Rudolf Carnap

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CHAPTER 27

Analyticity in an Observation Language

ONE OF THE OLDEST, most persistent dichotomies in the history of philosophy is that between analytic and factual truth. It has been expressed in many different ways. Kant introduced the distinction, as shown in Chapter 18, in terms of what he called "analytic" and "synthetic" statements. Earlier writers spoke of "necessary" and "contingent" truth.

A-statements are important in scientific discovery

In my opinion, a sharp analytic-synthetic distinction is of supreme importance for the philosophy of science. The theory of relativity, for example, could not have been developed if Einstein had not realized that the structure of physical space and time cannot be determined without physical tests. He saw clearly the sharp dividing line that must always be kept in mind between pure mathematics, with its many types of logically consistent geometries, and physics, in which only experiment and observation can determine which geometries can be applied most usefully to the physical world. This distinction between analytic truth (which includes logical and mathematical truth) and factual truth is equally important today in quantum theory, as physicists explore the nature of elementary particles and search for a field theory that will

bind quantum mechanics to relativity. In this chapter and in the next, we shall be concerned with the question of how this ancient distinction can be made precise throughout the entire language of modern science.

Distinction between observation and theory

For many years, it has been found useful to divide the terms of a scientific language into three main groups.

1. Logical terms, including all the terms of pure mathematics.
2. Observational terms, or O-terms.
3. Theoretical terms, or T-terms (sometimes called "constructs").

It is true, of course, as has been emphasized in earlier chapters, that no sharp boundary separates the O-terms from the T-terms. The choice of an exact dividing line is somewhat arbitrary. From a practical point of view, however, the distinction is usually evident. Everyone would agree that words for properties, such as "blue", "hard", "cold", and words for relations, such as "warmer", "heavier", "brighter", are O-terms, whereas "electric charge", "proton", "electromagnetic field" are T-terms, referring to entities that cannot be observed in a relatively simple, direct way.

With respect to sentences in the language of science, there is a similar three-fold division.

1. Logical sentences, which contain no descriptive terms.
2. Observational sentences, or O-sentences, which contain O-terms but no T-terms.
3. Theoretical sentences, or T-sentences, which contain T-terms. T-sentences, however, are of two types:
   a. Mixed sentences, containing both O- and T-terms, and
   b. Purely theoretical sentences, containing T-terms but no O-terms.

The entire language, L, of science is conveniently divided into two parts. Each contains the whole of logic (including mathematics). They differ only with respect to their descriptive, nonlogical elements.

1. The observation languages, or O-language (L_O), containing logical sentences and O-sentences, but no T-terms.
2. The theoretical language, or T-language (L_T), containing logical sentences and T-sentences (with or without O-terms in addition to T-terms).

The T-terms are introduced into the language of science by a theory, T, which rests upon two kinds of postulates—the theoretical, or T-postulates, and the correspondence, or C-postulates. The T-postulates are the laws of the theory. They are pure T-sentences. The C-postulates, the correspondence rules, are mixed sentences, combining T-terms with O-terms. As shown earlier, they constitute what Campbell called the dictionary for joining the observational and theoretical languages, what Reichenbach called coordinative definitions, and what in Bridgman's terminology might be called operational postulates or operational rules.

With this background, let us turn to the problem of distinguishing between analytic and factual truth in the observational language.

Logical truth

The first kind of analytic truth is logical truth or "L-truth" in our terminology. A sentence is L-true, when it is true in virtue of its form and of the meanings of the logical terms occurring in it. For example, the sentence, "If no bachelor is a happy man, then no happy man is a bachelor", is L-true, because you can recognize its truth if you know the meanings, the way of using the logical words "if", "then", "no", and "is", even if you do not know the meanings of the descriptive words "bachelor", "happy", and "man". All the statements (principles and theorems) of logic and mathematics are of this kind. (That pure mathematics is reducible to logic was shown by Frege and Russell, although some points of this reduction are still controversial. This question will not be discussed here.)

A-sentences are not restricted to logical truths

On the other hand, as Willard V. O. Quine has made clear, the observational language is rich in sentences that are analytic in a much wider sense than L-true. These sentences cannot be described as true or false until the meanings of their descriptive terms are understood as well as the meanings of their logical terms. Quine's well-known example is, "No bachelor is married." The truth of this sentence is patently not a matter of the contingent facts of the world, yet it cannot be called true because of its logical form alone. In addition to knowing the meaning of "no" and "is", it is necessary to know what is meant by "bachelor" and "married". In this case, everyone who speaks English would agree that "bachelor" has the same meaning as "a man who is not married". Once these meanings are accepted, it is immediately apparent that the sentence is true, not because of the nature of the world, but because of the meanings our language assigns to the descriptive words. It is not even necessary to understand these meanings fully. It is necessary only to know that the two words have incompatible meanings, that a man cannot be described simultaneously as both a bachelor and a married man.

