# Part I: GENERAL SYSTEMATICS

# CHAPTER 1: PRELIMINARY NOTIONS

It is the intent of the first part of this book to provide a general background in methods available for constructing the formal basis of understanding in scientific disciplines. In essence this involves the construction of a series of linked concepts and assumptions which are usually referred to as theory. Theory, both in prehistory and in the natural sciences, goes much further than what is presented here, for we are not directly concerned with how explanation s achieved, but rather with the formulation of phenomena in such a manner as to be amenable to explanation. Our concern is strictly with formal theory.

This initial background is not correctly assumed to be philosophy of science; instead it is based upon what is done, especially what is done by scientists, and not the way or ways in which non-scientists care to rationalize the procedures. Our model, the natural sciences, is part of Western Civilization and thus largely takes for granted the units by which it operates, much in the same manner (and for precisely the same reasons) that we as English-speakers take for granted the meaning of English words. The sciences, as we are accustomed to use the term, are Western “folk theories” of the phenomenological world, not different in kind or implication from any other pragmatically oriented means of explanation. On the other hand, the formulations of prehistory and other cross-cultural “sciences of man” must be capable of organizing simultaneously both our own system of ideas and things and those systems of the exotic subject matter. Consequently, while the sciences provide a model for the characteristics of units to be used in explanation, the actual construction of units must be considered in more detail than is customary in the sciences. Herein lies the most difficult aspect of making effective use of this sort of study, namely, its familiarity and simplicity. The kinds of things considered are those which all of us do constantly, but *intuitively*. In our day-to-day operation in a single cultural system, the intuitive quality of the way in which we carry out these operations is normally of little or no consequence. There is no need to question, much less any interest in questioning, why a house is a house, because we all conventionally agree on what houses are. The inherent ambiguity is eliminated by our common restricted view of the world; misunderstanding arises infrequently. However, once we turn our concerns to the world as others conceive it, these very operations of deciding what it is that is before us can no longer be taken for granted. The operations must be made explicit for a non-western understanding to be conveyed. In practical terms, this means that to make use of what is presented here it is necessary to rethink or relearn the operations we constantly use to create phenomena, in such a manner as to be able to state how it is we know what we know. The first part of the essay, then, is devoted to providing a general framework for this kind of consideration. It is important to remember that any work of this sort in the social sciences is part of its own subject matter, and to fail to realize this defeats the purpose of the study.

One obvious consequence of this approach to understanding how prehistory works is that we are going to be concerned primarily with words, or concepts as the special words of particular disciplines are called, and the means by which they are constructed. Furthermore, we will also need to concern ourselves with articulating these concepts into a system, a metalanguage in which all meaning is explicit. It is likewise obvious that there is no starting place; one must simply start. Words in ordinary English have to be our touchstone, the means by which the first and most basic concepts are developed. Once beyond the most basic concepts, it will become more and more feasible to create others, based upon the initial steps, without reference to ordinary English. It is necessary, as an initial step, to create a series of definitions and distinctions which will provide the basic set of terms and meanings to carry the discussion.

## Definition versus Description

Pragmatically the most important distinction to be made is that between “definition” and “description.” This consideration necessarily precedes all others, for it is necessary to create the basic set of terms. Further, the substantive basis for this distinction between definition and description finds numerous parallels in many of the concepts that follow.

A definition, if one consults a dictionary, is a statement of the meaning or significance of a word. The important feature in the dictionary definition is that definitions have as their subjects words, not objects. Two kinds of definition, differentiated on the basis of how definition is accomplished, are often and usefully recognized: extensional definition and intensional definition. Extensional definition for any given term is accomplished by listing the object for which the term is applicable, or doing this within some specified and restricted set of boundaries. For example, an extensional definition of the word “dog” would be comprised of a listing of all dogs, past, present, and future. Clearly, extensional definitions are practical only with a specified set of boundaries, for example listing all living dogs, or all dogs in the state of Georgia, and so on. The only practical application of extensional definition, definition by example, is within some otherwise defined field of time and space. Extensional definition will permit the identification of all dogs as dogs within the restricted realm of living animals. It does not, however, convey what a dog is, those things which go to make up the quality of “dogness.” Extensional definitions focus on defining a term in relation to the objects to which the term is applicable. As a result, such definitions are restricted in their utility to defining what is already known. To define the term “dog” extensionally requires that you already know what dogs are in order to make the definitional listing. Ultimately, then, extensional definitional term simply means that something is that something because it is, and nothing more. The finiteness of the term’s use comes from the necessary restriction of the field to which it is applicable and from which the definition was made. No new animals, for example, can be assigned to the category “dog” if they were not listed as dogs in the first place.

Extensional definitions have considerable utility within single cultural systems in which it is not necessary to know why a dog is a dog because the participants agree on what things should be called dogs and what should not. No information, not already the common possession of the participants, needs to be conveyed. Furthermore, from a pragmatic point of view the worlds of individuals are finite and the number of occurrences of dogs limited to a manageable number, and this provides the temporal and spatial boundaries required for extensional definition.

This kind of definition fails, however, those situations which require conveying information not held in common by the participants or when the referents for the term are not already known and limited in time and space. Such definitions are not suited to the purposes of science here because they cannot convey why a thing is that thing, only that it is.

Intensional definitions, on the other hand, specify a set of features which objects, whether known or unknown, must display in order to be considered referents for a given term . An intensional definition would explicitly list those things which we intuitively use to identify a given animal as a dog, and thus conveys why the term “dog” means in each case of application. This is usually phrased as a statement of the necessary and sufficient conditions for membership in a unit, to which we apply a label in the form of a term or sign. In our dog case, an intensional definition would list a set of attributes which constitute “dogness.” Obviously these would not be the sum of all attributes of all dogs, but rather only that combination of a tributes which all dogs have in common. If any unknown animal appears, it is readily possible to ascertain whether or. not t e new animal is a dog simply by observing whether the animal displays those characteristics necessary to be a dog. Thus, intensional definitions have predictive and heuristic value. The particular combination of features which constitute a dog is invariable, and thus provides not only a statement of the meaning of “d g,” but also the framework of comparison necessary to establish the relevance of the term to anything which may or may not have been considered when “dog” was defined. It is obvious that intensional definitions are the kind suited to conveying new information rather than simply directing the reader's attention to a portion of what he already knows.

