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# The Scientific Breakthrough of the Twentieth Century

By E. C. HARWOOD

## I

PRESUMABLY MAN'S INQUIRIES into himself and his surroundings began when men first appeared on the globe. Perhaps his attempts to learn could be considered as having begun even earlier in whatever form of animal life man's predecessors in the evolutionary progression may have been. In any event, there are many indications that man's acquisition of 'knowledge'<sup>1</sup> has been both slow and gradual, a prolonged process of accumulation by nearly infinitesimal increments.

Lost in the mists of antiquity are those great successes in the conduct of inquiry that enabled man to use fire as a household convenience, to talk and later to write, to use the wheel, and to 'know' countless ways and means of doing what he wishes to do, ways and means that most of us today take for granted. We surmise that even such a great advance as writing must have been achieved gradually rather than suddenly, but that it marked one of the significant breakthroughs in man's learning behavior seems apparent.

More recently and well within the range of recorded history man has achieved other significant breakthroughs. One frequently mentioned is the application of modern scientific method in the physical sciences as epitomized in the story of Galileo. Another is the application of similar methods of inquiry in the physiological sciences, where the work of Vesalius provides an outstanding example. Noteworthy is the fact that these more recent breakthroughs reflected great forward strides in the development and application of methods of inquiry. In fact, some skilled observers have insisted that the Galilean advance in particular was revolutionary in its effects on the conduct of inquiry in the physical sciences.<sup>2</sup>

In this twentieth century man once again has achieved a significant breakthrough carrying him beyond certain barriers of ignorance that have

<sup>1</sup> Because firm usage of various technical terms has not yet become widespread, even among highly educated individuals, I have used several words that have been found unsuitable, at present, for scientific discourse. Such terms, when used herein, are indicated by half quotes so that readers may understand that loose characterization rather than accurate specification is intended.

<sup>2</sup> For example, Joseph Ratner, *Intelligence in the Modern World*, (New York, The Modern Library 1939, p. 114): "We then see that the work of Galileo was not a development but a revolution; and the work of Einstein is not a revolution but a development."

blocked progress in inquiry for countless ages. Some readers may at first suppose that reference is made to the striking advance in the physical sciences that has culminated in application of atomic power to war and peacetime needs. Other readers may assume that reference is made to the widely publicized advance in the physiological sciences that has been reflected but recently in an antipolio vaccine. However, we suspect that, with the help of hindsight, our descendants in future centuries will regard these developments as hardly more than routine advances along lines already well charted rather than as highly significant breakthroughs to new successes in inquiry.

How fortunate for the welfare of the human race that advances in 'knowledge' have not waited upon man's first acquiring an adequate understanding of what 'knowledge' is. For some 2,000 years, at least, philosophers have been debating about 'knowledge'. Long before that debate began some men were sure that they 'knew' what 'knowledge' was; in fact so sure were they that they apparently did not even consider the question, What is 'knowledge'? worth asking and therefore made no attempt to answer it.

In spite of 2,000 years of debate by the world's most eminent philosophers, including some of those living today, the question, What is 'knowledge'? has remained unanswered, or at best unsatisfactorily (inconsistently and incoherently) answered, until recent decades. The situation as it has been until these mid years of the twentieth century has been summarized in these words:

"Knowledge: In current employment this word is too wide and vague to be a *name* of anything in particular. The butterfly 'knows' how to mate, presumably without learning; the dog 'knows' its master through learning; man 'knows' through learning how to do an immense number of things in the way of arts and abilities; he also 'knows' physics, and 'knows' mathematics; he 'knows' *that, what, and how*. . . . The issues that must be faced before firm use is gained are: Does the word 'knowledge' indicate something the organism possesses or produces? Or does it indicate something the organism confronts or with which it comes into contact? Can either of the viewpoints be coherently maintained? If not, what change in preliminary description must be sought?"<sup>3</sup>

In view of what has been said above readers presumably will not be surprised by the assertion that the significant scientific breakthrough of the present century is man's discovery of a satisfactory and therefore useful

<sup>3</sup> John Dewey and Arthur F. Bentley, *Knowing and the Known*, Boston, Beacon Press, 1949, p. 296.

answer to the question, What is 'knowledge'? Instead of using this form of the question, including that unsatisfactory word 'knowledge,' however, we can pose the question as follows: How can we be sufficiently confident that an assertion is warranted to justify using such a warranted assertion<sup>4</sup> in solving the problems of men? And the answer to this question may be summarized: Such confidence is justified when the allegedly warranted assertion is the outcome of applying certain well tested methods or procedures in conducting inquiry.

