

A Study of Thinking

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CHAPTER I

Introduction

"We may insist as much as we like that the human intellect is weak. . . . But nevertheless there is something peculiar about this weakness. The voice of the intellect is a soft one, but it does not rest until it has gained a hearing. Ultimately, after endlessly repeated rebuffs, it succeeds."

S. FRAUD
The Future of an Illusion
p. 93

We begin with what seems a paradox. The world of experience of any normal man is composed of a tremendous array of discriminably different objects, events, people, impressions. There are estimated to be more than 7 million discriminable colors alone, and in the course of a week or two we come in contact with a fair proportion of them. No two people we see have an identical appearance and even objects that we judge to be the same object over a period of time change appearance from moment to moment with alterations in light or in the position of the viewer. All of these differences we are capable of seeing, for human beings have an exquisite capacity for making distinctions.

But were we to utilize fully our capacity for registering the differences in things and to respond to each event encountered as unique, we would soon be overwhelmed by the complexity of our environment. Consider only the linguistic task of acquiring a vocabulary fully adequate to cope with the world of color differences! The resolution of this seeming paradox—the existence of discrimination capacities which, if fully used, would make us slaves to the particular—is achieved by man's capacity to categorize. To categorize is to render discriminably different things equivalent, to group the objects and events and people around us into classes, and to respond to them in terms of their class membership rather than their uniqueness. Our refined discriminative activity is reserved only for those segments of the environment with which we are specially concerned. For the rest, we respond by rather crude forms of categorial placement. In place of a color lexicon of 7 million items, people in our society get along with a dozen or so commonly used color names. It suffices to note that the book on the desk has a "blue" cover. If

states is provided by the sign behind a bar in the Southwest:

I ain't what I've been,
I ain't what I'm going to be.
I am what I am.

We speak of an equivalence class when an individual responds to a set of discriminably different things as the *same kind of thing* or as *amounting to the same thing*. Again we depend for our knowledge of the existence of a category upon the presence of a common response. While there is a striking phenomenological difference between identity and equivalence, both depend upon the acceptance of certain properties of objects as being criterial or relevant—again Michotte's *cachet spécifique*—and others as being irrelevant. One may distinguish three broad classes of equivalence categories, each distinguished by the kind of defining response involved. They may be called *affective*, *functional*, and *formal* categories.

Certain forms of grouping appear to depend very heavily upon whether or not the things placed in the same class evoke a common affective response. A group of people, books, weather of a certain kind, and certain states of mind are all grouped together as "alike," the "same kind of thing." Further inquiry may reveal that all of them were experienced during a particularly poignant summer of childhood. What holds them together and what leads one to say that some new experience "reminds one of such and such weather, people, and states" is the evocation of a defining affective response. Characteristically, categories marked by an affective defining response are not amenable to ready description in terms of the properties of the objects comprising them. The difficulty appears to lie in the lack of correspondence between affective and linguistic categories. As Schachtel (1947) and McClelland (1951) have suggested, categories bound together by a common affective response frequently go back to early childhood and may resist conscious verbal insight by virtue of having been established before the full development of language. For categorizing activity at the preverbal stage appears to be predominantly nonrepresentational, depending not so much on the common external properties of objects as on the relation of things encountered to internal needs, to follow Piaget's argument (1951), or, to follow Schachtel's, on idiosyncratic and highly personalized impressions. Dollard and Miller (1950) argue persuasively that much of psychotherapy consists of the verbal labelling and resorting of such preverbal categories, so that they may become more accessible to the forms of symbolic or linguistic

manipulation characteristic of adult problem-solving. Indeed, it is not difficult to imagine that the effectiveness of poetry often rests on its ability to cut across our conventional linguistic categories in a way evocative of more affective categorizations. Archibald MacLeish (1939) catches well this esthetic need for freedom from conventional verbal categories in his lines,

A poem should be palpable and mute
As a globed fruit
Dumb
As old medallions to the thumb
Silent as the sleeve-worn stone
Of casement ledges where the moss has grown—
A poem should be wordless
As the flight of birds.