For the purposes of our consideration, definition is to be understood as intensional definition only, and it may be defined as: the necessary and sufficient conditions for membership in a unit. This usage will be employed throughout the essay and permits unambiguous understanding as long as a given term is understood only as its definition. For each term developed, a list of distinctive features will be provided, and the term can be used as synonymous with only that particular set of features. A certain danger lies in attributing to a given term characteristics drawn from other usages.

The notion of definition was introduced as one portion of a dichotomous opposition with “description.” Description has relevance only for intensional definition, or, rather, it can be readily differentiated from definition only when the definition has been intensional. In our “dog” case, it was noted that some characteristics, those shared by all dogs, are used for the definition. These distinctive or definitive features do not exhaust the attributes of any one dog or any set of dogs. The other attributes of dogs which one cares to distinguish are variable. Some dogs are brown, some are spotted; some bark, some don't, and so on. If one wishes to convey what a given animal is like, once it has been identified as a dog, or if one wishes to talk about one set of dogs after they have been identified, the variable attributes displayed by the individual or individuals under consideration can be listed. Such a listing is what is meant by description. A description is a compilation of the variable attributes of an individual case or group of cases. Descriptions can take two forms. They can be simple listings of non-definitive attributes or statements of the frequency of occurrence of non-definitive attributes among the set of cases. Not infrequently the latter kind of description is summarized by listing first the attributes and then the mean and range of the attributes' occurrence, rather than noting each occurrence individually. For example, a description of a set o£ dogs might note that 14 are black, 17 brown and black, 12 brown, 43 brown and yellow, and five yellow, or this might be rendered in the form of a summary, stating that the coloring of dogs varies from black to yellow and averages light brown. Color for dogs, of course, is non-definitive. To be a dog does not require any particular color, even though experience tells us that those things called dogs exhibit a restricted range of possible colors. Importantly, if a green dog were to appear, it is certain that we would identify it as a dog, but one which was green.

In addition to the variable non-variable distinction, definition may be contrasted with description in another important manner. While definitions pertain to words, ideas, and other things not phenomenological, descriptions have as their objects only sets of real things. Words, concepts, must be defined; things can only be described. A great deal of confusion can, and indeed does arise from the misapplication of these two devices.

Intensional definitions explicitly identify the invariable attributes required to belong to a unit, so that one can state those attributes which are variable. Intensional definitions provide the framework for description. They establish in tangible terms what is being described and provide the rationale for associating the elements of the description. Intensional definitions are the means of conveying from one person to another the boundaries within which a given description is applicable.

## SCIENCE

With this background, our first task is the specification of the field of concern for our preliminary consideration, namely science. It is necessary to define this term for inquiry into systematics, and, since prehistory is presented as a kind of science, a rigorous definition sets the parameters for the general structure of prehistory. In English dictionaries the definitions of science, as it is most commonly employed, contain two important elements: (1) it is a kind of study which deals with facts or observations; and (2) it results in a systematic arrangement of facts by means of general laws or principles. The term science is often employed simply for the results of such study, and thus one also finds definitions of science which encompass only systematized knowledge of the physical world. Definitions of science do agree, however, that science is a systematic study involving principles or laws and that it is applied to observable phenomena, resulting in their arrangement as systematic knowledge. On this basis, science can be taken to mean systematic study deriving from a logical system which results in the ordering of phenomena.

One aspect of science not often considered by dictionary definitions is why it is done, the purpose to science. Based on observation of what appears to be the case in the natural sciences, the goal of science can be thought of as the explanation of the phenomena considered. What constitutes explanation is something that must he considered to a limited extent even though explanation per se is not of focal concern here. The character of anything is in part determined by the purpose to which it is to be put. Explanation, as ordinarily used, can and does mean many things. Following Eugene Meehan's Explanation in Social Science, it is useful to admit two kinds of explanation or goals within science: (1) prediction — a statistical statement of the probability of a given event as the outcome of a known sequence of prior events; and (2) control— a statement of the relationships of a given event to other events and sets of events which enables one to modify the outcome of a sequence to a specified result by altering one or more of the related factors. Using the term “control” does not imply that modification of a given outcome can actually be achieved, but only how such modification could be achieved. For example, a change in the mass of the earth would alter its orbit around the sun in a known manner, though the technical means by which such a change m mass could be effected are not available. Simple prediction, on the other hand, does not tell one why something happens, only that it is probable that it will happen on the basis of past experience. For example, if one smokes cigarettes the chances are very good that one of the several diseases correlated with smoking will overtake the smoker. Yet it is not proper to speak of smoking as a cause of any of the diseases, or any of the diseases as a cause of smoking, because the relationships between them are not known. It is impossible to tell from the correlation alone whether, for example, smoking causes lung cancer, lung cancer causes smoking, or people with a genetic predilection for lung cancer are for the same reason prone to smoke. Nonetheless, the two are linked by a statistical correlation, and thus it is possible to forecast that more smokers will die of lung cancer than will non-smokers. Without a, statement of the relationships that obtain between the diseases and smoking, it is not possible to modify the correlation, that is, to alter the forecast that more smokers will die of lung cancer than will non-smokers.

Prediction frequently, but not necessarily, precedes explanation in the sense of control and provides the basis for achieving explanation in this sense. While these two goals of science differ radically, there is one feature of paramount importance which they hold in common. In either sense of the term, the object of explanation is the forecasting or the manipulation of phenomena, and this is achieved by creating classes for the phenomena. In both prediction and explanation some means is required of stating that two things or events are identical in those respects that affect the problem at hand, and this is accomplished by systematics. Systematics functions to convert phenomena into data for a discipline, categorizing historical and time-bound events in such a manner as to create ahistorical units upon which predictions and explanations can be based. This, then, is why sciences are characterized as systematic and as deriving from logical structures. Fully explicated, then, *science is a systematic study deriving from a logical system which results in the ordering of phenomena to which it is applied in such a manner as to make the phenomena ahistorical and capable of explanation.* Provided with this kind of definition it is possible to differentiate science from other kinds of study, particularly those called history and humanistic studies.

