

R471  
WRS

SOME BASIC PRINCIPLES FOR  
INTERPRETING SPECIFICATIONS OF QUALITY

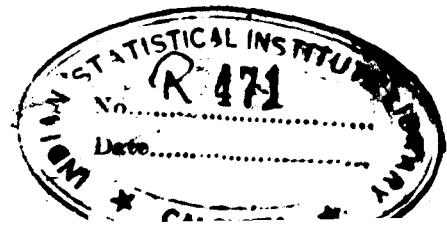
In general, a specification is an attempt to prescribe certain quality characteristics that things of a given kind are supposed to have in terms that have a common meaning to all concerned - to say in a language common to a certain group what is meant and to mean what is said.

In so far as this goal is attained in a given case, the interpretation becomes definite and precise. There are, however, certain inherent limitations to the specification of the quality of a thing in a way that will have a common meaning to all concerned and these make the problem of interpretation difficult. Since it is the interpretation that really gives a specification life, this problem is of significance not only from the viewpoint of the one who writes the specification but also for the one who inspects the quality of a thing to see whether or not it has the quality specified.

The object of the present discussion is to propose certain basic principles for interpreting specifications of quality.

Principle 1 - It is impossible to specify the quality of a thing even to one person in an operationally definite manner.

In other words, there is a limit to which a person can go in specifying the quality that a thing shall have when made. The basis for such a principle is simply that we never know everything that is to be known about the quality of a thing of a given kind. The best that we can hope to do is to specify the quality of a thing as we know it from past experience involving sensations and feelings toward the thing and thoughts about the qualia revealed through these sensations and feelings. Furthermore, our only method of measuring or determining operationally the qualities of a thing involves other things, such as measuring instruments, persons, and the like. Presumably the number of such relations is indefinitely large. It is conceivably possible to specify all of the operational techniques for characterizing certain qualities of a thing previously experienced but we cannot rationally specify all of the quality characteristics of a thing.



It follows that the specified quality of a thing not yet made can never be the whole of the experienced quality in the use of the given thing and, in turn, the experienced quality is always less than the experienceable quality. It is, however, the experienced and experienceable quality of a thing that is of importance from the viewpoint of the user of the thing. In fact, the experienced quality of things of a given kind helps to shape the customary or modal experience which constitutes one of the factors in shaping a standard of quality. Furthermore, it is the experienced quality which constitutes the basis for consumer reactions. It is therefore significant that experienced and experienceable quality can never be specified completely in an operationally definite manner.

Principle 2 - An operationally definite specification of quality must for practical reasons always cover less than the operationally definite meaning of quality even to one person.

In other words, there is a limit not only to how far one can go but also to how far it is feasible for one to go in specifying the quality of a thing. Principle 1 has to do with an inherent limitation because of lack of knowledge whereas Principle 2 has to do with certain practical limitations to going as far as knowledge will permit in specifying the quality of a thing.

For example, if one wishes to specify in an operationally definite manner that the mass of a thing shall be let us say,  $2.00 \pm .001$  gms., it is necessary for him to specify the method of measurement, the number  $n$  of repetitions of the measurement to be made under presumably the same conditions, who is to do the measuring, the method of analyzing the results of the  $n$  repetitions, and the limits within which the results of the analysis shall lie. When an engineer says, however, that a thing shall be, let us say,  $2.00 \pm .001$  gms., he intends more than is given by any such finite set of operations. For example, he likely implies among other things that if this same set of operations were repeated again and again, the results should be within the same limits. Likewise, it is intended that, if the mass of this particular thing were measured by any one of several other methods, the results should bear a certain definite relation to the results obtained by the method which he does specify in an operationally definite manner.

Thus it is that the operationally definite meaning of any quality is one involving a whole pattern of interrelations between the results obtainable through

different conceivable sets of verifiable operations. Furthermore, it is true that the quality of a thing is indefinitely continue, extending for practical purposes from the time that the raw materials are brought together into the finished article to the time that the article goes out of service. In other words, there is always a more or less definite intended life history of any quality characteristic which alone is sufficient to make it practically impossible for one to specify by means of a finite number of operations the meaningful quality of a thing.