The problems of specifying the properties of objects that mediate a common categorizing response become less arduous when the category is a functional or utilitarian one. Rather than an internal state rendering a group of things equivalent, now equivalence is based on an external function. The objects of a functional category fulfill a concrete and specific task requirement—"things large enough and strong enough to plug this hole in the dike." Such forms of defining response almost always have, as Bartlett (1951) suggests, a specific interpolative function ("gap filling") or a specific extrapolative function ("how to take the next step"). The experiments by Maier (1930, 1931, 1945) represent an outstanding instance of research on the conditions which facilitate and inhibit the recognition of "requirements" necessary for correct identification of an object as fulfilling specific functions in a particular task situation, such situations, for example, as how to bridge a gap between two objects given certain limits and certain properties in the materials provided.

Formal categories are constructed by the act of specifying the intrinsic attribute properties required by the members of a class. Such categories have the characteristic that one can state reliably the criteria of a class of objects or events short of describing their use. The formal properties of science are a case in point. Oftentimes the careful specification of defining properties even requires the constructions of special "artificial" languages to indicate that common-sense functional categories are not being used. The concept "force" in physics and the word standing for the functional class of events called "force" in common sense do not have the same kind of definition. What is accomplished in effect by formal categories is that one is able

to devise classes whose defining properties are not determined by the suitability of objects to a specific task. The emphasis of definition is placed more and more on the attribute properties of class members and less and less on "utilitanda properties," to borrow a term from Tolman (1932). The development of formalization is gradual. From "things I can derive this tent stake with" we move to the concept "hammer" and from there to "mechanical force," each step being freer of definition by specific use than the former.

The development of formal categories is, of course, tantamount to science-making and we need not pause here to discuss this rather impenetrable problem. It suffices to note that formal categories and formal category systems appear to develop concurrently with methods for representing and manipulating them symbolically. What impels one to formalization we cannot say. That the urge is strong is unquestionable. Indeed, it is characteristic of highly elaborated cultures that symbolic representations of formal categories and formal category systems are eventually developed without reference to the classes of environmental events that the formal categories "stand for." Geometry provides a case in point, and while it is true that its original development was contingent upon the utilitarian triangulation systems used for redividing plots after floods in the Nile Valley, it is now the case that geometers proceed without regard for the fit of their formal categories to specific empirical problems.

It is obvious that there are close relationships between affective, functional, and formal categories and that they are often convertible one into the other. About the conversion of functional categories into formal ones—finally rendering the category of "things good for postpartum mothers" such as ground bone and certain chalks into the formal class "calcium"—we have already taken some notice. It is interesting that the gifted mathematician often speaks of certain formal categories in terms that are also affective in nature. G. H. Hardy in his delightful "apology" (1940) speaks of the class of things known as "elegant solutions" and while these may have formal properties they are also marked by the fact that they evoke a common affective response. The distinction between the three types is, we would suggest, a useful one and it may well be that the process whereby they are learned is informatively different. It is suggestive, for example, that the brain-injured patients described by writers like Goldstein (1940) and Head (1926) seem quite capable of utilizing functional categories but are precipitated into a crisis when faced with the need of locating or forming or using categories divorced from the immediate function to be served by their exemplars.

THE INVENTION OF CATEGORIES

To one raised in Western culture, things that are treated as if they were equivalent seem not like man-made classes but like the products of nature. To be sure, the defining criteria in terms of which equivalence classes are formed exist in nature as potentially discriminable. Rocks have properties that permit us to classify them as rocks, and some human beings have the features that permit us to categorize them as handsome. But there exists a near infinitude of ways of grouping events in terms of discriminable properties, and we avail ourselves of only a few of these.

Our intellectual history is marked by a heritage of naive realism. For Newton, science was a voyage of discovery on an uncharted sea. The objective of the voyage was to discover the islands of truth. The truths existed in nature. Contemporary science has been hard put to shake the yoke of this dogma. Science and common-sense inquiry alike do not discover the ways in which events are grouped in the world; they invent ways of grouping. The test of the invention is the predictive benefits that result from the use of invented categories. The revolution of modern physics is as much as anything a revolution against naturalistic realism in the name of a new nominalism. Do such categories as tomatoes, lions, snobs, atoms, and mammals exist? In so far as they have been invented and found applicable to instances of nature, they do.* They exist as inventions, not as discoveries.

