stages of investigation will not know just what

factors or variables need to be considered to bring about functional adequacy. After a preliminary investigation, he is in a better position to determine just which factors or variables are most directly related to his purposes and he will be able to define functional adequacy. Hence, after the educator has done some initial investigation and has acquired a backlog of evidence, the order of selection of first order criteria will change. In the first instance he is interested in identifying relevant variables and chooses the most powerful formulation for that purpose, but after some of the "results are in" he will turn to other criteria. In this case the educator will look to functional adequacy, and he will no doubt attach more weight to precision and eventually perhaps simplicity.

With these things in mind the role of simplicity in a particular context will be defined and evaluated in terms of the following second order criteria: (1) objectivity, (2) effectiveness, (3) appropriateness, (4) compatibility, (5) sequential significance, and (6) overall significance. The first three criteria are somewhat independent from the particular contexts discussed. Appropriateness of a first order criterion is a necessary condition for its inclusion in any list of criteria. If a criterion is

not appropriate to a set of decision problems it cannot be objective, effective and so forth in relation to that set of problems. Both objectivity and effectiveness are desired of all first order criteria and are to that degree independent of any context.

There is a second kind of second order criteria however. The weight to be attached to each of them is related to the particular context in which first order criteria are being selected. But before this contextual relationship is discussed it would be well to specify the meaning of the second order criteria and give some explanation of each of them. It should be noted at the outset that second order criteria may be applied to first order criteria in relation to either particular decision problems, or sequences of decision problems.

(1) Objectivity: The first order criterion x is said to be objective if it can be applied mechanically or routinely to appropriate cases, or if an algorithm can be constructed for its application. For instance, a criterion is said to be objective if it can be applied by a machine, or by any person with access to it. Measures of length and duration are objective when standards and appropriate instruments for their application are available. A criterion such as beauty, as it is commonly used, is not an objective criteria

because it is dependent in principle upon private knowledge, moods and attitudes.

(2) Effectiveness: The first order criterion x is said to be effective if it can discriminate in all cases to which it is appropriate. In the case of a man sorting potatoes the criterion "big potato" and "little potato" are not effective criteria unless "big" and "little" are operationally defined since there will be a number of cases which cannot precisely be judged either "big" or "little." "Equal to or less than three ounces" and "greater than three ounces" would be more effective criteria because they could discriminate in more case. "Greater than ten" is absolutely effective when applied to the domain of integers.

(3) Appropriateness: The first order criterion x is said to be appropriate to a decision problem if there is something in the subject matter that "answers to" the criteria. The criterion "confirmedness" is not appropriate in the selection of nontheoretic formulations because confirmedness (as has been used here) is a characteristic of empirical laws, and nontheoretic formulations qua nontheoretic do not generate or contain empirical laws. In the same sense "ripe" is an inappropriate criterion in the selection of swimming pools, and "invalid" is inappropriate in the selection of apples. It is easy to see that if a first order criterion

is inappropriate for a decision problem or set of problems, then that criterion falls out of further consideration. Intuitively appropriateness is the first criterion of second order criteria used in the selection of first order criteria.

(4) Compatibility: A first order criterion x is said to be compatible with a first order criterion y in appropriate cases when the attainment of condition x does not require loss of condition y. For instance, when dealing with black raspberries, raspberry r may be either "red" or "ripe" but it cannot be "red" and "ripe" at the same time. Certain of the first order criteria used in the selection of formulations may be incompatible, for instance it may be the case that a simple formulation may not be clear. In cases where two first order criteria are not compatible, the selection of an assignment of weight to one of them will be determined on the basis of the purposes of the person or community making the decision. For instance, if the educational community were faced with the task of selecting a stratification formulation, it might well be the case that the choice is between a relatively clear and precise formulation, and one that promises to be functionally adequate but is not as clear and precise, it would probably choose the functionally adequate formulation.

(5) Sequential significance: A first order criterion x is said to be sequentially significant in appropriate cases when it is the first in a sequence of ineffective criteria to be applied. This again is a contextual matter, and might be conceived as a matter of degree. First order criterion y might have a higher sequential significance in the educator's context than it does in the sociologist's context. For instance, functional adequacy will have a high degree of sequential significance in many decisions faced by the educator, while it will have less sequential significance in the sociologist's context. Sequential significance will be directly related to purposes and as purposes change the sequential significance of first order criteria will change.

(6) Overall significance or weight: The first order criterion x is said to have a high degree of overall significance in a sequence of problems if it is appropriate to a high percentage of cases and has a high degree of sequential significance in those appropriate cases. For instance, a football coach might assign high overall significance to the criterion "speed" by always first asking how fast a prospective player is. Overall significance is contextual in nature, since it is dependent upon the sequential significance. High overall significance will characterize first order

criteria that are tied to the central purposes of a context. For instance, perhaps the most important goal of science is adequately explain "the world." Since confirmedness of theory is tied to that goal it displays a high degree of overall significance.

In sum then, the scientist and applied scientist are often faced with the task of deciding between formulations, and in order to carry out the decision in a systematic way, or in order to rationalize the decision after the fact he must use certain criteria. The problem is complicated by the fact that there are a number of criteria that might be used, and the scientist is faced with the problems of making a choice between criteria, of attaching weight to one or more of them, and ordering the sequence of their application. In order to do this he must look to other criteria, here called second order criteria. Of the six second order criteria defined, three of them might be universally applied in the selection of first order criteria, and the other three take on content or meaning within a particular context because they are related to the purposes of individuals, and communities and other contextual matters.

Figure I is an attempt to represent the relations of first and second order criteria.