Quine proposed, and I follow his proposal, that the term "ana-

lytic" be used for "logically true" in the broader sense, the sense that includes sentences of the type just discussed, as well as L-true sentences. "A-truth" is the term I use for analytic truth in this broad sense. Thus, all L-true sentences are A-true, although not all A-true sentences are L-true. An L-true sentence is true because of its logical form alone. An A-true sentence, not L-true, is true because of the meanings assigned to its descriptive terms as well as because of the meanings of its logical terms. In contrast, the truth or falsity of a synthetic sentence is not determined by the meanings of its terms, but by factual information about the physical world. "Objects fall to the earth with an acceleration of 32 feet per second per second." It cannot be decided whether the statement is true or false simply by an examination of its meaning. An empirical test is necessary. Such a statement has "factual content". It tells something about the actual world.

A-truth contrasted with L-truth

Of course, no natural language, such as English, is so precise that everyone understands every word in the same way. For this reason, it is easy to formulate sentences that are ambiguous with respect to their analyticity; they are sentences whose analyticity or syntheticity will be argued about.

The analtyticity of the given sentence is often not clear-cut

Consider, for instance, the assertion, "All red-headed woodpeckers have red heads." Is it analytic or synthetic? At first you may answer that it is, of course, analytic. "Red-headed woodpeckers" *means* "woodpeckers that have red heads", so the sentence is equivalent to the assertion that all woodpeckers with red heads have red heads. Such a sentence is not only A-true but also L-true.

Analyticity in the vernacular depends on context

You are right *if* the meaning of "red-headed woodpecker" is such that "having a red head" is, in fact, an essential component of the meaning. But is it an essential component? An ornithologist may have a different understanding of "red-headed woodpecker". For him the term may refer to a species of bird defined by a certain type body structure, shape of bill, and behavior habits. He may consider it quite possible that this species of bird, in some isolated region, may have undergone a mutation that changed the color of its head to, say, white. For sound taxonomic reasons, he would continue to call such birds red-headed woodpeckers even though their heads were not red. They would be a species variant. He might even refer to them as "white-headed red-headed woodpeckers". Therefore, if "red-headed woodpecker" is so interpreted that having a red head is *not* an essential component, the sentence becomes synthetic. It is necessary to make an empirical survey of all red-headed woodpeckers to determine whether all of them do, in fact, have red heads.

Even the statement "If Mr. Smith is a bachelor, he does not have a wife" could be taken as synthetic by anyone who interpreted certain words in an unorthodox way. For example, to a lawyer the word "wife" may have a broad meaning that includes "common-law wife". If a lawyer interprets "bachelor" to mean a man not legally married but takes "wife" in this broader sense, then clearly the sentence is synthetic. One must investigate Mr. Smith's private life to find out whether the sentence is true or false.

Analyticity can be isolated in an artificial language

The problem of analyticity can be discussed with respect to an artificial observational language that can be constructed by laying down precise rules. These rules need not specify the full meanings of all descriptive words in the language, but meaning relations between certain words must be made clear by rules that I once called "meaning postulates" but now prefer to call, more simply, "A-postulates" (analyticity postulates). We can easily imagine how complete specifications *could* be given for all the language's descriptive words. For example, we could specify the meanings of "animal", "bird", and "red-headed woodpecker" by the following designation rules:

Meaning postulates for such a language

($D1$) The term "animal" designates the conjunction of the following properties (1) . . . , (2) . . . , (3) . . . , (4) . . . , (5) . . . (here a complete list of definitory properties would be given).

($D2$) The term "bird" designates the conjunction of the following properties (1) . . . , (2) . . . , (3) . . . , (4) . . . , (5) . . . (as in $D1$ above), plus the additional properties (6) . . . , (7) . . . , (8) . . . , (9) . . . , (10) . . . (all the properties needed to specify the meaning of "bird").

($D3$) The term "red-headed woodpecker" designates the conjunction of the following properties (1) . . . , (2) . . . , . . . , (5) . . . (as in $D1$), plus (6) . . . , (7) . . . , . . . , (10) . . . , (as in $D2$), plus the additional properties (11) . . . , (12) . . . , (13) . . . , (14) . . . , (15) . . . (all the properties needed to specify the meaning of "red-headed woodpecker").

If all the required properties were written out in the spaces indicated by dots, it is apparent that the rules would be enormously lengthy and cumbersome. Something like this would be necessary if a full specification of the meanings of all descriptive terms in our artificial language

were insisted upon. Fortunately, it is not necessary to go to such tiresome lengths. A-postulates can be limited to specifying the *meaning relations* that hold among the language's descriptive terms. For example, for the three terms just discussed, only two A-postulates are needed.

($A1$) All birds are animals,
($A2$) All red-headed woodpeckers are birds.

If the three D-rules are given, the two A-postulates can obviously be derived from them. But, since the D-rules are so cumbersome, it is not necessary to formulate them when the purpose is merely to indicate the analytic structure of a language. Only the A-postulates need be given. They are much simpler, and they provide a sufficient basis for making the distinction between analytic and synthetic statements in the language.