Now, this difference between the meaningful quality of any thing in the mind of one writing the specification and any finite set of definite operations that are verifiable constitutes what we shall term the intent of the specification. This intent obviously constitutes a much larger part of the meaningful quality of a thing than does the part that it is feasible to specify in an operationally definite manner. Of course, if it were true that a verification of the specifiable quality constituted the necessary and sufficient condition for the fulfillment of the intent of the specification, there would be no difficulty. However, verification of the specification can only constitute grounds for a probable inference as to whether or not the intent is met.

The inspection engineer must, of course, give attention not only to the operationally definite part of the specification but also to the intent of the specification. Thus, when inspecting any given thing in accord with the written specification, he must give consideration to whether or not, in the light of his previous experience up to that time, the fulfillment of the operationally definite part of the specification constitutes adequate assurance that the intent will be satisfied.

Principle 3 - One person can never know the meaning or intent of a specification to another except in terms of the observable reactions of the other.

One object of science is, of course, to obtain an objectively definite and common understanding of certain pointer readings. In other words, it attempts to eliminate in so far as possible the human element. Strictly speaking, however, this is never feasible in that, among other things, it is always necessary for someone to judge that the conditions under which pointer readings were taken are those intended and that the conditions themselves are kept constant from one reading to another. Moreover, the significance to any one of pointer readings in

any given case depends upon the meaning or interpretation of the pointer readings, which, as we have seen in the discussion of previous principles, involves experience, both sensuous and emotive, as well as thinking.

This principle is of very broad significance from the viewpoint of inspection in that specifications are often made the basis of contractual agreements, stated or implied, between two parties, the producer and the consumer. It follows from this principle that even though the specification is reduced to an operationally verifiable requirement<sup>1</sup> in terms of certain limits on certain pointer readings, nevertheless the significant or meaningful interpretation of these need not be and very likely will not be the same for the two parties concerned. Furthermore, the inspection engineer has no way of knowing at first hand the meaning of either. The only thing that can be done is to base interpretation upon the observable reactions.

Put in another way this principle simply means that inspection cannot be reduced to an operationally verifiable technique likely to have the same meaning to both producer and consumer; that is to say, we cannot by means of operationally definite specifications of quality get away from the need for the exercise of trained or conditioned judgments on the part of inspection engineers even in respect to conceivably verifiable qualities constituting meaningful quality.

Principle 4 - A specification always implies that the one writing it (or the one using it to specify what he wants) wants certain assurance that the thing furnished upon the basis of the specification has the quality specified.

In other words, the specification always implies on the part of the consumer that the evidence upon which the producer judges the quality of his product must be potentially such as to provide an adequate degree of assurance or belief to the consumer that a given thing has the quality specified. On the other hand, the specification implies on the part of the producer that the evidence obtained by the inspection engineer must also be such as potentially to provide adequate assurance to the producer that the quality is that specified. These two degrees of assurance may not be the same. Furthermore, the same operationally determined results, if studied by both producer and consumer, may not produce the same degree of belief in each case. Still further, the assurance wanted may or may not be rational and it is difficult to determine in most instances from the actions of another whether or not the assurance wanted is rational. This matter of

-----  
1. See I.E.B. 5, page 15.

assurance is one of the most important elements both from the viewpoint of the consumer and the producer.

In the light of these conditions no definite rule can be set down for determining either the nature or quantity of evidence required in order to be potentially sufficient to give adequate assurance to both producer and consumer. This is a matter which involves judgment on the part of an experienced inspection engineer and requires that he be one conditioned to, or experienced with, reactions of both producer and consumer in the making and using of the thing in question. Hence operationally definite specifications of quality cannot be made in such a way as to remove the need for the exercise of engineering judgment on the part of the inspection engineer in determining the implied degree of assurance that goes with the meaningful interpretation of the specification.

December 6, 1935.

W. A. SHEWHART