To many readers the assertion that men have just begun to find a satisfactory and useful answer to the question, What is 'knowledge'? may seem patently ridiculous. Many able philosophers have assumed what at first seems obvious, that men, some men anyway, must have known what 'knowledge' is in order for any 'knowledge' ever to have been acquired. This seemingly obvious conclusion is fortified by formal or Aristotelian logic, and until the last century was hardly questioned.<sup>5</sup>

## II

THE ROOTS from which the inadequate and unsatisfactory notions grew are found far back in the ages before recorded history when men first began to use language with facility.<sup>6</sup> The subsequent development of knowing behavior followed a natural course via word magic, revelation (religious and secular), proverbs, Plato's idealism, and Aristotelian logic with one growing out of the other yet never discarding primitive attitudes toward words, men, and other things. In a sense, the primitive language development provided the medium in which the 'thoughts' of men were trapped until the developing inquiries of men broke the binding in which man, the time binder, had enmeshed himself.

How men could thus be trapped in a web of their own making can readily be understood when one remembers that man is fundamentally and

<sup>4</sup>The specific application of the technical name "warranted assertion" is discussed at length by John Dewey in *Logic: The Theory of Inquiry*, New York, Henry Holt & Company, 1938. A useful summary of Dewey's views will be found in Dewey and Bentley, *Knowing and the Known*, *op. cit.*, p. 208 *et seq.*, and we suggest for readers who have found Dewey's style of writing somewhat difficult, Joseph Ratner's *Intelligence in the Modern World*, *op. cit.*, especially Dr. Ratner's introduction extending from p. 3 to p. 241.

<sup>5</sup>For an adequate description of how man acquired an excess of confidence in his past 'knowledge' about 'knowledge,' readers are referred to the publications already cited and to John Dewey, *The Quest for Certainty*, New York, Minton Balch & Company, 1929.

<sup>6</sup>A hasty sketch of the ages-long development of man's knowing behavior was attempted by the present writer in *Reconstruction of Economics*, American Institute for Economic Research, Great Barrington, Massachusetts (1955), pages 9-16.

greatly different from the other forms of life found in our universe. Like plant and animal forms of life, man is an energy binder, that is, he can absorb the materials of his environment and convert the energy in them to his own uses. Like animal life, man is a space binder, that is, he can move about in space and use it as a means of adapting to and otherwise utilizing his environment. But, unlike either plants or animals, man is also a time binder; that is, he can accumulate the results of his experiences over time and make the lessons of these experiences available to successive generations of men.

This time-binding capacity of man apparently is made possible by the development of the human brain and the development of language and tools. The details of the process would require volumes to describe, and such volumes are to be found among others in the libraries that are part of man's cultural heritage, some of the most pertinent evidence of man's time-binding activities.

Now it is obvious that for men to be able to learn from experience and from their cultural environment, there must be a plasticity of habit-forming capacities, an elasticity as it were of learning ability. But the very fact of capacity to learn new habits implies that what is learned will be habitual, will have a tenacious hold on the learned individual.

Thus we can see how man the time binder is likewise bound.<sup>7</sup> The accumulating libraries of the world have their influence on each generation of students and tend to impress on them the habitual outlooks and 'knowing' behaviors of earlier days. Moreover, the unconscious learning processes of infants in relation to language become habitual behaviors toward words. These primitive habits must be replaced by different behavior if an individual is to learn to use language scientifically, that is, if he is to 'think' in the modern way. To the extent that the more primitive 'knowing' behaviors are firmly fixed habits they constitute restrictions on the intellectual development of men, restrictions as pervading and effective as the great weight of the cultural environment embodied in libraries, folklore, and superstition, all the prescientific knowing behaviors and culture of man.