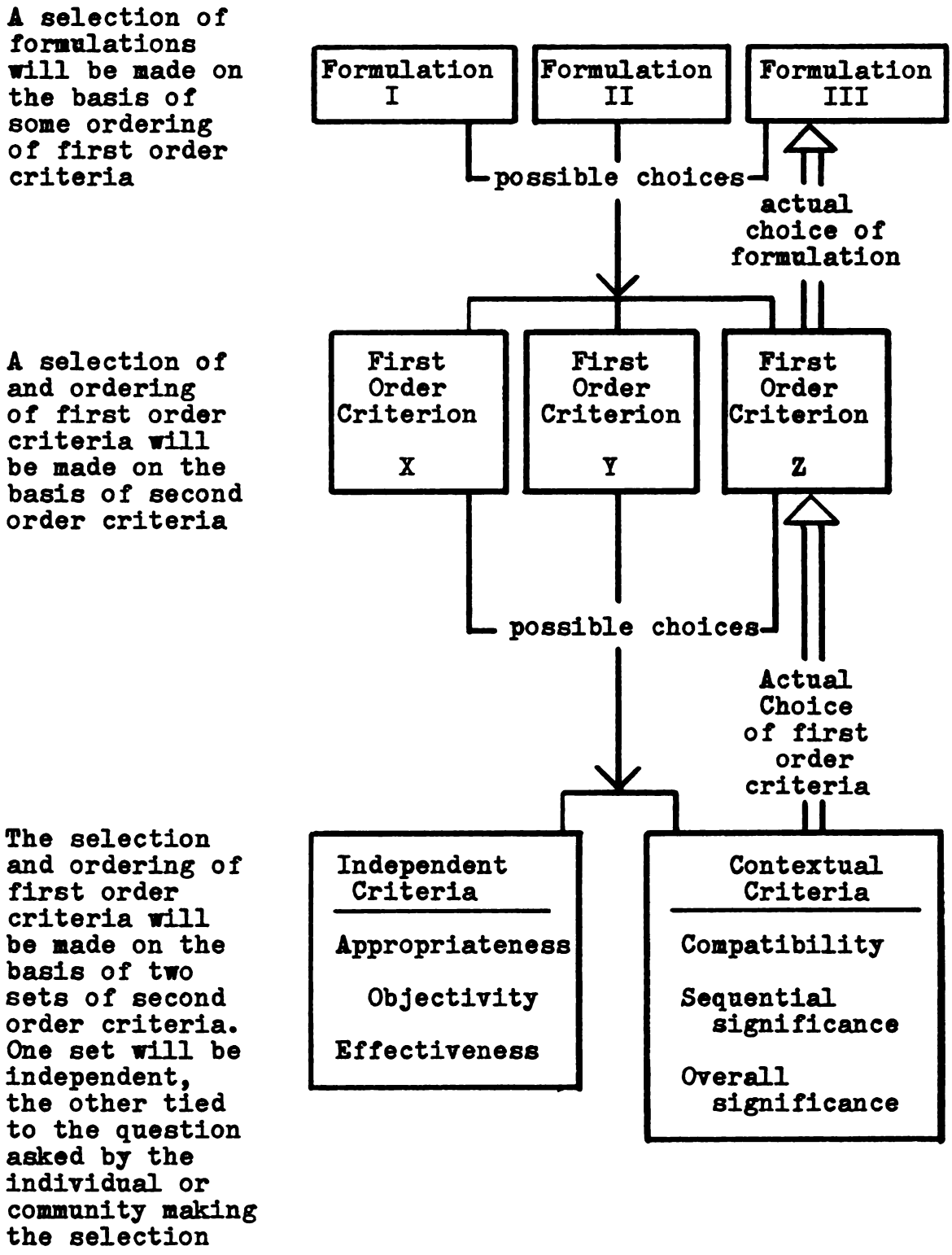

FIGURE I

A GENERAL MODEL FOR THE SELECTION OF SCIENTIFIC FORMULATIONS

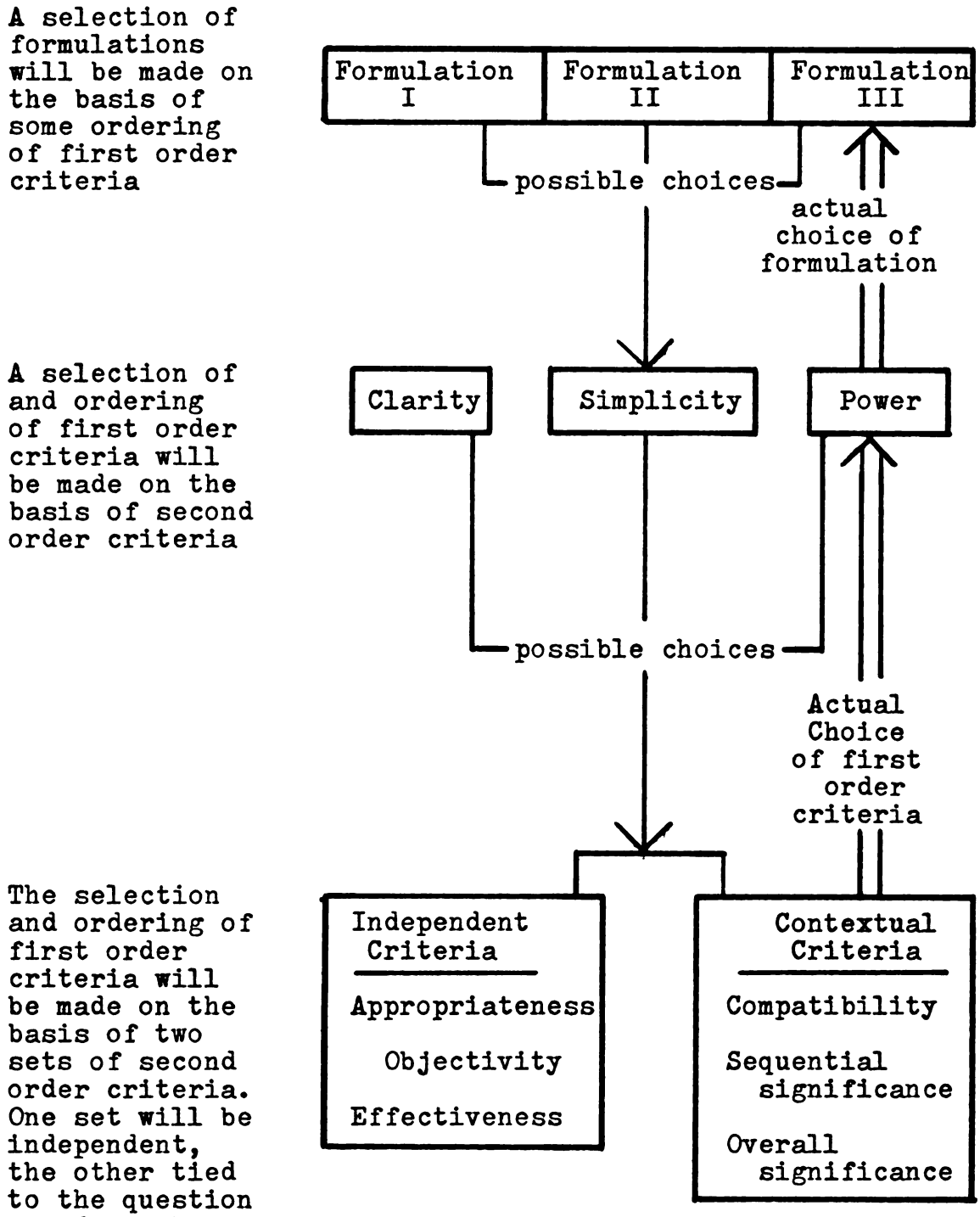

FIGURE II

AN EXAMPLE OF THE SOCIOLOGIST'S SELECTION OF FORMULATIONS

A selection of formulations will be made on the basis of some ordering of first order criteria

A selection of and ordering of first order criteria will be made on the basis of second order criteria

The selection and ordering of first order criteria will be made on the basis of two sets