Stevens (1936) sums up the contemporary nominalism in these terms: "Nowadays we concede that the purpose of science is to invent workable descriptions of the universe. Workable by whom? By us. We invent logical systems such as logic and mathematics whose terms are used to denote discriminable aspects of nature and with these systems we formulate descriptions of the world as we see it and according to our convenience. We work in this fashion because there is no other way for us to work" (p. 93). Because the study of these acts of invention is within the competence of the psychologist, Stevens calls psychology "the propaedeutic science."

The recognition of the constructive or invented status of categories changes drastically the nature of the equivalence problem as a topic for psychological research. The study of equivalence becomes, essentially, a study of coding and recoding processes employed by organisms who have past histories and present requirements to be met.

* See Burma and Mayr (1949) for an enlightening discussion of the "reality" of the species concept in systematic zoology.

The implicit assumption that psychological equivalence was somehow determined by the "similarity" or "distinctive similarity" of environmental events is replaced by the view that psychological equivalence is only limited by and not determined by stimulus similarity. The number of ways in which an array of events can be differentiated into classes will vary with the ability of an organism to abstract features which some of the events share and others do not. The features available on which to base such categorial differentiation, taken singly and in combination, are very numerous indeed. As Kliver (1933) so well put it more than two decades ago, the stimulus similarity that serves as a basis for grouping is a selected or abstracted similarity. There is an act of rendering similar by a coding operation rather than a forcing of equivalence on the organism by the nature of stimulation.

Two consequences immediately become apparent. One may ask first what are the preconditions—situational and in the past history of the organism—that lead to one kind of grouping rather than another. The characteristic forms of coding, if you will, now become a dependent variable worthy of study in their own right. It now becomes a matter of interest to inquire what affects the formation of equivalence classes or systems of equivalence coding. The second consequence is that one is now more tempted to ask about systematic individual and cultural difference in categorizing behavior. In so far as each individual's milieu and each culture has its own vicissitudes and problems, might one not expect that this would reflect itself in the characteristic ways in which members of a culture will group the events of their physical and social environment? And, moreover, since different cultures have different languages, and since these languages code or categorize the world into different classes, might it not be reasonable to expect some conformance between the categories normally employed by speakers and those contained in the language they use?

Consider now the scope of the problem, the generality of categorizing, and the benefit to be derived from studying its various manifestations.

THE GENERALITY OF CATEGORIZING

The first benefit to be derived from a closer study of categorizing behavior is a gain in generality for psychological theory. Categorizing is so ubiquitous that an understanding of its psychological nature cannot help but shed light on a wide range of problems within psychology. Most of the examples we have given thus far have, perhaps for simplicity's sake, been drawn from the field of perception. This is

misleading. For the act of categorizing, operationally defined in the manner discussed in the foregoing, may occur in a perceptual situation or one not involving the presence of stimulus objects. Logically speaking, there is no distinction between them save in the sense that the materials categorized differ. Categorization at the perceptual level consists of the process of identification, literally an act of placing a stimulus input by virtue of its defining attributes into a certain class. An object of a certain color, size, shape, and texture is seen as an apple. The act of identification involves a "fit" between the properties of a stimulus input and the specifications of a category. Categorization of "conceptual objects" also involves the fit of a set of objects or instances to the specifications of a category. We categorize, say, Whig and Tory statesmen of the first half of the 19th century in terms of whether each instance of the class had certain characteristics of allegiance, belief, etc. Or we class together all prime numbers by virtue of whether they meet the criterion of nondivisibility.

One of the principal differences between the two forms of categorization—the "perceptual" on the one hand and the "conceptual" on the other—is the immediacy to experience of the attributes by which their fitness to a category is determined. In the perceptual case, the relevant attributes are more immediately given by which we judge the categorial identity of an object, at least in simple perceptual situations. At the other end, the attainment of knowledge about the attributes that are relevant may require a difficult strategy of search as, for example, in the field of art history when one seeks to identify a painting as, say, a Massaccio or a product of one of his students, or as in science when by the use of the Aschheim-Zondek test one seeks to classify a woman two weeks after her last menstruation as pregnant or not. There are, of course, steps in between the two extremes where the relevant cues to categorization are only "moderately immediate" and in which some strategy of search behavior is required of the subject, a striking experimental example being the behavior of subjects attempting to identify tachistoscopically presented material or material presented peripherally or at low illumination or with a high noise background.