From one point of view we may say that *the* great problem of our times is: How shall we free man the time binder from the multitudinous, all-

<sup>7</sup> The nineteenth century American social philosopher, Henry George, pictured societies as sustained, and yet restricted in their progress, by webs of culture, "the matrix in which mind unfolds and from which it takes its stamp." *Progress and Poverty*, New York, Schalkenbach, 1954, p. 504.

encompassing, and intricately tangled web that is one obvious result of his own time-binding propensities?<sup>8</sup>

As it happened certain of man's great successes in inquiry were achieved some 300 years ago in the physical sciences. These successes provided consistently useful solutions to the problems of men and opened a door to the technological advance that is proceeding like a giant with ever-increasing strides in our own times. The next great successes were in the physiological sciences with results that have ameliorated the conditions of living men beyond the dreams of an earlier day.

Finally, within the past several decades, persistent researchers have broken the binding in another field and have studied man as wholly natural in his natural environment. Instead of assuming that the 'mind' has its own ways of 'knowing' and can 'know' with peculiar certainty that it 'knows' what it 'knows' is so, such men as Charles S. Peirce, Henry James, John Dewey, Arthur Bentley, and Joseph Ratner put aside all such preconceptions and chose to inquire into man's successful inquiries. They sought answers to the question, What methods have been applied by those inquirers who have conducted successful inquiries? Moreover, "success" has been judged on the practical basis of virtually unanimous acceptance of the results by all skilled and informed inquirers rather than on the dubious basis of belief in the results by followers constituting a religious or secular cult.

The result of these inquiries is, it seems to me, the most significant breakthrough in all of man's ages-long effort to inquire into his own doings and the rest of his cosmos. Now in these mid years of the twentieth century man at long last has learned what 'knowledge' is, what circumstances justify confidence in an allegedly warranted assertion about man's behavior, about physiological processes, and about physical events and things. This is not to assert that man now 'knows' all there is to 'know' about 'knowing'. On the contrary, what remains to be learned will be revealed only in the hidden future. But man now does 'know' enough about 'knowing' so that he can discuss coherently and consistently how he 'knows' what he 'knows,' a major and essential first step through the newly opened door to the future.

The great importance of the twentieth century breakthrough may not at first be apparent to many. They perhaps will ask, What is so important

<sup>8</sup> For a more detailed discussion of man's time-binding propensities see Alfred Korzybski, *Manhood of Humanity*, Garden City, N. Y., Country Life Press, 1950, chapters 3 and 4, and *Science and Sanity, an Introduction to Non-Aristotelian Systems and General Semantics*, Lancaster, Pa., Science Press Printing Company, 2d ed., 1945, chapters 2, 24, and 30.

about an advance that does not offer the hope of greatly accelerated progress in the physical and physiological sciences where the progress of inquiry already is rapid? The answer is that solutions are needed for the problems of men in society, problems that are subject matter for the behavioral sciences. Without attempting to demonstrate reasons in detail here, we may simply note that unless enough such problems are solved in the next several decades or few centuries, western civilization may follow its predecessors into oblivion.

In one of the last essays he wrote,<sup>9</sup> Arthur Bentley said:

Even more radical may seem a further assertion, again one to be taken strictly under transactional postulation. *It is that the characteristic behavioral process is the process of knowing.* Knowing—the naturalistic knowing-contact between organism and environs—is that which must receive basic examination and expression the moment the effectiveness of physiological techniques has been left behind, and the behavioral field has been entered. *Its study constitutes the primary behavioral science.* Knowing is not some wonder perched on top of organic life; it happens as process in and of the world; *it is to behavioral science what radiation and gravitation are to physics, and what blood circulation and neural transmission are to physiology.* (Italics supplied)

The door has been opened to a revolutionary advance in inquiries into the behavioral sciences. Through that door man may advance in finding solutions to the problems of men in society. Given time, a few decades at least but perhaps a few centuries, there may be sufficient progress to insure the survival of the best that western civilization has developed through its long and troubled past. We and our immediate followers now are in a far better position to learn how we got where we are, how it happens that civilization has flowered as it has here in the United States, how the new nation that was to be the hope of the world, that inspired and still is inspiring the struggles of men to break out of the bonds enslaving them, how that nation has succeeded to the extent that it has, and perchance how all men may move forward to a better world. From improved understanding of the behaviors of men in society we may reasonably hope for what men have sought since time began, not an Utopia of plenty and slothful ease but a civilization that will foster in every possible way the development of individual men to their maximum capacities and the firm establishment of a good society.

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<sup>9</sup> Arthur F. Bentley, "Kennetic Inquiry," *Science*, 112 (Dec. 29, 1950), pp. 775-83.