of second order criteria. One set will be independent, the other tied to the question asked by the individual or community making the selection

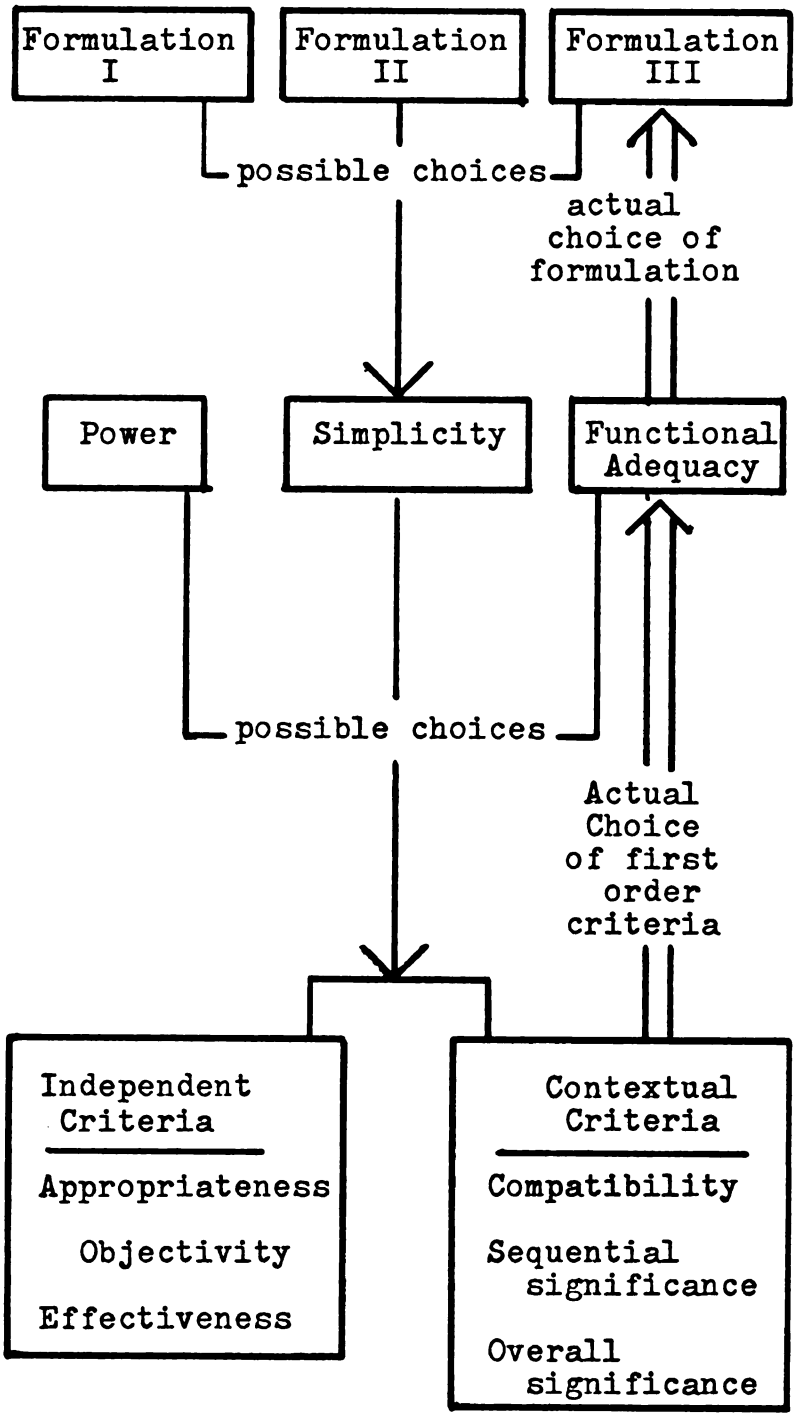

FIGURE III

AN EXAMPLE OF THE EDUCATOR'S SELECTION OF FORMULATIONS

Now that a specification of criteria has been made, simplicity can be evaluated in each of the contexts. Before that is done however, Goodman's arguments for the centrality of simplicity will be tested in the sociologist's and educator's decision contexts.

