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TAXONOMY OF MAN-MADE OBJECTS

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To begin this discussion, I shall inflict on you exactly twenty lines of doggerel. This verse bears the title, which I trust you will understand, of:

No Room in the Ark for Noah

Watch-chains and weathervanes
Coffee pots and guns
Derby hats, calico cats
And synchro-cyclotrons
Automobiles and ferris-wheels
Diamond rings and clocks
Window panes and streamlined trains
Binoculars and locks
Spectroscopes, manila ropes
Baseball bats and books
Ice-cream freezers, eyebrow tweezers
And uniforms for cooks
Piano stools and folding rules
Mattresses and nails
Shaving mugs and thermos jugs
And pots and pans and pails
Hiking shoes, ice-skates, canoes
Chloroform and gaskets
Rubber bones, telephones
Paper clips—and caskets.

Twentieth-century man lives midst a clutter of things fashioned by himself. The variety and complexity of these creations have reached truly bewildering proportions. Yet man has no scientific understanding of these devices, above the level reflected by the mail-order catalogue. Consider for example what happens in a discussion of whether so-called thinking machines really think. It is not surprising that such a question should be rather vehemently debated, with no decisive conclusion. But it does come as something of a shock to realize that there are available no clearly defined terms, no basic principles of recognized wide validity—in short, no bases of any sort to support a truly scientific argument of the question.

This is, of course, but one aspect of man's appalling ignorance of man. Pope's advice, that "the proper study of mankind is man," has been signally honored in the breach. There is an increasingly recognized need for massive effort directed toward better understanding of the human individual and, especially, of the human society. One way of pursuing this task is to attempt a systematic study of the fruits of man's creative activity. For as the heavens declare the glory of God, the works of man speak of their creator. Man and his material environment must be understood together, or neither will be understood at all. Let us look, therefore, at Noah and at his ark.

Human Purpose and Human Activity

Engineering and art refer to the two principal types of human activity resulting in artifacts. Art is based on esthetic standards and values, engineering on less abstract utility. This distinction does not appear to be of taxonomic value, however, since objects of the most utilitarian sort, such as clothing and furniture, are also heavily involved in esthetics. An object may be valued for its utility, for its beauty, or "for sentimental reasons"—or for all three of these. Rather than considering why artifacts are valued, perhaps one should ask why artifacts are created. (Answers to these two questions have much, but not everything, in common.) In biology this pathway of asking why artifacts are created is not open. The sinewy black leopard may be admired and appraised as a work of art or of engineering,

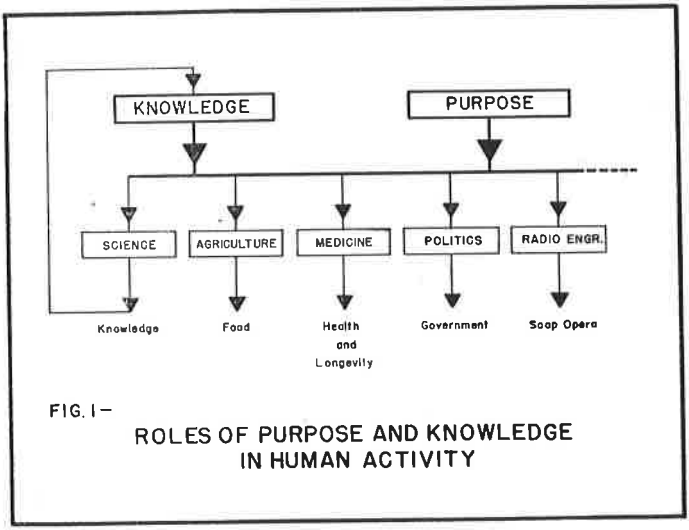


FIG. 1—
ROLES OF PURPOSE AND KNOWLEDGE IN HUMAN ACTIVITY

but the reason for his creation, the purpose he serves—these escape scientific inference. By contrast, a can opener is manifestly made for the one express purpose of opening cans. Perhaps the study of human purposes might lead to a useful taxonomy of man-made objects.

Figure 1 is an attempt to display the role of purpose in the broad panorama of creative human activity. Purpose and knowledge are shown as the twin ingredients of various activities such as agriculture, politics, medicine, etc. These activities are motivated by desires for certain ends, such as satisfaction of bodily appetites, maintenance of bodily health and long life, and the moving of persons and things from one place to another. Science, the application of knowledge to the attainment of further knowledge, is seen to be in a class by itself. Like engineering and artistic activities, science is inspired by a certain human purpose and makes use of all human knowledge in achieving this purpose. But unlike these others, science functions solely to en-

rich that same store of knowledge and understanding upon which it, along with all purposeful activity, continuously feeds.