The distinction between science and history is most important, for prehistory is often spoken of a kind of history, culture history. As a primary goal of the discipline, history is not concerned with explanation in either of the senses employed in sciences. Its purpose by-and-large is a statement of events conceived as unique qualities which happen but once; It’s primary product is not principles but chronicles, and generalizations based upon them. Because it is not future-oriented and does not attempt to explain events beyond a statement of which events preceded the event in question, it does not have need of systematics. Generalizations demand only associations, statistical correlations of the cancer/smoking sort. History m most of its manifestations has no formal theory beyond the common cultural background of the historian and his reader. Formal theory is not required by history because: (1) it does not have to categorize sets of events into classes since explanation is not an end goal; and (2) the organization of the events is assumed to be known, that is, chronological, and thus the events do not require ordering for the purposes of history. It is for these reasons, especially the lack of systematics, that history is often characterized as “particularizing” (ideographic) and opposed to the sciences which are characterized as “generalizing” (nomothetic). Lest this polemic be misunderstood, it should be remembered that this is a characterization not directly applicable to specific cases. Increasingly, history produces “scientific” results and, conversely, much of anthropology concerned with the past, especially the series of results termed “culture history,” is strongly historical. There is no neat division in practice (Figure 1).

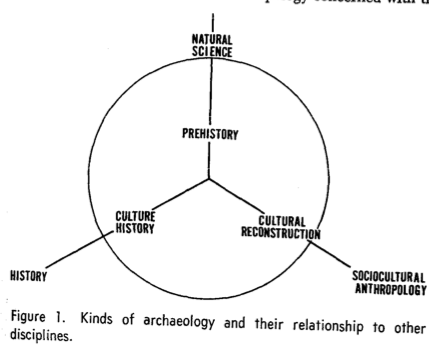


Figure 1. Kinds of archaeology and their relationship to other disciplines

Complicating a distinction between history and science is the fact that science often makes use of the chronicle. Chronicles in science, however, take a different character because they are toward explanation of what is chronicled, not just its and summarization. In history, the categories used by chronicle are largely those of the language in which it is written. While chronicles as statements of a sequence of events common to both history and science, those of science are executed in a terminology which is the product of systematics, whereas those of history are executed in the common meanings of words in the language of the writer.

Humanistic studies are different still and in some cases more difficult to separate in practice from science. In common with history is their lack of concern with explanation of the phenomena considered (though explanation is often given lip service). In contrast with both history and science, which have overt but different goals, humanities have a diffuse purpose at best. The product, especially in the arts, is often stated to be “appreciation” of the phenomena. Such a product is not knowledge in the ordinary sense of the word, but simply a cultural value. Humanistic studies value things as good or bad in a cultural sense, but not in a pragmatic system with overt criteria for judgment. Thus what is good music varies through time as a style or fad.

Humanistic studies categorize phenomena and so, like the sciences, have their own disciplinary terminologies or jargon. The genesis of these categorization varies widely from that of science however. Without a testable product, Without explanation the evaluation of categories becomes a matter of opinion while the humanities categorize, they do so without the aid of systematics, thus falling victim to accusations of not having any theory. Categorization is done for its own sake rather than for a specified and testable purpose. Even with the great amount of verbiage expended on categorization, humanistic studies still focus on the phenomena and thus retain a strong historical quality as well as a tendency to confuse categories with phenomena (e.g., the popular use of “society” in many quarters today).

The contrast between science and humanistic studies is fairly overt in the case of the arts; however, many of the social sciences are humanistic studies in the sense described here. While they make use of categories and concepts, they do not employ any systematics; categorization is done for Its own sake; there is no theory, though the word is often used; the results are not testable or, when they are, the cases are tautological functional studies, and the product is not knowledge but a kind of wisdom which one has to acquire a “feel for” rather than learn. They are contemporary in that what is “good” in social science changes in the same manner as what is good music. Part of the difficulty in separating those non-scientific social sciences from science proper is that a manipulatory purpose is often espoused, and probably has been achieved. The modification of any sequence of events must remain speculative, however, since there is no means by which the unmodified sequence can be posited with certainty. The ability of the non-scientific social sciences to manipulate clearly does not derive from any scientific aspect, but rather from ordinary sources of cultural change. A sociologist is not required to start a revolution; history can tell us that. The intent here is not to deprecate humanistic studies as humanistic studies, only the masquerade of such studies as science to gain credibility.

While both humanistic studies and history are readily separable from science analytically, it is often difficult to recognize them in practice. They have been treated here as indivisible monolithic entities which in fact they are not. As there are scientific trends in history, so the social sciences include both scientific and non-scientific disciplines, and even ·within the latter there are scientific practitioners. As in the case of history and culture history, there are kinds of archaeological anthropology that are strongly humanistic, as is most of what could be called “cultural reconstruction” (Figure 1). The main point is however, that the distinctions drawn are not ready-made for practical application, but are polemically designed to limit the realm of practice considered here.

## Systematics

As the foregoing discussion of the field of concern here called science should indicate, one thing stands out both as distinctive and crucial: systematics as the means of creating units within a scientific discipline. To avoid this tautology, it is necessary to reconsider in some detail the formulation and the characteristics of units created in science. The consideration will result in a new definition of systematics which is heuristically useful for looking at the ways in which units are created.

All living things respond in a limited number of ways to environment, and so all things must categorize their environment, sorting it into elements for which they have instinct or cultural responses. Thus it should be obvious that there are many ways of creating categories and, further, that systematics is best regarded as a special case of such procedures in the larger field of categorization. The object of any sort of unit creation is the categorization of phenomena for one or more purposes, implicit or explicit. There is an infinite variety of ways for men to categorize things, even the same things. Systematics constitutes one such human way of categorization. Units formulated by means of systematics are not held to be “good” or “bad” as are similar kinds of constructions in cultural systems but, rather, are assessed in terms of their use in organizing phenomena for explanation. This latter case can be empirically tested and is usually referred to as “utility.” Utility, however, is not an appropriate term, for categories may be “useful” because they are “good” and still have no applicability in organizing phenomena so that prediction and control result. Such empirical testing of units requires a specified purpose for which a set of categories has been constructed. Without such a purpose or problem, testing is impossible because there is no standard against which the organization achieved can be measured for its effectiveness.