4.3 An evaluation of Goodman's arguments in other contexts

In Goodman's arguments for the centrality of simplicity in the selection of primitives for a system he suggests that often predicates are considered definitely inappropriate for selection as primitives if they are inapplicable or obscure, but that selection of primitives from the remaining predicates cannot be so definitely made. He also argues that clarity is not an effective criterion since scientists often coin terms to be used as primitives. He also argues that the problem area to be treated seldom determines uniquely the choice of primitives and hence in the absence of other effective criteria, simplicity takes on greater importance.[20] The question to be raised here is whether Goodman's arguments carry weight in the sociologist's and educator's respective contexts.

There is no doubt that inapplicable predicates

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[20]Goodman, The Structure of Appearance, 64-66

are inappropriate choices in any formulation, but some question is raised by what is meant by "obscure" predicates. Goodman gives as examples of "obscure" predicates, "Predisposed to telepathic communications with supernatural aid," and "denotes."[21] These predicates are questionable on several grounds, but a question remains as to just what constitutes "obscure" and whether or not the demand for rejection of "obscure" primitives is appropriate to the purposes of the sociologist. Are such terms as "society," "social order" and "culture" obscure? Surely they must be considered so until their systemic meaning is elaborated.[22] It would seem that the sociologist faces a paradox if he takes seriously the rejection of "obscure" predicates, while he admits that some predicates have systemic meaning. Such predicates are necessarily obscure until they are assigned meaning through elaboration of the formulation, so the rejection of "obscure" predicates as primitives has the affect of eliminating all predicates that have a high degree of systemic meaning. If this is what Goodman is arguing, it is probably a valid argument. It does however point up the fact that the sociologist places himself at a disadvantage when he takes the constructionist's stance.

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[21]Goodman, The Structure of Appearance, 64-65

[22]Kaplan, The Conduct of Inquiry, 64

The educator will probably lack interest in the role of obscurity in the selection of primitives predicates, and be more concerned with the obscurity in the total set of extralogical predicates.

Finally, Goodman argues that the problem to be dealt with seldom determine uniquely the primitives to be used.[23] If this is true in the constructionist's context it is probably less likely to be so in the sociologist and educator's contexts. After all, the sociologist and the educator are treating different problems. The constructionist's problem is to bring logical system to a set of concepts, and interpretation of those concepts is secondary. The sociologist in his interest in content is constantly frustrated by the demands of the pragmatics[24] of the situation. The educator's interest in functional adequacy complicates the problem further and restricts his range of appropriate choice to that degree.

In sum then, Goodman's minimization of certain concerns and his subsequent maximization of the importance of simplicity is probably less valid in the

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[23]Goodman, The Structure of Appearance, 66

[24]The sociologist seeks not only a logically neat system, but a true one in the pragmatic sense. He is therefore less free to systematize a formulation than the constructionist. The sociologist must give the world a chance to "object" while he is developing an objective formulation.

sociologist's and educator's contexts than it is in his own. The following section is an attempt to point out that while simplicity as Goodman explicates it is an objective and effective criterion, it has little sequential significance in the sociologist's and educator's decision contexts.

4.4 The role of simplicity in each context

This section of the dissertation is addressed to the question of the role of simplicity in the contexts within which the educator and sociologist makes decisions. In section 4.2 the problem of evaluating criteria such as clarity and simplicity was discussed and a number of criteria for that purpose were specified. In this section the question of the objectivity, effectiveness, appropriateness, compatibility, sequential significance, and overall significance of simplicity in the context of the sociologist and the educator is addressed.

In the sociologist's context of inquiry, what is the role of simplicity as explicated by Goodman in the selection and rejection of formulations? In the light of the criteria elaborated in 4.2, and in the light of Rudner's comments elaborated in chapter two, the answer at present is that simplicity is an inappropriate criterion for use in the selection of formulations. It is inappropriate on the grounds that there are at present no formulations formalized to the extent necessary

for the application of the calculus. There is nothing in the formulations of sociology of education that "answer to" the criteria.[25]

Any role that simplicity might play in the future will be dependent upon something similar to Rudner's suggestions for formalizing formulations or altering the explication in such a way that it might be applied to partial-formalizations. The first alternative has already been discussed and it has been pointed out that formalization makes demands and assumptions that conflict with other desiderata of sociology of education. Hence, if simplicity is to be made appropriate by formalization of sociological formulations, it will become incompatible with other desiderata that fall higher on the hierarchy of values of the sociological community, and hence simplicity will become sequentially insignificant. Take as an example the area of stratification theory.[26] In stratification

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[25]The term "formalization" is used by social scientists in a number of ways. As far as could be determined it is always used in a weaker sense than necessary for the purposes here described. In Types of Formalization in Small-Group Research, Berger says, "By 'formalization' we refer to the general process of making explicit the logical structure of a set of assertions."

[26]Stratification theory is chosen because it is of interest to both sociologists and educators, and it contains formulations that fall under both the "theoretic" and "nontheoretic" rubrics.

theory the present thrust of the sociological community is to keep the conceptualization open enough so that progress can be made in the development of the concept of social class while allowing enough systematic vagueness in the terms employed to make legitimate inquiry. Two things have become apparent in recent years concerning social class: (1) Sociological research can be useless if it is infected with a priori categories, and (2) all communities do not have similar social characteristics, hence the notion of social class must be systematically vague.