Now in the pursuit of these ends, man is led to conceive, design, and manufacture artifacts. In fashioning these objects man uses energy, materials, tools, and instruments, as indicated in figure 2. Of all the things which man can make, tools and instruments are the most important. For by the making of new tools and instruments his power of making all sorts of objects is augmented. Primitive man started this process with only his hands for tools and only his eyes and ears for instruments, and these natural endowments are still most prized.

Instruments are extensions of the senses; tools are extensions of the muscular functions. There are other objects which may be regarded as extensions or projections of the self. This leads to the possibility of considering the motivation of all human action as two-fold: an intro-

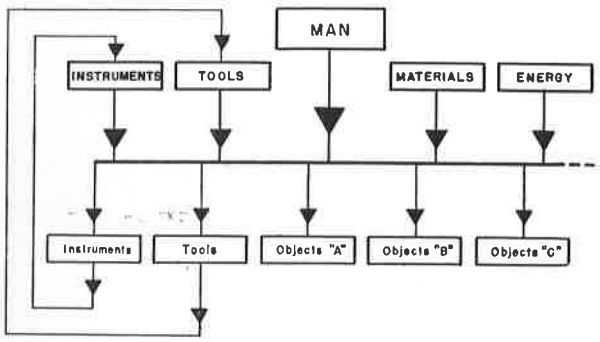


FIG. 2—
CREATION OF MAN-MADE OBJECTS

vert attention to the needs of the self, and an extrovert drive to extend and project the self. On this basis one may start the classification of man-made objects with two main groups:

1. Facilities: artifacts relating to personal surroundings and needs.
2. Automata: artifacts relating to strengthening, extending, projecting, or replacing of the person.

Further development of the taxonomic system might be as shown in figure 3. Facilities can be divided into such major sub-groups as food, clothing, and housing. Automata are shown grouped into instruments, extension of the senses; tools, extensions of the muscular functions; mental aids, devices such as pencil and paper, calculating machines, which help one to think and remember; communication aids, such as pencil and paper (again), books, telephones and other extensions

of speech and gesture; art objects, pure projections of feeling (where utility enters, it seems preferable to classify according to utilitarian purpose); and robots, which replace the entire person with respect to some specified, limited function or task (*e.g.*, the task of regulating the domestic heating plant).

Further general taxonomic subdivision will not be attempted here. It will be instructive, however, to carry through at least one example to the ultimate specific level. The example chosen is shown in figure 4, where a mercury-in-glass thermometer is classified in the same number of groups as is customary in biology. For comparison, the zoologic classification of the ordinary cat is included. It may or may not be wise to use the same number of groups, and the same names for these groups, as used by biologists. In any case, the taxonomist of artifacts, like his biologic predecessor, will soon feel the need of recourse to super-families, subspecies, etc., or their equivalents.

FACILITIES	AUTOMATA
FOOD	INSTRUMENTS
CLOTHING	TOOLS
HOUSING	MENTAL AIDS
	COMMUNICATION AIDS
	ART OBJECTS
	ROBOTS

FIG. 3–
CLASSES OF FACILITIES AND AUTOMATA

In this classification of a thermometer, the most difficult decision is in the step from class to order. The term "physical instrument," to have meaning, must be contrasted with other orders of the instrument class. These might be chemical, biological, psychological, sociological, economic, and perhaps still other orders of instruments. The difficulty comes in deciding what can actually serve as basis for these distinctions. The measurement of essentially physical quantities such as pressure (of blood) or sound (of applause) is done with instruments almost identical with those used by the physicist. One might conclude that all instruments are physical instruments. The tiny germ of difference, however, is exceedingly important. The applause-meter, for example, is a sociological instrument because conversion of units of sound into units of applause can be done only with reference to a standard which resides in the sociological entity, the audience.

Similarly, there are no objective, physical standards of loudness, brightness, or intelligence; these standards reside in the psychological entities, the human ear, the human eye, and the human brain. It is suggested, therefore, that an instrument's order should be decided according to the field in which the relevant standard of comparison resides.