Implicit in the discussion is the notion that systematics involves more than a single category; that is, it is a means of creating sets of units rather than a single unit. Categorization of any sort involves at least two units: this and everything else. Even in a simple example, it is obvious that the units must be derived from or be analogous to some kind of system; any kind of categorization involves the minimum two units and the relationship between them. In the case of systematics the system from which the units are derived is a logical one, that is, one which when articulated involves no contradictory elements and is complete. Furthermore, it is explicit because the relationships that obtain between the categories figure prominently in explanation. So systematics may be thought of as an arrangement of categories, the arrangement being derived from a logical system. Other kinds of arrangement are, of course, possible, and frequently encountered. An arrangement may take the overt form of a system, but upon examination be neither logical nor complete. Many sets of cultural categories are precisely of this sort. Likewise the categorizations of many of the social sciences fall into this pattern. In still other cases no relationships are obvious between sets of categories. This brings into focus another aspect of systematics as opposed to other kinds of arrangements: the system from which the relationship between categories is derived must be explicit. One must not be in the position of having to assume the nature of the relationship between a given set of categories, but rather one must know. If the relationships must be assumed, they will in part be a function of the individuals playing them, thus not replicable and ultimately lacking m ability to organize phenomena in a fashion amenable to prediction or control.

One final aspect of systematics which needs attention is that of the categories themselves. Units produced by means of systematics require explicit definitions. Otherwise, it is impossible to apply the categories to phenomena in a replicable manner. Descriptions have no relevance or, indeed, meaning in terms or categories, since only actual objects can be described. If description were to be employed in systematics, categories could not be employed, and the character of science so based would be historical.

With this further consideration it is possible to define systematics for the purposes herein attended as: the procedures for the creation of sets of units derived from a logical system for a specified purpose. We thus can view systematics as a special instance within the broader field of categorization. Categorization is implied in all actions of all living things and therefore its application in arrangement is not restricted to science. Our brief considerations of history and humanistic studies both imply different kinds of categorization. In the first case, pre-existing categories of the language of the historian and his reader, in which all operations and definitions are implicit and which serve to convey meaning by virtue of the shared cultural background of writer and reader, are utilized. In the second, it takes the form of implicitly or, less frequently, defined categories (often compounded with the phenomena categorized in description) which may or may not be from a logical system but share the feature of not being amenable to empirical testing. In actual practice, science may be based upon systematics, but scientists often employ other kinds of categorization. Likewise, social scientists may make of systematics tangentially, but social science in general is not founded in systematics. In this more than in anything else lies the source of the vast difference in the nature of the results of the sciences and the social sciences.

In the following pages a set of distinctions and concepts is introduced which will provide the basis for considering how systematics operates in science in general. Our goal is not an exhaustive explication but, rather, the explication of systematics in science for the purpose of examining how prehistory works. To this end the preliminary considerations are much simplified from what would be required to thoroughly treat science.

## The Fundamental Distinction: Ideational versus Phenomenological

In order to provide unambiguous structure to any consideration, it is necessary for the investigator to be able to separate himself and his tools from the phenomena that he is investigating. The distinction between the phenomenological and ideational is designed to do this. By dividing analytically all “things” into phenomenological and ideational realms a number of important sources of confusion and error can be avoided. It is important to remember, however, that this and any other distinction are artificial. They do not say anything about the real world, whatever that may be; they are designed for a purpose to facilitate scientific inquiry-and nothing else. Those things which are considered as the referents for the term phenomenological are those which we can observe, things and events (e.g.,, a chair and a solar eclipse). The ideational realm is taken to include those things which have no objective existence, commonly called ideas. Those things classed as ideational can be known only by means of some phenomenological manifestation (e.g.,, someone explaining to you by means of noises what he has been thinking). It is not profitable to argue about the relative “reality” of the two categories, for all categories are clearly derived from the ideational realm. We perceive these two kinds of things differently, and thus our means to deal with them are different. In practical terms, no given instance is purely ideational or purely phenomenological. All phenomena are categorized, and in the process most of their attributes are deleted. All ideas must be given some kind of phenomenological expression before they can be conveyed. Science is designed, however, to enable us to deal with a single one of these categories-the phenomenological realm. For this reason, an analytic distinction between those things which may be observed (things and events) must be clearly separated from those things which cannot (ideas). One important ramification of this distinction lies in the means by which truth may be assessed, for this differs between these cases. In these terms science is a system of ideas used to explain phenomena. By utilizing a distinction between phenomena and ideas, it is possible to separate the means of explanation from the explanation itself. The hard sciences have not much concerned themselves with this distinction at this level. The phenomena they investigate lie at a radically different level than the investigator, and the possibilities of confusion are slight. However, in the case of the social sciences where the investigator is part of the phenomena, the utility of the distinction is much greater. The laws of physics certainly apply to men-but their application is trivial because the level of the laws is far beneath our interest in man.

One encounters this distinction or, rather, a parallel distinction, at lower levels, as the distinction between form and content. Form is analogous to ideational; content, to phenomenological. Forms are not bound to objective existence; they are not real in the usual sense of the word. Form is represented by the categories to which things are assigned. Content is bound to the contingencies of the real world and is analogous to phenomena. Content is represented by the actual things assigned to categories. The content in a given instance is thus unique; the form, recurrent. The barking brown and black dog standing before you at 11:00 A.M., Thursday, April 10, 1957, is unique, for this phenomenon never has been before or will be thereafter; however, dog as a form will recur, as will the barking event, and so on. Implicitly or explicitly, form must precede content, for without it there is no way to identify the content. Unless the forms dog, barking, brown, and so on, were available from English, there would be no way to convey the phenomenon just described, either as a class or as a unique event. The form-content contrast clarifies abundantly the analytic nature of the distinction, for in actual practice the two are inseparable. A former teacher of mine used to employ quite effectively this same set of distinctions at the level of procedures using the terms strategy and tactics: strategy, being a model or plan, is contingency-free and thus analogous to form or the ideational realm; tactics are bound to actual circumstances obtaining in a given case of application and thus are analogous to content or phenomena.