Kaplan once said that if you give a boy a hammer he will find that everything he encounters needs pounding.[27] Sociologists and scientists in general have agreed that a similar phenomenon exists among scientists--give them a set of categories and they will see to it that all phenomena are ordered according to them. The general response of the scientific community to this has been to distrust a priori judgments and to include an openness or systematic vagueness in their technical terms. It seems that the general stance of the Constructionists in their demand for precise concepts conflicts with the sociologists desire and need for systematic vagueness.

Melvin Tumin reports on the systematic vagueness

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[27]Kaplan, The Conduct of Inquiry, 28

of stratification formulations in pointing out that stratification refers to five attributes of the phenomena of stratification:

> "1. It is social, i.e., patterned in character.
> 2. It is ancient, i.e., it has been found in all past societies.
> 3. It is ubiquitous.
> 4. It is diverse in its forms.
> 5. It is consequential, i.e., the most important, most desired, and often scarcest things in human life constitute the basic materials which are distributed unequally."[28]

Brookover notes: "The concept of social class has many diverse meanings, all of which have to do with differentiation in the population of a society."[29] Hodgkinson discusses the problems in measuring social class:

> "In general, there have been four views of social class structure that have dominated research done in this field. (There are about one thousand articles and books published since 1925 which deal with social classes in America, so that we are talking about a large segment of the field of sociology.)"[30]

Just what causes this proliferation of formulations is still problematic. Several people have tried to explain why it exists, and in doing so have attested to the community goal of openness of concepts.

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[28]Melvin Tumin, Social Stratification, (Englewood Cliffs: Prentice-Hall, 1967), p. 13.

[29]Brookover, A Sociology of Education, 154

[30]Harold Hodgkinson, Education, Interaction, and Social Change, (Englewood Cliffs: Prentice-Hall, 1967), p. 88.

Zetterberg laments the hiatus between theoretical and applied sociology, and points out that established sociological knowledge is not being used by sociological practitioners because they reveal a "common inability to draw upon codified knowledge."[31] Implicit is the assumption that sociologists ought to draw upon codified knowledge, and this in turn seems to indicate an openness of "codified knowledge." Alpert notes four limitations upon general sociology in the United States: (1) inadequate historical and comparative perspectives; (2) lack of critical scholarship with respect to past sociological accomplishments; (3) excessive concern with methodology; and (4) failure to establish close relationships with biology.[32] Number two seems to make a similar appeal to the openness of past accomplishments.

In an earlier article in Synthese, Leyton attributes the failure of sociologists to draw upon codified knowledge and their lack of critical scholarship with respect to the past sociological accomplishments to sociologists lack of "verbal responsibility" in their communications.[33]

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[31]Zetterberg, Hans, Social Theory and Social Practice. (New York: Bedminster Press, 1962), 190.

[32]Alpert, Harry, "Some Observations on the State of Sociology," Pacific Sociological Review, 1963, 6.2, Fall, 45-48.

[33]Leyton, Alvin C., "Sociology and Obligations of Interpretation," Synthese, Vol. XI (1959), p. 177.

In a recent book Berger, Zelditch, and Anderson lament the fact that students are not taught to work with theory, and set out to write a book, "Its purpose is to expose students, by example, to the pitfalls, the problems, and the difficulties of construction systematic theory."[34]

These men were moved to write such a book by Parson's statement: "But the most disappointing single thing about it has been the degree to which the results of this work (empirical research done in our field) have failed to be cumulative."[35] Each of these criticisms assumes that research should be cumulative and it seems that a desirable if not necessary condition for such a cumulative effect is the systematic openness of formulations.[36]

Rudner argues that the first order criterion theoretic fruitfulness is inappropriate to the selection of formulations which have not been fully elaborated.

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[34]Berger, et al. Sociological Theories in Progress. (Boston: Houghton Mifflin Co., 1966), xi.

[35]Berger, Sociological Theories in Progress, xii.

[36]No distinction has been made between systematic openness of formulations and systematic openness of a conceptualization. Systematic openness of conceptualizations may or may not make logical demands upon the forms of formulations. It has been stated that the axiomatic form of formalized theories assumes that an incumbent formulation is in a terminal stage of development, and this seems to demand a closure of the underlying conceptualization.

It is possible that if simplicity is made appropriate by formalizing formulations, and that formalization is possible only in terminal stages of inquiry, that theoretic fruitfulness would be made appropriate by the same process of formalization. It is also quite probable that theoretic fruitfulness would have considerably more sequential significance than simplicity in the sociologists context.

It is doubtful whether formalization of particular formulations would serve the general purposes of the sociological community. A second argument might be entered at this point claiming that formalization of particular formulations might make them easy to communicate and work with. This argument is so weak however that it will not be considered here.

The second approach to the problem of making simplicity appropriate to decisions in the sociologists context would be to weaken it in such a way that it could be applied to more cases. It has already been pointed out by Goodman himself in his rationale for the calculus that if simplicity is measured by counting primitive predicates or by counting predicate places in extralogical primitives is ineffective because the number of primitives in any formulation can be reduced to one by conjunction.

Goodman's explication might also be modified by

reducing it to a "rule of thumb" like "extralogical predicates should be explicitly defined whenever possible." The vagueness of such a rule argues against it however, since it would be difficult to determine when such definition is possible. In certain cases such a rule might be used as an analytic tool however and help clarify certain terms. It would be questionable whether explicit definition of all possible terms would allow for the systematic vagueness spoken of earlier. To the degree that explicit definition frustrated this purpose it would be unwarranted. It should also be pointed out that while explicit definition would clarify the syntactical relations of a formulation, other means such as metalinguistic explanation might work better to specify the meaning of such a term.