Reverting to the higher taxonomic level, it may be well to consider a few examples of the class of tools. The automobile, as an extension of the muscular function of walking, is classed as a tool. The piano might also be so classed, if singing and whistling are regarded as muscular functions; however, the relation to communication and to art would need to be closely scrutinized before one would be satisfied with this assignment.

Beyond the classification of man-made objects, what can be said of the larger science of which this taxonomy is a part? How soon

	ORDINARY CAT	ORDINARY THERMOMETER
PHYLUM	VERTEBRATES	AUTOMATA
CLASS	MAMMALIA	INSTRUMENTS
ORDER	CARNIVORES	PHYSICAL
FAMILY	FELIDAE	THERMAL
GENUS	FELIS	THERMOMETER
SPECIES	DOMESTICA	MERCURY-IN-GLASS

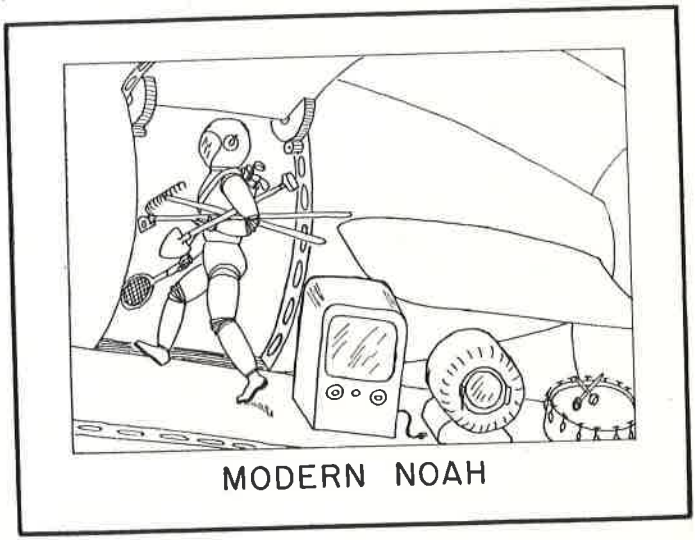
FIG. 4–
CLASSIFICATION OF A THERMOMETER

can there be such a science? What shall it be named? Here is virgin territory, beckoning to the pioneer.

Consider the familiar picture of a machinist at his lathe. With the lathe serving him as a tool and with the micrometer in his hand as an instrument, he fashions a piece of metal to some preconceived design—his own or that of some other man. After a while, when the gleaming metal has been roundly turned to the last hair's breadth, it is taken from the lathe and laid aside, finished. But what can be said, in scientific terms, of the process which led to this result? Can the process be characterized, for instance, by conservation of some quantities, increase or decrease of others? The physicist would say that mass and energy are conserved. What about entropy? Here the argument begins! And it has only just begun.

Entropy is related to probability and it is significant that processes

of measurement and of communication are beginning to be understood afresh by application of probability considerations. The result of every measurement may be called an improbable result, since so many different results might have been obtained. Similarly, every message communicated is an improbable message, because so many different messages might have been selected. The same thought may be extended to the domain of man-made objects. Clearly, every artifact is improbable, in that it might differ from itself in so many ways. Linking of this improbability to human purpose may be one of the necessary steps to be taken in launching a true science of man-made objects—a science which must include, among its other integral parts, a well-developed taxonomy.



MODERN NOAH

NEWS OF TENNESSEE SCIENCE

Top event of scientific interest in the South during the summer was the Oak Ridge Symposium, August 25-30, on "The Role of Atomic Energy in Agricultural Research."

The Atomic Energy Commission is to develop Tennessee shale. A contract of 48,238 has been awarded to the Department of Geology of the University of Tennessee to cover continuation and expansion of studies of the Chattanooga shale. This study is under the direction of Dr. Paris B. Stockdale. Also, under contract with the AEC, the U. S. Bureau of Mines will begin operation of a small experimental mine near Sligo, Tennessee, to develop satisfactory methods of mining Southeastern shale deposits. These shales contain minute percentages of uranium and are of interest to the AEC as a potential domestic uranium reserve.

The Middle Tennessee Science Fair, sponsored jointly by The Nashville Banner and Vanderbilt University, was held in the gymnasium at Vanderbilt, April 23-25, 1953. There were over one hundred entries in ten divisions. The winners were: Chester Burns, David Lipscomb High School, with a display on Principles of Nutrition; Donald H. Miller, West End High School, with a display on Ground Water; and Ronald Smith, Isaac Litton High School,

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