INFORMATION THEORY AND PLATONIC FORMS

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It is a characteristic of the positivistic approach to a philosophy of science that all non-empirical metaphysical concepts are rejected as "meaningless." However, as the positivist considers his view in greater depth, he frequently finds that metaphysical problems are unavoidable if a consistent position is to be developed. One example of such an issue is the problem of universals. The positivist who wishes to avoid the notion of universals will find himself in a distinctly embarrassing position when he attempts to deal with classes.

It is clear that the scientist wishes to classify the entities of the empirical universe into objectively organized groups. The simplest protocal sentence presupposes such classifications. However, it is also clear that realism, as usually presented, would be alien to the positivistic tradition. To accept that Platonic forms exist in the real universe would appear to violate the positivistic principle whereby metaphysical entities without a clear empirical basis are rejected.

Nominalism and conceptualism are likewise unacceptable if the principles of science are to function. The assertion that the classes into which material objects are placed have their origins exclusively in language or in the subjective mind seriously undermines any claim to objectivity that the scientist might wish to make. Let us examine this in greater detail.

The scientist might attempt to avoid this difficulty by adopting a mind-brain identity theory and placing the origin of classes in the brain. However, this will not extricate him. If he supposes that each brain must independently arrive at the same set of classes, thus saving objectivity, he must then explain how this similarity arises. Once more he is faced with the need to explain how classes can objectively exist.

If he supposes that classes come from the classes of language, he must accept one of two positions. Either he must consider the classes of language to be necessary, in which case, he must again explain their origin, or he must assume that they are mere accidents of similarity, as the classical nominalist would. In the second instance, classes again lose their objective character and cease to have any objective origin.

He likewise cannot resolve his difficulty by resorting to a resemblance theory of universals, as many modern nominalists do. First, he must still explain the origin of the resemblances, which as Russell[1] points out, are themselves universals. A second and more serious problem faces him in Wittgenstein's[2] observation that there is no <u>thing</u> which is common to all members of some nevertheless well defined classes. Thus, one must ask how a resemblance may be observed? What is it that is observed in order to discover the relationship of the resemblance? In short, the resemblance theory fails to solve the essential problem of the metaphysical nature of classes for the scientist.

A still more serious problem for a scientific nominalist is found in Hillary Putnam's[3] argument that modern nominalism cannot admit mathematics. Mathematics deals with classes which lack concrete referents. Mathematical entities are thus unequivocal examples of universals and yet are entities without which science cannot function. To deny their existence is a patently absurd move for the philosopher of science. To assume that they are merely mental entities and nothing more is to undermine the validity of the mathematical model when it is applied to the empirical universe. If the scientist attempts to attribute mathematics to brain states and thereby, at least in principle, preserve their empirical character, he is thrown back again into the problem of explaining the origin of brain states in such a way that such states are part of the objective world. He will thus be forced to accept some sort of realism.

It thus seems that a scientist who wishes to adopt a positivistic position is forced to accept some form of realism, since nominalism and conceptualism either merely return him to a realistic position or present insurmountable difficulties. However, if, as we have suggested, the scientist is compelled to seek a realistic theory of universals, it is clear that such a theory must have some rather unusual characteristics. It must be a theory founded on empirical observation. Universals must be in this theory the sorts of things which are subject to the procedures of verification. It will be the contention of the remainder of this paper that such a theory of universals is implicit in the discipline of information theory.

Von Foerster suggests in his article "Circuitry of Clues to Platonic Ideation"[4] that "information," as the term is used in information theory and cybernetics, may be considered identical to Plato's forms. However, it is clear that if such an equation is correct, a somewhat Aristotelian version of the theory of forms must be intended. The forms must be seen as subsisting in objects in order to satisfy the principle of physics that all information must have a material carrier. In information theory information exists only by being actualized by some "lump" of matter. Thus, an existent realm of forms is ruled out in the theory we are considering.

Likewise, a scientific theory of universals cannot involve any Platonic principle in which the universals are assumed to have greater moral value than the matter which actualizes them. Such a principle is not consistent with the practice of science.

Given these stipulations, let us consider whether it is reasonable to equate information and the forms. To do this we

must examine the concept of information as it functions in information theory.

The technical concept of information first appeared in two now classic works: Shannon's "A Mathematical Theory of Communication"5 and N. Wiener's Cybernetics.6 Although there is an underlying concept in common, the expression of the idea in these two works differs. Shannon defines information by the formula log21/pk where p is the probability of a message k. The logrithmic function is included to deal with the binary character of the sorts of messages that Shannon was considering and is not philosophically interesting. The essential characteristic of Shannon's use of the term "information" is thus that it represents "news," the unexpected. The more likely the message, the less information it conveys.

One can visualize this by considering Leibniz's identical spheres. If one observed first one sphere and then the other, no information would be conveyed by the second.