The number of formulations that the educator has to draw upon is identical with that available to the sociologist and the present inappropriateness of Goodman's explication of simplicity is just as definite in the educator's context as it is in the sociologist's context. Formalization as a method of making simplicity appropriate will not generally be as antithetical to the educator's purposes as it was to the sociologist's purposes. Whereas the sociologist sought to develop formulations that reflected a

systematic vagueness of concepts, the educator is not as interested in systematic vagueness. The educator employs sociological formulations for one of several reasons. He may want to compare classrooms, school districts, or alternate teaching strategies through the use of a classificational schemata, he may want to identify social factors influencing academic achievement, or he might seek a law-like generalization to be used in an explanation or prediction of a future state of affairs. There is one common element, the educator will use sociological formulations or generalizations as tools in the educational enterprise. He does not seek the kind of openness that the sociologist must seek, but he seeks precision and functional adequacy in particular formulations. Formalization does not conflict with the general purposes of the educator then, at least insofar as formalization does not obscure and make the content of a formulation unintelligible on practical grounds.

The question of the sequential and overall significance of simplicity as a criterion in the educator's context remains after it is conceded that simplicity might be made appropriate to such choices by formalization of formulations. It was pointed out earlier that the concerns of the educator as an applied scientist are directed toward the solution of particular

problems, and for that reason the educator as other applied scientists must seek formulations that are functionally adequate for his purposes. Out of the large number of stratification formulations available to the educator, it is unlikely that he will be faced with a decision problem unless he is faced with a problem that is to be analyzed in terms of stratification theory. When the educator is faced with the problem of providing equality of educational opportunity, or with the problem of turning out equally well educated individuals who bring different backgrounds to the educational context, he then becomes interested in social class differences, but even then his interest in social class differences will be limited to variables that have a bearing upon the educational task. He can, as an applied scientist, abstract from much of stratification theory, and focus upon certain particular elements of the formulation. In the same way, a doctor setting a broken bone does not have to know everything about bones at that point in time.

It is then doubtful whether simplicity would be sequentially significant even if it were to be made appropriate by adequate formalization of formulations. It would seem that the first order criterion of functional adequacy takes on such sequential and overall significance that simplicity would be insignificant by

comparison.

The second tack could be attempted, that is of forming a nonformal analogue of Goodman's calculus, but it has already been pointed out that a weakening of the criteria serves to trivialize it.

In sum then, simplicity as explicated by Goodman is inappropriate to the selection of formulations in sociology of education because there are no formalizations to which it can be applied in that area. Simplicity could be made appropriate in one of two ways, first by formalizing formulations in sociology of education, and second by weakening simplicity itself. When simplicity is made appropriate by the first method it becomes incompatible with the systematic vagueness sought by sociologists, and hence becomes sequentially insignificant in the sociologist's context, and it is similarly insignificant in the educator's context because of its relationship to functional adequacy. A weakening of simplicity results in a trivialization of it on the very grounds that every formulation can be made simple by conjunction or substitution of predicates.

CHAPTER V

SUMMARY AND CONCLUSIONS

This inquiry was based upon the assumption that education finds its reason for existence in what it can contribute to human welfare and the preservation of man, and that the size of that contribution is in direct proportion to what educators know about the educative process. Sociology of education has promised to make intelligible certain aspects of the social context within which education is carried on, and it has accomplished this task to some extent, but has failed at least in part because of the very enthusiasm with which new and different theories and formulations were produced. A brief look at the literature of the field disclosed a shocking proliferation of overlapping and competing formulations. This proliferation of formulations seems to have blocked for educators the very intelligibility that was so diligently sought.

It was assumed that the solution to the problem of proliferation would involve the rating and subsequent selection of formulations for use by the educational "consumer" and further development by the sociologist.

It was also assumed that the development of an adequate decision procedure would require among other things the development of adequate criteria by which formulations could be rated. This dissertation was to be the report of the inquiry into the possible role of structural simplicity as a criterion in the selection of alternate formulations in the sociology of education.

Richard Rudner's writings on simplicity were important to this inquiry because Rudner made the initial suggestion that simplicity might play an important role in the selection formulations in the social sciences, and because in them he made an attempt to classify and evaluate various attempts to explicate the term simplicity. Rudner first divided all attempts at explication of simplicity into two categories: Ontological Simplicity and Descriptive or Linguistic Simplicity. Ontological Simplicity was to have been applied to those explications of simplicity that presumed to predicate something of the universe or of the way men perceived the universe, while Descriptive or Linguistic Simplicity was to have been applied to those explications conceived to be predicated of man's descriptions of the universe. Rudner rejected the notion of Ontological Simplicity as fundamentally obscure and irrelevant to the tasks of science. Instead he selected as relevant to those tasks the subdivision of Descriptional Simplicity called

Objective-Logical Simplicity, and he noted that of two approaches to the explication of that notion, Nelson Goodman's approach was most promising. He also noted that Goodman had devised a calculus of simplicity to be applied to formalized formulations to yield simplicity values based upon the number and relevant kind of extra-logical primitive predicates of each formulation.

Professor Rudner argued that the empirical test of confirmation does not apply to many formulations in the social sciences since it can only be applied to formulations that contain empirical laws, and many of the formulations used in the social sciences are nontheoretic, that is, they are classificational schemata or typologies that do not generate empirical laws. He also argued that among other criteria (clarity, power, theoretic fruitfulness) simplicity was the most promising for evaluation of nontheoretic formulations. This made simplicity the most promising for the social sciences, since they contain large numbers of nontheoretic formulations.