The truth of A-sentences is discovered without looking at the world

Assume that the artificial language is based on the natural language of English but we wish to give A-postulates to make it possible, in all cases, to determine whether a given sentence in the language is analytic. In some cases, the A-postulates can be obtained by consulting an ordinary English dictionary. Consider the sentence, "If a bottle is tossed out of a window, the bottle is defenestrated." Is this analytic or synthetic? The A-postulate, derived from the dictionary definition, says, "x is defenestrated if and only if x is tossed out of a window." It is apparent at once that the sentence is A-true. It is not necessary to toss a bottle through a window to see whether it does or does not become defenestrated. The truth of the sentence follows from the meaning relations of its descriptive words, as specified by the A-postulate.

The uncertainty in deciding analyticity is due to the uncertain meaning of descriptive terms, but not due to the uncertainty of the analytic/synthetic distinction

An ordinary dictionary may be precise enough to guide us with respect to some sentences, but will be of little help with respect to others. For example, consider those traditionally ambiguous assertions, "All men are rational animals" and "All men are featherless bipeds." The main difficulty here lies in the great ambiguity of what is meant by "men". In our artificial language, there is no difficulty because the list of our A-postulates settles the matter by fiat. If we desire to interpret "men" in such a way that "rationality" and "animality" are essential meaning components of the word, then "All men are rational" and "All men are animals" are listed among the A-postulates. On the basis of these A-postulates, the statement "All men are rational animals" is A-true. On the other hand, if the A-postulates for "men" refer only to the structure of men's physical bodies, then the statement, "All men are rational animals", is synthetic. If analogous A-postulates are not laid down for the terms "featherless" and "biped", this indicates that in our language "featherlessness" and "bipedity" are not considered essential meaning components of "men". The assertion "All men are featherless bipeds" also becomes synthetic. In our language, a one-legged man would still be called a man. A man who grew feathers on his head would still be called a man.

Summary

The important point to understand here is that the more precise the list of A-postulates is made, the more precise a distinction can be made between analytic and synthetic sentences in our language. To the extent that the rules are vague, the constructed language will contain sentences that are hazy with respect to their analyticity. Any haziness that remains—and this point is essential—will not be because of lack of clarity in understanding the dichotomy between analytic and synthetic. It will be because of haziness in understanding the meanings of the descriptive words of the language.

Always bear in mind that the A-postulates, although they may seem to do so, do not tell anything about the actual world. Consider, for example, the term "warmer". We may wish to lay down an A-postulate to the effect that the relation designated by this term is asymmetric. "For any x and any y, if x is warmer than y, then y is not warmer than x." If someone says he has discovered two objects A and B, of such a nature that A is warmer than B, and B is warmer than A, we would not respond by saying: "How surprising! What a wonderful discovery!" We would reply: "You and I must have different understandings of the word 'warmer'. To me it means an asymmetric relation; therefore, the situation you have found cannot be described as you have described it." The A-postulate specifying the asymmetric character of the relation "warmer" is concerned solely with the meaning of the word as it is used in our language. It says nothing whatever about the nature of the world.

In recent years, the view that a sharp distinction can be made between analytic and synthetic statements has been strongly attacked by Quine, Morton White, and others.[1] My own views on this matter are

[1] Quine's attack is in his paper, "Two Dogmas of Empiricism," *Philosophical Review*, 60 (1951), 20–43; reprinted in *From a Logical Point of View* (Cambridge: Harvard University Press, 1953); (New York: Harper Torchbooks, 1963). See also his essay, "Carnap and Logical Truth," in Paul Arthur Schilpp, ed., *The Philosophy of Rudolf Carnap* (La Salle, Ill.: Open Court, 1963), pp. 385–406, and my reply, pp. 915–922. For Morton White's animadversions, see his paper, "The Analytic and Synthetic: An Untenable Dualism," in Sidney Hook, ed., *John Dewey* (New York: Dial, 1950), and Part 2 of White's *Toward Reunion in*

given in two papers reprinted in the appendix of the second edition (1956) of my previously cited book *Meaning and Necessity*. The first of these papers, on "Meaning Postulates", replies to Quine by showing in a formal way (as I have indicated informally here) how the distinction can be made precise for a constructed observation language by the simple expedient of adding A-postulates to the rules of the language. My second paper, "Meaning and Synonymy in Natural Languages", indicates how the distinction can be made, not for an artificial language, but for a commonly used language, such as everyday English. Here the distinction must be based on an empirical investigation of speaking habits. This involves new problems, which are discussed in the paper but which will not be considered here.

So far, analyticity has been discussed only in reference to observation languages: the observation language of everyday life, of science, and the constructed observation language of a philosopher of science. It is my conviction that the problem of distinguishing analytic from synthetic assertions in such languages has, in principle, been solved. Moreover, I believe, and I am convinced that almost all working scientists would agree, that, in the observation language of science, the distinction is a useful one. When, however, we seek to apply the dichotomy to the *theoretical* language of science, we meet formidable difficulties. In Chapter 28 some of these difficulties and a possible way of overcoming them are considered.

Philosophy (Cambridge: Harvard University Press, 1956); (New York: Atheneum paperback, 1963). A list of some important articles replying to Quine will be found in Paul Edwards and Arthur Pap, eds., *A Modern Introduction to Philosophy* (Glencoe, Ill.: The Free Press, 1962), p. 89.