

BOX 5.1

Operationalization Across the Sciences

One aspect of the stereotype of science shared by many educated persons is that it invariably involves precise measurements with instruments that are accurate to several decimal places. Indeed, this is seen as a crucial difference between the so-called hard sciences, such as chemistry and physics (more accurately called the natural or physical sciences), and the soft sciences, such as psychology, sociology, and anthropology (most of which are social sciences). Of course, the hard-soft distinction is not meant to be flattering to that which is considered soft; and many natural scientists, who misunderstand the nature of social measurement, believe that the social sciences do not constitute science at all. According to biologist Jared Diamond (1987), however, this criticism misses two crucial points. First, all scientists, natural or social, face the task of operationalizing concepts. As Diamond says, "To compare evidence with theory requires that you measure the ingredients of your theory." Second, the "task of operationalizing is inevitably more difficult and less exact in the [social] sciences, because there are so many uncontrolled variables."

Diamond illustrates operationalization with examples drawn from both the natural and social sciences. Learning how various scientists go about this task should help your understanding and appreciation of the measurement process. The first example comes from mathematics. As Diamond says,

I'd guess that mathematics arose long ago when two cave women couldn't operationalize their intuitive concept of "many." One cave woman said, "Let's pick this tree over here, because it has many bananas." The other cave woman argued, "No, let's pick that tree over there, because it has more bananas." Without a number system to operationalize the concept of "many," the two cave women could never prove to each other which tree offered better pickings. (p. 38)

Diamond's second example comes from another "hard" science, analytical chemistry, which generally seeks to measure the properties of substances.

When my colleagues and I were studying the physiology of hummingbirds, we knew that the little guys liked to drink sweet nectar, but we would have argued indefinitely about how sweet sweet was if we hadn't operationalized the concept by measuring sugar concentrations. The method we used was to treat a glucose solution with an enzyme that liberates hydrogen peroxide, which reacts (with the help of another enzyme) with another substance called dianisidine to make it turn brown, whereupon we measured the brown color's intensity with an instrument called a spectrophotometer. A pointer's deflection on the spectrophotometer dial let us read off a number that provided an operational definition of sweet. (p. 38)

One of Diamond's "soft" science examples is taken from the field of clinical psychology, specifically his wife Marie Cohen's work with cancer patients and their families. Marie was interested in how doctors reveal the diagnosis of cancer. What determines how frank they are and how much information they withhold? She guessed that this

might be related to differences in doctors' attitudes toward things like death, cancer, and medical treatment. But how on earth was she to operationalize and measure such attitudes . . . ? . . . Part of Marie's solution was to use a questionnaire that other scientists had developed by extracting statements from sources like tape-recorded doctors' meetings and then asking other doctors to express their degree of agreement with each statement. It turned out that each doctor's responses tended to cluster in several groups, in such a way that his [or her] responses to one statement in a cluster were correlated with his [or her] responses to other statements in the same cluster. One cluster proved to consist of expressions of attitudes toward death, a second cluster consisted of expressions of attitudes toward treatment and diagnosis, and a third cluster consisted of statements about patients' ability to cope with cancer. The responses were then employed to define attitude scales, which were further validated in other ways, like testing the scales on doctors at different stages in their careers (hence likely to have different attitudes). By thus operationalizing doctors' attitudes, Marie discovered (among other things) that doctors most convinced about the value of early diagnosis and aggressive treatment of cancer are the ones most likely to be frank with their patients. (p. 39)

Notice how the problem (finding and creating ways of operationalizing one's intuitive concepts) is the same in each case. Notice also how operationalization can be very indirect, as in both the chemistry and clinical psychology examples, irrespective of the accuracy of the measurement. Finally, these examples might suggest, as Diamond (p. 39) concludes, that the "ingrained labels 'soft science' and 'hard science' could be replaced by hard (i.e., difficult) science and easy science, respectively." For the social sciences "are much more difficult and [to some] intellectually challenging than mathematics and chemistry."