The immediate promise of simplicity as a criterion in the social sciences was dimmed by the fact that Goodman's calculus of simplicity could be applied only to formalized formulations, and since there were few such formulations in the social sciences, simplicity was only potentially useful. Rudner suggested that simplicity might be made appropriate to the social sciences in

one of two ways: first, the formulations could be formalized or partially formalized, or second, the calculus could be modified to be applied to nonformalized formulations.

Some comments were offered concerning the usefulness of Rudner's suggestions concerning simplicity and social science formulations in relation to sociology of education. It was specifically noted that present weaknesses in theory in sociology of education are related to the problem of assessing formulations, and that several areas of sociology of education are quite concerned with the use of nontheoretic formulations.

As the inquiry progressed it was further noted that the concerns and perspective of a philosopher of social science might well differ significantly from those of either a social scientist or an educator. It was specifically noted that Rudner's view of "science-as-product" within which simplicity showed so much promise, might be inadequate for the sociologist's and educator's purposes.

In chapter three Nelson Goodman's explication of simplicity was reviewed. It was found that Professor Goodman's explication of simplicity turned on a particular notion of system; one which Goodman had explicated earlier. For Goodman a system was a specialized language constructed within a larger language, for some

special purpose. Within a system the terms are precise in extension, the relations between terms are, where possible, explicit through definition and the logical mechanisms for relating propositions are explicit. The system has two kinds of nonlogical terms: primitives which are explained by metalinguistic devices in the metalanguage, and nonprimitives which are defined explicitly within the system. When a theory is formalized, that is, systematized in a constructional system, a decision problem concerning the selection of primitives arises. Goodman's central argument for simplicity was that the most powerful formulation with the least possible primitives is always desired in science. That is, given formulations of equal power, as would be the case when selecting alternate formalizations for a given theory, the most economical formulation is the simplest formulation; that is, the alternative with the fewest primitive terms is the most economical.

Professor Goodman went on to point out that the number of primitives in a given system can be reduced by various means, some of which are counted as spurious, and others of which are counted as legitimate simplifications. He argued that the relevant characteristics of predicates in the assessment of simplicity are the number of predicates in a base, the number of predicate places in a base, and the characteristics of reflexivity,

self-completeness, and symmetry.

Other arguments for the importance of simplicity turned upon the rejection of other criteria for the selection of primitives. It was noted however that the context named as appropriate for the application of simplicity is far more restricted than the context within which the theory builder or the user of theory works. This raised the question of the weight of Goodman's arguments for the weight of simplicity in those other contexts. It was finally argued after accepting the calculus as effective in the context defined by Goodman that four questions remained to be taken up concerning the use of simplicity in the selection of formulations in sociology of education: (1) Are there differences in the contexts faced by the philosopher of science, the sociologist of education and the educator that affect the relevance of simplicity to each context? (2) How is selection of rejection of criteria such as clarity, comprehensibility and simplicity rationalized in the three contexts? (3) Do Goodman's arguments for the centrality of simplicity hold in all three contexts? (4) What is the role of simplicity in each of the contexts?

An inquiry into the three contexts within which the philosopher the scientist and the applied scientist works showed that there is a significant relation

between the purposes held by a community and the criteria that are used in selecting formulations. It was argued that the context within which the philosopher of science, at least those of the breed of Rudner and Goodman, move assumes that the most important aspects of theory building and evaluation are logical. This assumption allows them to put considerable stock in the use of formal or constructed systems. The unfortunate part of this is that the axiomatic form assumes that the content of the system is the result of a terminal stage of inquiry. This is to be contrasted with the context within which the sociologist moves. In this context, the sociologist is more interested in the content of a conceptualization than in the form that it takes, and along with this interest in content comes the interest in continuing inquiry. Where the philosopher can well afford to look at instantaneous states of inquiry, the sociologist is interested in the development of a set of concepts that underly particular formulations. The educator is also primarily interested in the content of formulations, and is consequently less interested in the formal aspects of formulations. The educator however has a different interest in sociology than does either the sociologist or philosopher. The educator is interested in the power that can be gained through sociological

knowledge, and in the selection of formulations he is interested in the functional adequacy of the formulations.

It was concluded that there are some significant differences in the contexts within which the philosopher the scientist and applied scientist move, and that these differences play an important role in the selection of formulations and criteria for the selection of formulations.

It was further argued that neither Goodman nor Rudner had adequately treated the problem of selecting criteria for the selection of formulations. In the second part of Chapter Four the question of the evaluation of criteria was taken up. It was concluded that the selection of criteria for the selection of formulations requires the specification of a second level of criteria, and that some of the second order criteria are directly related to the purposes of the community or scientist making the decision. It was argued that there are at least six second order criteria that might be used in the selection of first level criteria. Three of those six are independent and might be used in the evaluation of any criteria. Appropriateness, objectivity, and effectiveness might well be required of all first order criteria. Compatibility, sequential significance, and overall significance are directly related to the context within which a decision is being made. The

question of the compatibility of first order criteria is raised when more than one criteria is required for a particular decision. Sequential significance and overall significance are attached to criteria within a particular context on the basis of the purposes of decision makers within that context.

Since the calculus of simplicity can be applied only to fully formalized formulations, and at present there are no fully formalized formulations in sociology of education, Rudner's conclusions that simplicity is inappropriate under present conditions is seen as accurate. This is true in both the sociologist's and educator's decision making context. And beyond that, since appropriateness is a necessary condition for further consideration of a first order criterion, simplicity cannot be either objective or effective in those contests as they presently stand.

There are a number of strategies that might be employed to make simplicity appropriate to the selection of formulations in sociology of education. Those strategies fall into one of three categories: those that would formalize formulations and take the calculus of simplicity as it stands, those that would modify the calculus to make it appropriate to nonformalized formulations, and those that would modify both the formulations of sociology of education and the calculus of simplicity.

Each of these approaches might be attempted in each of the contexts.