The division of things into ideas and phenomena, into forms and their contents, into strategy and tactics, has an important parallel in the distinction between definition and description. Definitions pertain only to the ideational realm; they are the way in which ideas may be conveyed, even though the ideas and the definitions themselves can be known only as phenomena. Intensional definitions provide a means of circumventing the uniqueness of a given instance by restricting meaning to recurrent attributes and permit the designation of unique aspects as variables. Descriptions, as we noted, are capable of rendering the variable attributes, thus providing content for a form when required, and are bound to a particular set of phenomena, embodying the historical uniqueness of the phenomena described. Descriptions can be made only of phenomena; definitions can be made only for ideas. Descriptions of ideas or definitions of phenomena are nonsensical. We may define our terms, but we must describe our phenomena.

As has already been indicated, the evaluation of things ideational and things phenomenological differs. In the case of ideas, the evaluation is logical, for ideas are neither real nor composed of actual instances. A single idea has no utility, no testability; however, articulated sets of ideas, systems, can be evaluated in terms of their consistency (logical structure), their, parsimony (number of assumptions incorporated), and their elegance (simplicity). Only in the case of ideas can one speak of proof. If a system of ideas is logically consistent, that is, there are incorporated no elements which contradict other elements, thus preventing the system from being closed, it is logically true. Of course, this says nothing of its utility, for it may be a trivial truth such as A +B = C - B = A, or a nonsense truth with no application. But importantly, no data have any relevance in the evaluation of ideas-the proof of a system of ideas cannot be established by observation, only its relevance to those observations can be so established. Phenomena, on the other hand, may be observed. Being part of the real world, the notions of proof or logical truth are not relevant or useful. The term truth when applied to the phenomenological world, factual truth, is a matter of observation: X event did in fact happen. Future-oriented phenomenological statements are always probabilistic; overtly or covertly, they are statements of statistical probability. In the natural sciences where infinitely large samples of events have been accumulated (e.g.,, boiling water) the statements made about phenomena are highly probable (e.g.,, water boils at 212°F at sea level). Because of the high degree of probability, there is a tendency to treat these statements as true in the sense of ideas, which they are not. This predictability is a function of the large number of prior cases and the distinction between phenomenological and ideational statements must be maintained, especially in the case of social phenomena. Because of the large scale of social phenomena, a large series of prior cases is impossible, and thus the degree of probability that can be attained is lessened proportionately. However, the phenomenological statements of the hard sciences and the social sciences can be of the same kind, only varying in the degree of probability.

This distinction between the ideational and the phenomenological is often phrased in terms of the means of reasoning appropriate to each: demonstrative reasoning in the ideational realm and plausible reasoning in the phenomenological realm. Because ideas are constructed, they have a finite set of specified characteristics which enable them to be completely controlled, completely predictable. Ideas are invariable in the aspects which are of direct concern and maintained so by intensional definitions. Thus logical truth, proof, and demonstration are possible. Phenomena, not being constructed, are infinitely variable and historical and cannot therefore be controlled or anticipated a priori. Statements about phenomena must be based on finite sets of prior cases observed, there being no way to incorporate that which has not yet come into being.

The connections between the ideational realm and the phenomenological realm are many. Firstly, we cannot actually deal with phenomena but rather only with categorizations (themselves ideational) of phenomena. Thus two different people seeing the same event see, to a greater or lesser degree, two different events. The common points between the two observations will be in those respects in which they share the same categorizations. Secondly, there is an important connection between the two realms in the form of explanation. Explanation is nothing more than matching a system of ideas whose outcomes and entailments are known (because it is an ideational system) with analogous events in the phenomenological world, thus positing their entailments and outcomes. Modification of the events may be made on the basis of what happens when one or more elements in a system of ideas is modified in a specified manner. Both of these articulations between phenomena and ideas are made by all people as a matter of living and operating in the world. In the case of science, for reasons which have already been discussed, these operations must be explicit, whereas they are more often than not ignored in everyday living.

Insofar as systematics is concerned, the most important articulation between the ideational and phenomenological realms is embodied in the notion of identification. If the goal of science is the manipulation or forecasting of phenomena there must be some means of equating ideational units (classes) with segments of the phenomenological world. Identification is the term applied to this process and is essentially the assigning of real objects or events to the ideational units by means of recognizing attributes of the objects or events that are analogous to the definitive features of the class. While the focus of attention here is upon the construction of ideational units, it must be clearly understood that units so formed are completely useless unless analogous phenomena can be identified with them.

With the foregoing discussion as a basis, it is possible to provide the fundamental notions necessary to construct the examination. A series of concepts will be set forth below to accomplish this purpose. In each case, the concepts can be used only if they are understood as their definitions. If they are considered as having implications or alternative meanings, they will become ambiguous and unable to carry the weight of the examination.

## Some Basic Propositions

*1. CONCEPT. Of prime importance is the notion of concept. This term is used to cover a wide variety of things ranging from a fancy term applied to words which one wants to dignify for one or another reason, to simple ideas or notions. Concept should be understood here to mean the \*intensionally defined terms specific to an academic discipline*. The need for concepts is obvious. Academic disciplines have general fields of phenomena in which they are interested with regard to particular kinds of problems. The real world must be categorized in such a manner as to permit the kind of inquiry attempted, not only m terms of specific classes of phenomena but also in relating the level of the classes. One needs, for example, not only the concepts species and genus in biology, but also the terms used to relate these two. The first role of the concept in scientific inquiry is to precisely identify the units being discussed. Secondly, concepts are employed to discuss operations with data and to discuss the theory and method on which the operations are based. Thus in biology one has terms such as evolution, which is a concept of this second category. Because the kind of inquiry is different from what you or I undertake in day-to-day living, the terms must be suited to the task and thus are different from ordinary English. Concepts, then, are words, and nothing more. They are words with explicit intensional definitions which permit the structuring of the world for a specific form of inquiry and which serve additionally to convey the operations performed as a part of the inquiry.