In order to see why, we will extend Leibniz's hypothetical universe somewhat. In the real world the situation we will describe is impossible, but the formalization of information theory allows the possibility of this as a thought problem. If, in addition to assuming that the two spheres' areas are absolutely identical, we assume that a message conveying information about them to an observer is transmitted exactly as it is sent, with no alteration or "noise," then the observer will obtain all possible information about the spheres by examining the first one. When he views the second sphere, the message (k) will be identical, and thus the information content will be zero.

This fact has an interesting consequence. If the second sphere conveys no information, then it follows that between the two spheres there is only one ontologically existent set of information. Since our observer might have begun his observation with either sphere, it is entirely an accident that one sphere was designated "the first." Thus, the information is not peculiar to a particular sphere and, to a considerable extent, the information of a message is an entity above and beyond the matter actualizing it.

N. Wiener used the term "information" to designate the message rather than the probability of the message. This is the more primitive and therefore more philosophically interesting idea. Wiener defined information as the pattern into which matter is grouped. Information for Wiener is thus, like the information common to the two spheres of Liebniz, something which, while it cannot exist in the observable universe without matter, is not the same as matter and cannot be reduced to matter.

Furthermore, science discusses information and matter as separate entities. The hypothetical "singular state" from which the "big bang" expanded was characterized by matter that was so compacted as to be isotropic and homogeneous.[7] In short, no information differentiated any "piece of stuff" from any other. This "singular state" was thus composed of informationless matter.

Information likewise can be considered (although not observed) independently of matter. For example, some entity adheres among a printed page of music, the sound waves of that same music being played, and the neural firings of a person listening to the music. This entity is defined by Wiener as the information of the music itself. It has proceeded through three totally unrelated groupings of matter. Another example we might consider is that hammer considered by classical philosophy which remained the same although both the head and handle were replaced. That which remained to allow such an identification was the information which various "pieces of stuff" actualized.

This notion is basically the same one which we find in Plato; that is, that for each possible entity there is only one form. Thus, there is only one form for "man." In terms of information, some of the information one may gain from "Socrates" is the information message which we refer to by the term "man." Lest it be thought that most of the interesting universals cannot be dealt with by an information theory-cybernetics approach, it should be noted that work has already been done which has considered shape, color, extention, and purely verbal universals.[8]

However, this equation of information and Platonic forms is of no value to the philosopher of science if it cannot be shown to represent a realism consistent with positivism. The primary objection which a positivist makes to traditional theories of realism is that they require the postulating of unobservable entities, i.e. the forms. For the equation of information and forms to be of value, it is necessary to consider whether "information," as the term is technically used in information theory, is an objectively observable entity and one subject to the principles of verification.

It is an essential premise of information theory that such is the case. The basic insight which led to the development of this discipline in the late 1940's and early 1950's was the realization that information is an entity which can be observed in the same sense that the entities of physics such as electrons and neutrons can be observed. Information has the same status, ontologically, as these phenomena, in that it can be indirectly observed, and its existence is required and verified by a consistent scientific theory. It can be quantified, moved about, and its behavior can be successfully predicted in the same fashion that quantum phenomena can be predicted. Thus, it would seem that the positivist who accepts the principles and objects of modern physics is justified in accepting information as an ontological entity.

Information theory therefore supplies a possible solution to the problem of universals for the positivist. Information functions

in the same way that universals do, but it is an acceptable object of scientific study. A positivistic realism may therefore be founded on the discipline of information theory.

NOTES

1. Bertrand Russell, The Problems of Philosophy (Oxford: Oxford University Press, 1912), p. 96.
2. Ludwig Wittgenstein, Philosphical Investigations, trans. G.E.M. Anscombe (New York: McMillan, 1963), numbers 65-77.
3. Hilary Putnam, Philosophy of Logic (New York: Harper and Row, 1971), p. 15-23.
4. Heinz Von Foerster, "Circuitry of Clues to Platonic Ideation," Aspects of the Theory of Artificial Intelligence, ed. C.A. Muses (New York: Plenum, 1962), p. 43-81.
5. C.E. Shannon, "A Mathematical Theory of Communication," The Bell System Technical Journal 27 (July, 1948): 379-423.
6. Norbert Wiener, Cybernetics (New York: John Wiley and Sons, 1948).
7. E.L. Schatzman, The Structure of the Universe (New York: McGraw-Hill, 1974), p. 238-239.
8. John Freeman, "The Modeling of Spacial Relations," Computer Graphics and Image Processing 4 (1975): 156-171.

D.R. Morrison, B.W. Lindsay and M.D. Weston, An Introduction to Sandia Image Digitizer, Connector, Analyzer, and Plotter: A Pattern Recognition System, SIDCAP Report Number 1, SC-DR-68-811 (Albuquerque: Sandia National Laboratories, 1971).

Russell A. Kirsh, "Computer Interpretation of English Text and Picture Patterns," IEEE Tranactions of Electronic Computers EC-13 (1974): 363-376.

A.P. Ambler and R.J. Popplestone, "Inferring the Positions of Bodies from Specified Spacial Relationships," Artificial Intelligence 6 (1975): 157-174.