We have lingered on the continuity of categorization at the perceptual and conceptual levels not so much to insist upon the identity of all categorization behavior—for there are striking differences in the behavior of subjects operating with conceptual and perceptual categories as we can see in examining the experimental literature—but rather to urge the importance of the economy gained by treating the underlying process as common in the two activities and in the phe-

nomena that lie between. Undoubtedly some people show preferences for the extreme of utilizing perceptually immediate attributes in their categorizing while others are more "conceptual" or "abstract," which we know from the important work of Hartmann and Kasanin (1937, 1942), Goldstein and Scheerer (1941), and others who have studied sorting behavior systematically. Our objective is to show that the basic processes of categorization are the same, even though operating under different conditions of attribute immediacy and under different conditions of life history in the organism.

One final point on the relationship between conceptual and perceptual categorization is worth attention. It is frequently the case that people develop means of altering conceptual categories into categories that can be utilized with more immediate perceptual cues. One example will suffice, one that is fairly common in the act of differential diagnosis in medicine. It is the pride of the good diagnostician that with practice he no longer needs elaborate laboratory tests to determine the nature of a patient's syndrome, that frequently he can "spot" the case by the time the patient has walked across the consultation room and taken his seat by the physician. Immediate features of categorization that had formerly to depend upon highly mediate cues gleaned from laboratory tests.

In the most general sense, then, any cognitive operation involving the grouping and regrouping of materials into equivalence classes is rendered more comprehensible once one has a better grasp of the nature of categorizing. Judgment, memory, problem-solving, inventive thinking, and esthetics—not to mention the more conventional areas of perception and concept formation—all involve such operations.

There is a more extended sense in which categorizing is ubiquitous. To this we turn next.

LANGUAGE, CULTURE, AND CATEGORIZING

The categories in terms of which man sorts out and responds to the world around him reflect deeply the culture into which he is born. The language, the way of life, the religion and science of a people: all of these mold the way in which a man experiences the events out of which his own history is fashioned. In this sense, his personal history comes to reflect the traditions and thought-ways of his culture, for the events that make it up are filtered through the categorial systems he has learned. The typologies into which kinds of people are sorted, as, for example, witches and nonwitches among the Navaho; the

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manner in which kin are categorized in societies with and without primogeniture rules; the classification of women into "sisters" and "eligibles" described by Hallowell (1951); the categorization of certain acts as friendly and others as hostile: all of these are projections of deep cultural trends into the experience of individuals. The principal defining attribute of an "intelligent man" for the Navaho is, according to one informant, a man who has seen a great many different things and travelled much. The word *yaigeh* which denotes this type of intelligent man does not include a man who, say, is noted for his domestic wisdom. It is difficult to determine whether there is a unitary category for "general intelligence" in Navaho. The first category used by our informant in specifying intelligence is especially interesting. The Navaho were historically a nomadic people who, though geographically no longer mobile, continue to show a great interest in distant things and events.*

The example just cited immediately suggests the controversial theories of Benjamin Lee Whorf (1940) and brings into question the relation between the lexical categories of a language and the customary cognitive categories in terms of which the speakers of a language sort their worlds. We shall not pause here to attempt a resolution of the two extreme views, the "cloak theories" and the "mold theories," the one holding that language is a cloak conforming to the customary categories of thought of its speakers, the other that it is a mold in terms of which thought categories are cast. The resolution will obviously have great bearing on theories of categorizing and on the issues involved in understanding the relation between culture and personality. These are problems the reader will find discussed in the appendix to this book prepared by Dr. Roger W. Brown.

In fine, we would note only that problems of how categories are formed and used are relevant not only to classical problems within psychology, but also to the sciences of culture, notably anthropology and linguistics.

THE ACHIEVEMENTS OF CATEGORIZING

What does the act of rendering things equivalent achieve for the organism? It is a good preliminary question, like the functional query of the biologist: "What is accomplished by digestion?" The

* We are greatly indebted to Professors Evon Vogt and John Roberts, both of whom have discussed with us at length the cognitive characteristics of Navaho and Zuni society. Professor Vogt also made it possible for one of the authors (J.S.B.) to get some sense of the cross-cultural importance of categorizing phenomena on an all-too-brief visit to New Mexico in the summer of 1954.