Looking at concept as words, two kinds may be readily distinguished: those which occur in English and those which are especially invented by a discipline. The first category, those common to a discipline and ordinary English, are the most troublesome. In these cases, the ordinary English word is use restricted by the academic discipline to one of its common meanings. Substantial misunderstanding, particularly by a lay reader, can result by interpreting a particular word in one of ordinary meanings rather than in the academic sense. The problem is not entirely one of the selection of words. Especially the social sciences concepts are often borrowed into common rather than the reverse. Without the strictures of explicit definition that accompany the word as a concept, the meaning of the borrowed word may stray far from the original meaning. An excellent example of this phenomenon widespread current usage of “society” and “culture.”

Those concepts which are words without analogous forms in common English do not present much of a problem. The layman has to learn a new word and with it the meaning. There is no chance that he will think he already knows what it means since it is not part of his vocabulary. The importance of this understanding of concepts cannot be overestimated in the social sciences. The problem is greatly diminished in the hard sciences where mathematics conveys much of the meaning accomplished with words in the social sciences. Mathematics is a fairly effective barrier against misinterpretation for it consists entirely of symbols which have no meaning whatsoever in ordinary vocabulary. One last thing with regard to concepts ought to be noted: in all cases they are part of the ideational realm. Only the words, as spoken or written, which embody the concepts are ever phenomenological. It is with concepts that science operates, conveying its categories and the operations performed on them, and thus concepts are the cornerstone in understanding the nature of any discipline and its particular inquiry.

2. THEORY. The term “theory,” like “concept,” is used in a number of widely discrepant ways. The dictionary defines theory in the most common sense as the general principles by means of which a certain class of phenomena may be explained. Importantly, theory is not an explanation, but the principles by which explanation is achieved. Restricting theory to the means of explanation eliminates most of the ambiguity generally involved in the use of theory, for the most common confusion is between the means of explanation and the explanation itself. Explanations are history-bound, necessarily tied to a specific set of circumstances and a finite and stipulated set of data. Theory, on the other hand, to have the power of providing a means of explanation, must be contingency-free, part of our ideational realm.

Theory, then, consists of ideas about general classes of phenomena. The definition indicates that there are essentially two parts to theory: the classes of phenomena and the principles by means of which the classes are related. The principles often go under the label “laws,” but to avoid some of the ambiguity associated with “law” we will term the operations and relations between classes principles. It is obvious that both parts of theory are required to produce explanations of anything.

First one must have a set of classes by means of which one can categorize, then identify, and finally convey the meaning of the real world for the purposes to which the theory is directed. This is what is here termed formal theory. Purpose, in general terms is crucial, for it is *theory that separates the various discipline; from each other, not their subject matter*. Both a physicist and a prehistorian study the same thing-stuff. What is different about the two practitioners is the way in which they care to view stuff, the kind of statements they wish to make about stuff. Both may look at the same piece of stone. The physicist talks about collections and configurations of atoms and can make certain predictions about their behavior. The archaeologist perceives a tool, not a collection of atoms, and the things he can say or is interested in saying about the rock are very different. The two men in their capacities as scientists have seen different things, and only in their common participation in American culture can they share the rock as a rock. The importance of purpose to theory is then obvious-without it there can be no theory, for purpose enters into the conception of the real world. The classes, the categories by means of which the real world is conceptualized, are the first crucial elements of theory. Without these units it is impossible to conceive phenomena as data with any degree of control. As has already been pointed out, the categorization by sciences takes the form of systematics. The units, by virtue of being units, are static entities, and thus the product of systematics is entirely formal.

While ability to categorize the phenomena one is facing a necessary part of theory, it cannot in and of itself ever generate any explanations, even if accompanied by explicit intensional definitions. Theory must also consist of the relationships at obtain between the units so created. Relationships, not being units, are not formal in the same sense as units. A set of units is not a system until relationships are established between them. If explanation is accomplished by matching a system of known consequences by means of analogs, the relationships constitute a necessary part of theory. Moreover, most theory involves not a single set of units, but many different sets of units, the relationships between which must be stipulated in addition to the relationship between units in the same set.

The relationships, or principles, that articulate units into a system which can be called theory bear a direct relation themselves to the units. It is obvious that the relationships between any two given units must be a function of the characteristics of those units; that is to say, the definitions of the units are the means of deriving the relations between any given set of units. Intensional definitions serve to keep both the meaning of the units and the relationships explicit.

From this consideration the crucial, but partial, role of systematics or formal theory is evident. Systematics must be the beginning point in theory construction, for it is the only means of identifying subject matter. Further, systematics provides the basis for deriving the relations between the units, which in combination with the units permits the generation of explanations. Systematics, on the other hand, is but a relatively small part of what is appropriately regarded as theory, and certainly less visible than relationships or laws. Theory will designate the system of units (classes) and relationships (laws or principles) between units that provides the basis for explanation of phenomena. Our concern here is with the units and their construction.

3. METHOD. A term frequently used in connection with theory is “method,” and, like the other terms considered, its usage is varied. This is especially the case since method has many meanings in ordinary English. For the purposes of this consideration method should be taken to mean *a sub-system of a larger theory which is directed toward the solution of a particular kind of problem*. A theory will stipulate or should stipulate all the relationships that obtain between all the units contained within it. When a specific problem is faced by an investigator, not all the theory of his discipline is relevant to its solution. Some segments of it, for his particular problem, will be invariant, and these can be ignored. A method is the model to which the phenomena under consideration will be compared in order to produce the explanation desired. Most frequently, methods can be given the form of a model, and the model can usually be procedural or processual. Not all possible relationships are embodied in the model, but only those relevant to the solution of the class of problems faced. In Figure 2, where the relationship of method to theory is diagrammatically shown, the method seriation does not make use of all the characteristics of all the units used by prehistory, but only those germane to the problem of chronologically ordering sets of artifacts, and it takes the form of a distributional model.

While theory at least ought to be unitary for a discipline of inquiry, method is not. Even given a specific problem, chronology, there will be many methods for solution, all deriving from the same theory but utilizing different elements. For example, if one of the elements in a particular method for chronology involves stratigraphic position, many cases will occur in which this variable cannot be stipulated. Other methods are available for chronology which do not make use of this particular variable. A great many models are usually possible for achieving the same goal from the same theory, differing from each other in that they utilize different elements and relationships within the theory to arrive at the unknown which constitutes the problem.