In the sociologist's decision making context, simplicity can be made appropriate by formalizing formulations, but since formalization is appropriate to the terminal state of inquiry or preterminal stages of inquiry viewed instantaneously as terminal states of inquiry, and since one of the primary goals of the sociological community is to continue inquiry and conceptual development, the very process by which the calculus is to be made appropriate frustrates an important goal of the sociological community. To that degree simplicity is incompatible with systematic openness of formulations. In cases of incompatibility of first order criteria, a judgment must be made to place a value on the conflicting first order criteria. Such a decision, insofar as it is systematically made, will be made by reference to the primary purposes of the decision maker. It is likely that in such a case the philosopher of science would refer to the goal of systematicity and choose the criteria with logical import, while the sociologist would refer to a different goal or purpose, probably that of content development and tend to choose other criteria such as systemic openness. Just what the individual sociologist's or sociological communities' choice might be in this case is problematic, and can be

resolved by empirical investigation, but it is likely that the sociologist would choose the criterion of systematic openness. If this were the choice in a particular instance, simplicity would be sequentially insignificant in that case. If it were often the case that the sociologist chose systematic openness over simplicity, this would mean that simplicity is of little overall significance.

In the sociologist's decision making context simplicity could be made appropriate by modifying it in one of several ways to be applicable to nonformalized formulations. But if this strategy is employed, simplicity is trivialized, that is, it becomes ineffective. If the assessment of simplicity is reduced to the counting of predicates or predicate places, Goodman has already established that all formulations can be made maximally simple by conjunction or redefinition and simplicity cannot be used to choose between equally simple formulations. Hence simplicity is ineffective as a result of this kind of weakening. If simplicity is reduced to a "rule of thumb" or a canon of formulation building such as "make maximal use of explicit definitions," or "always reduce the number of primitives when possible" then simplicity becomes either destructively vague, or it requires a closure that violates systematic openness. This is not to say that such a

canon would not be useful and instructive in some cases, but it seems that insofar as it has any import for the formulation builder, that import can be reduced to a call for logical clarity.

The sociologist might finally take the tack of developing partial formalizations in which tenative or provisional primitives are named and a tenative assessment of simplicity be made upon that basis. This is the suggestion made by Rudner. Surely some benefit is to be realized from such an exercise, but the benefit will more likely be from the kind of analysis that is necessary prior to the assignment of provisional primitives than from the tenative assessment of simplicity that would result. In the light of the overall insignificance of final assessments of simplicity, it is hard to imagine just how a tenative assessment of simplicity could be any more significant.

In the educator's decision making context, it seems that attempts to make simplicity appropriate by weakening the criterion would have the same affect as those suffered in the sociologist's decision making context. A weakening of the calculus would result in making the criterion ineffective. This is probably also true of the approach of using partial formalization and a tenative assessment of simplicity.

In the educator's decision context, formalization does not immediately seem to be anthithetical to

the educator's purposes it was to those of the sociologist. It seems to be the case however that if simplicity is made appropriate to decisions by formalizing formulations, simplicity will still be insignificant in the face of the overall significance placed upon the criterion of functional adequacy by the educator. It seems that the educator's or the educational communities' purposes are centered upon the use of formulations to gain power to achieve a number of educational objectives, and insofar as this is true they must first look to the functional adequacy of a formulation. It seems to be the case that simplicity is not a necessary condition for functional adequacy, since that is true, simplicity seems insignificant in the educator's context.

The general conclusion of this dissertation is then that simplicity, as explicated by Nelson Goodman, does not offer promise as being an important criterion in the selection of formulations in sociology of education. This is attributed to the fact that it has been conceived as a criterion applicable only to formulations, which are and can only be the terminal stages of inquiry, and the scientist is primarily interested in a continuing process of inquiry, and the educator is interested in the power that is to be derived from sociological inquiry as a set of methods or techniques and the product of inquiry as a set of concepts.

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APPENDIX A

The purpose of this study was to determine how educators and sociologists differ in their selection of topics for study in the sociology of education, and to determine what criteria that they would use in the selection of alternate formulations.

The population tested was seventy doctoral candidates at Colorado State College, sixty one of whom were candidates for degrees in some area of education and nine of whom were studying for degrees in the social sciences.

Each of the candidates was given the questionaire attached. (See Figure II)

Twelve of the candidates from education answered the question about the criteria that they might use in the selection of alternate formulations. (question 3.) Of those twelve, four pointed out that their selection of criteria would depend upon the particular choice situation, five said that they did not know what criteria they would use and three said that they would choose formulations cast in terms through which a strategy for educating the "self actualizing man" could be realized. The candidates for degrees in education all chose some form of educational or social problem as appropriate topics for study in sociology of education, and they all chose them <u>because</u> they were educational problems.

The candidates for degrees in social science

all answered the question concerning the criteria by which alternate formulations would be selected. Six of them answered that they would choose formulations that were most "well developed" or most "well confirmed" while three of them pointed out that they would choose formulations which were part of a particular "school of thought." The candidates for degrees in social science chose topics that were problem oriented, but three of them mentioned classical studies in sociology relevant to the schools.

Figure IV. Questionnaire Given to Doctoral Candidates Concerning the Selection of Topics and Criteria

Degree program_____Major_____Minor____

Resident Student_____

Years of teaching experience_____Subject taught_____

Level_____

Years of Administrative experience_____Position_____

Other educational experience_____

_____

Do you have any special interest in sociology of education?_____

_____

(1) What topics do you see as appropriate for study in sociology of education?_____

_____

(2) What criteria have you used in the selection of topics?_____

_____

(3) In several areas in sociology of education there are a number of alternate formulations or conceptualizations available which may be used to describe and analyze those areas. Given this situation what criteria might you use to select alternate formulations?

_____

_____

_____

_____