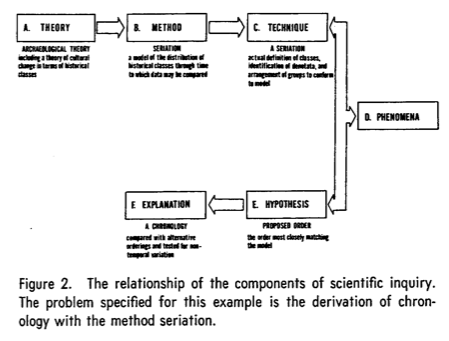
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Figure 2. The relationship of the components of scientific inquiry. The problem specified for this example is the derivation of chronology with the method seriation.

Method, then, is a system directed toward the solution of a particular unit or relationship in the phenomenological world. Its rationale lies in theory and, indeed, method may be considered a sub-system derived from part of a larger theoretical system. Like theory, methods are ideational, not phenomenological. They have no direct relationship to phenomena, but rather provide direction to theory for a specific goal. As we have indicated, methods can usually be rendered as models; however, model and method are not synonymous. Models can be used to convey any system of ideas, both methods and theory as well as other kinds of “abstraction.”

While not properly part of a discussion of method as we have defined it here, a consideration of the term “methodology” is warranted by its consistent misuse (in terms of standard English). Methodology is frequently used as a longer word for method, thus being more “scientific.” Any dictionary of English is specific in relegating this word to the study of the relationships between various disciplines of inquiry. Methodology is the inquiry into the relationships between the theory of each of the sciences. It is inquiry into inquiry in general, an ideational system designed to investigate ideational systems and not germane to our consideration, nor properly used within any special science.

4. TECHNIQUE. Unlike the other terms thus far considered, technique has seen fairly consistent usage restricted to actual manipulations of data. A technique serves to implement a given method in a specific instance, adapting the method to the contingencies obtaining in the case at hand and satisfying the conditions of application for the method. While methods may be rendered as procedural models, techniques constitute the actual sequence of procedures employed in a case. Actual procedures necessarily differ from the method because they operate upon unique historical cases.

It is through the vehicle of technique that content is introduced into inquiry, and thus technique constitutes the link between the theory and methods of a discipline and the phenomena which they are designed to organize. To fulfill this function, techniques first must order phenomena into meaningful categories. This is the link with theory, for the categories are drawn from theory. Technique applies the definition of those categories to frame the phenomena being considered in terms amenable to the particular method being employed. Identification, from the point of view of formal theory, is one of the most important facets of technique. All methods have conditions under which they are applicable, and the second element in technique is assessing whether or not those conditions are met. It is this step in technique which acts to eliminate misapplication of a method to a body of information for which it is not appropriate. The final step in technique is the actual organization and manipulation of the data according to the stipulations of a given method, with the goal of solving the problem attended by the method. This last step can be clarified if you think of an equation in mathematics as a method (A+ B =X). A technique in this analogy would be the substitution of values for the variables in the equation ( 2 +7 = X) and its solution (2 + 7 = 9). The equation itself is just an ordered set of classes and operations for the solution of a particular unknown until actual data are substituted.

The importance of distinguishing technique from method lies in the fact that methods are part of the ideational realm, while techniques, deriving from methods, are part of the phenomenological realm, and this means that their respective evaluation is different. Methods are amenable to evaluation in terms of logical truth. They are consistent, simple, and parsimonious, or they are not. Techniques, on the other hand, once one has evaluated the method involved, are testable in terms of empirical fact. Serious complications can and do arise if method and technique are confused so that methods are evaluated as techniques or vice versa. This kind of confusion makes it impossible to distinguish between a faulty method and misapplication of a good method.

Technique is crucial, then, because it is the means of implementing theory and methods. Without techniques, theory and method have no utility because they cannot be made operational; they cannot provide explanations of phenomena. Techniques permit the matching of a known system in the form of a method with a partially known one, the phenomenon, to produce explanations of the unknown portions of the latter. Technique can be understood as *the application of a particular method to a given set of phenomena*.

5. HYPOTHESIS. The goal of inquiry as we have indicated is explanation of phenomena. In science explanation takes the form of hypotheses. A hypothesis is a proposed explanation for a specific sort of things or events, and thus is the product of the application of theory and method by means of a technique to a given body of data. Hypotheses are probabilistic statements about the relations between phenomena. Hypotheses are not proved; rather, the limits of their utility in terms of prediction and/or control are established. They are replaced by hypotheses of greater utility.

The term hypothesis itself is fairly consistently applied to explanations derived by science, especially those which are held to be tentative. The only confusion lies with the use of theory, as the term “theory” is often applied to statements properly termed hypotheses. Because this confusion between theory and hypothesis is common, and because of the magnitude of confusion that can be so introduced, the relationship between theory, the means of explanation, and hypothesis, the explanation, needs to be treated in some detail. Systematics, formal theory, consists of a system of units for the categorization of phenomena into meaningful classes. A method selects sets of relations between some group of units and articulates them into a system within which it is possible to solve for particular unknowns. Techniques, by means of identification, match the units and relations of the method to the partial system of phenomena, and the solution for the relationships or units produced constitutes an hypothesis. Theory is ideational; hypotheses are phenomenological. Theory creates units and the relationships between them; hypotheses recognize analogous units in phenomena and explain the relations between phenomena so conceived.

As with method and technique, theory and hypothesis are not amenable to the same kind of evaluation because they are directed toward different kinds of proof or truth. Theory is amenable to logical verification only. It is evaluated in terms of its elegance, parsimony, and consistency. Hypotheses are amenable to empirical testing only. They are evaluated in terms of sufficiency in addition to elegance and parsimony, under the rubric “scientific method.” Regardless of how one derives the hypothesis in a given case (e.g.,, one may start with a solution and test it or one may “induce” it from the data), the relationship of the hypothesis to the data from which it is derived must be inductively explicated, that is, the data treated as the source of the explanation. Almost inevitably when this is done, not one but several explanations are possible for a given set of phenomena, either as the result of alternative analogs between the phenomena and the classes in a method or as the result of differences in method and technique. Explicating the relationship between hypothesis and data inductively permits the development of alternative explanations, or multiple working hypotheses as they are often called. To approach the explication of the relationship of hypothesis to data deductively, that is, to “test” a hypothesis against a body of data, does not permit this possibility, and, using this means, one finds that one can demonstrate nearly any proposition. One hypothesis may be compatible as an explanation with many bodies of data, but this does not mean that it is the best explanation for those sets of data. The deduction/induction contrast applies here only to the explication of the relationship and says nothing about how the explanation was actually achieved. To muse over the actual derivation of explanations is to predicate science on psychology, something that is neither necessary nor profitable.

Once there is a series of alternative explanations or hypotheses for the relations obtaining between a given set of phenomena, then the familiar form of evaluation, scientific method, is clearly in evidence. Competing explanations are weighed in terms of: (1) their respective elegance, the simpler the explanation, the better the explanation; (2) their parsimony, whether the explanation posits any data not in evidence; and (3) their respective sufficiency, whether the hypotheses explain all of the data. Weighing in these terms will usually eliminate many if not all but one hypothesis, but not infrequently there will still be competing hypotheses. These can be further evaluated by (1) deductively applying them to data from which they are not derived and seeing which explanation has the greatest power of explanation; and (2) by deducing consequences of the explanation and then testing to see if the consequences are in evidence in the data. Even if there are no alternative hypotheses beyond the initial evaluation, the credibility and probability of the hypothesis are enhanced by applying it to data from which it is not derived and by examining its logical consequences in the data available. To complete either type of test, the relation of the data to the hypothesis must be restated inductively so that one can demonstrate not only the sufficiency of the hypothesis but also its elegance and parsimony. The simplest, most parsimonious explanation which encompasses the most cases and which has logical consequences that are verified is best. The temptation, of course, is to regard such a hypothesis as true rather than highly probable or credible. Since, however, its “truth” is predicated on testing against data, it cannot be considered true unless tested against all cases, which is, of course, impossible (future events, etc.)

The ultimate evaluation of a hypothesis lies, then, in its power of explanation of phenomena.. It must be tested against facts, and it is the product of this testing that permits the evaluation of the hypothesis. Theory, as a system of ideas, is not testable in terms of facts, for the facts are generated by the theory in the categorization process. This is the genesis if the “don't confuse your facts with your theories” statements. Given that the differences between theory and hypothesis are largely a product of the former being ideational and the latter being phenomenological, they must be evaluated by appropriate means. A means appropriate for one is not appropriate for the other. Empirical testing is not relevant for theory. Logical consistency, on the other hand, is not a “test” to be applied to hypotheses.

The effects of confusion between the two realms of notions can be clearly seen in contrasting principles, laws or elements of theory, and generalizations, statistical abstractions, or aggregates of events. The source of confusion between the two lies in the fact that neither are real, or, as it is more commonly phrased, both are abstractions. Principles, as segments of theory, are ideas; they are not testable in terms of phenomena. They may or may not be relevant in any particular instance (e.g.,, law governing the relationship between voltage and amperage in electrical circuits and the flight of a bird), but the fact that they do not permit explanation of a given case is not valid evaluation. Generalizations, on the other hand, are statistical models built up from observations. Their statistical quality may be overt or covert, but they are always normative statements based upon a given finite set of cases. Generalizations are in a very real sense nothing more than a set of averaged facts. Generalizations thus change with each new increment of information, and they are either accurate means and ranges of a set of events or they are not. Generalizations are a form of description, a form useful in many kinds of cases (the boiling of water) when their nature as generalizations is appreciated. Far less infrequently than one might hope, generalizations are employed as principles. This effectively nullifies a distinction between ideas and phenomena and eliminates the possibility of rational evaluation. When a generalization, representing a statistical description of a set of past events, is employed to understand new information, it is called prejudice in our social world (I was bitten by a dog once; therefore, all dogs bite). Surprisingly enough, this same procedure is not uncommon in some social sciences today, but without the perspective provided by the social situation. Failure to realize that generalizations are neither explanations nor “means of explanation has robbed much of the social sciences of ability to explain. The results of such misapplied generalization are capable of evaluation in the manner described above and these products become matters of untestable opinion. The literary polemic which abounds in the social sciences is possible only because of the lack of definitive means of evaluating statements based upon generalizations employed as theory.

The pragmatic point to making a distinction between definition and description, between ideational and phenomenological realms, is that such a distinction permits the rational evaluation of statements by matching the kind of evaluation to the nature: of the statement. When explanation is the goal, as it is m science, rational evaluation is an absolute necessity to establish explanations and to modify the means by which explanation is reached. Figure 2 presents a simplified model of the relationships between the terms used in categorizing scientific inquiry. From the nature of the diagram, it is obviously not intended to convey the actual procedures used in reaching explanation, but rather to be a formal model of how the procedures are logically related to one another. While the example provided by the text in this figure is concerned with a particular problem within archaeology, the general structure is applicable to any kind of inquiry: one starts with a set of explicitly defined notions (theory) which are capable of being organized according to some of the defined relations in a model for the solution of a particular class of problems (method), which in turn is capable of being matched With phenomena (technique) in order to produce a testable hypothesis capable of being used as an explanation (prediction/control). The model, of course, assumes that no modification of the theory and method is required for the solution of the class of problems treated in the figure and does not indicate alternative methods for the solution of the same relationship among phenomena. Were these procedural options included, the model would have to contain more elements and relations, but this is not necessary to illustrate the basic relationships within inquiry.

As indicated previously, the totality of inquiry is not the subject of our examination, but rather the restricted portion we have termed systematics, the creation of units in theory and method. The crucial role played by the products of systematics in the overall structure of scientific inquiry is evident, for it is with these units that phenomena are apprehensible, that they can be structured by technique to produce explanation. Systematics is the first step in achieving explanation and lies within the ideational realm, though it must be applied to phenomena. This discussion is not intended to apply to how explanations. are actually achieved. Anything new is first learned by guessing. The structure to inquiry outlined above is not a program for how to guess, but how to demonstrate the utility of the guess and precisely convey to others the content of the guess.