

## SAMPLING—A BASIC PSYCHOLOGICAL OPERATION

Harold R. Fossler

University of South Dakota

We do not propose to make anything deep or mysterious out of the concept of sampling. What we shall describe by that term is a matter of everyday experience for each one of us. Let me illustrate by a few examples. We look out at the weather in the morning and plan for a picnic. We taste the soup and decide it is excellent. We examine a small piece of cloth and order a suit on the basis of it. We examine the corn on various farms and estimate the prospects for a crop. We count grasshopper eggs in soil taken here and there and lay in a supply of hopper-bait. We look at the stock quotations and decide that business is sluggish. We listen to a news commentator and send telegrams to Washington. We observe a few symptoms and send the patient to a hospital for an operation. We glance over a few pages of a book and decide that it is dull. We hear a bit of gossip and become fluttery. We listen to some atrocity stories and go to war. Someone utters the words, Democracy, Progress, Science says, and we fall upon our knees. We meet an Englishman whom we don't like and decide that the English are contemptible. We imagine an account of the origin of the Universe and we get nasty with others who remain unimpressed. A man is called a politician and we set him down as a rogue. We argue from a few abstract premises and make pronouncements upon the nature of things. We have ideas upon public questions and profess amazement that any intelligent person could think otherwise. In short, we do endless astonishing things on the slenderest bits of information and often take the consequences without relish.

Is there anything which one may abstract from such an array of doings that may serve as a tool of investigation and correlation? Let it be noted that all these bits of experience perform a representative function. Each bit purports to represent a segment of experience beyond itself.

The term, domain, will be used to designate any such segment which purports to be represented. If you prefer, "domain" may be translated by frame of reference, realm of discourse, problematic situation, or field. The term, sample, will be used to designate any such bit which purports to represent some domain. This sample-domain relation is therefore a functional relation. What may be designated as domain in one situation may be regarded as sample in another, and on the other hand, what is sample in one situation may be domain in another, depending upon the function performed. These terms express a relativistic relation. In no case may they be interpreted in any absolute sense. This representative function is a matter of degree. The sample may be regarded as more or less adequate for the domain. What may be sufficiently adequate for one purpose may not be adequate for another. Consequently the notion of standard must be included. In the ideal case the limits within which the sample shall be declared to be adequate must be indicated, the domain must be precisely specified, and the sample must be precisely specified, precision meaning the highest attainable at the time. The relation then will be relative to the precision with which sample, adequacy, and domain are specified. This functional emphasis does not militate against nor detract from the importance of formal or structural factors, which are essential to any complete description.

The sampling operation varies widely in terms of these variables from dim vagueness in sample and domain with negligible adequacy in many daily affairs to the highest precision and adequacy as revealed in the most carefully worked fields of advanced research in science. The world in which we live is too vast and complex for us to comprehend it in all its variety, richness, and detail. Even in those regions where we come into the most intimate contact with it and where we press our investigations with the utmost vigor and vigilance we appreciate the frontiers still beyond us. Other regions remain scarcely touched. We live day to day by our samples. On the basis of them we judge the rest. We are

grateful when they are sufficient for the purpose. All too frequently for comfort we are obliged to revise them.

Think of a landscape viewed by a farmer, a geologist, a real estate agent, an oil prospector, and a fisherman. Each abstracts from the landscape those features, aspects, or relations which are relevant to his purpose. This purpose is part of the frame of reference, or domain, in terms of which the abstracting or sampling is done. No one sampling forbids any others. Domain and sample may be more or less precisely specified and the sample be more or less adequate for the domain. If adequacy falls short of requirement, either sample, domain, or both must be readjusted by successive approximation. What may be sufficiently adequate for the farmer may not be at all adequate for the geologist.

I believe it is generally conceded that workers in any field are privileged to limit the scope of their problems, to adopt appropriate methodology, and to develop concepts that shall enable them to come to grips more successfully with their problems. In the development of the concept of sampling I am simply availing myself of that time-honored privilege. There is no quarrel with anyone who may prefer other concepts. We are grateful for assistance from any source, regardless of the conceptual tools employed.

Since sample and domain are relative to each other and adequacy is relative to both of them, it is clear that whenever we are confronted with what is called a problematic situation we must look carefully to these three aspects. It is also clear that what is called a solution will be limited to the specifications of these variables. If a certain domain be given, the problem becomes one of determining a sample of it that shall be adequate within certain limits. Sometimes a sample is given and the problem is to determine whether or not some domain is adequately represented by it. Tightening the requirement of adequacy may compel a readjustment in either or both sample and domain. The more precisely these variables are specified, the more dependence we may put in the results within the limits; the more nearly we may be said to know what we are talking about; and

the more readily may the results be tested by others. Such samplings as we have been able to gather together constitute our stock in trade for attack upon new problems.

From what has been said it may be conceded that what is called scientific method exhibits the sampling operation in both its analytic and synthetic aspects. The experimental conditions together with the purpose of the experiment constitute the domain of operations. Given the experimental setup, certain selected operations are performed, a certain posture of observation is taken, and certain results are obtained. These selected experimental results constitute the sample which, if one be fortunate, will be adequate within the limits specified. The great precision with which the experimental domain is specified, the elaborate instrumentation and meticulous operations with which experiments are carried out in advanced fields of research exemplify vividly what we call sampling in its greatest refinement. This stands in contrast to the examples offered at the beginning which exhibit the operation in the crude and the rough. The operation is exemplified throughout that range whenever a human being works at a problem. From top to bottom these two questions emerge: What is an adequate sample of this domain? and Of what domain is this an adequate sample? Only as sample, domain, and adequacy are specified, do we know what we are talking about.

The concept of correlation and its dignified companion, law, may be envisaged under the concept of sampling. Uniformities specified at various levels of abstraction are observed within certain domains. Such uniformities are called laws. What may be a law within one domain may not be a law for another domain. The extension of a law to a new domain in advance of investigation always has an element of hazard in it. The concept of sampling emphasizes what is involved in the hypothetical extension of samples to domains involving other boundaries than those within which the sample was determined by experiment to be adequate. This goes under the name, extrapolation. The effectiveness and validity of the sampling operation are not reduced by a

candid recognition and emphasis upon its relativistic, contingent, and limited character.

Another exemplification of sampling is found in what is called classification. If one be confronted with a variety of specimens, one proceeds to examine them with a view of selecting a set of characteristics according to which groups may be made. The problem is to break up the large domain of specimens into sub-domains such that each specimen shall have some domain of which it is representative. If on the other hand a variety of classes is already established, given a new specimen, the problem is to determine of which domain the specimen is representative. Systematic zoologists, for example, recognize the relativistic character of their classifications for they have been called upon from time to time to readjust them as new specimens have come in. No one is exempt.

The concept of sampling is not only exemplified in the realm of perceptual things and operations. It is exemplified equally well in those domains sometimes described by the term, pure reason, such as theology, metaphysics, logic, or mathematics. In these fields a domain is specified in terms of a set of undefined concepts, a set of postulates, and a set of rules of operation. Samplings must be specified in terms of these elements just as the domain is specified in terms of them. But the representative function still remains basic. The logical criteria of independence and consistency take the place of experiment as a test of sampling. Logicians are as hard pressed to develop their postulate systems in order to come out where they want to, as are the experimentalists. Once they set up a domain they must abide by the rules. Although they are dealing with specified abstractions rather than perceptual things they are obliged to have respect for their abstract entities once they have been set up. The subject matter may be different from that of the experimentalist but the sampling operation is exemplified just the same. The same sample-adequacy-domain relation persists. If one refers theological, metaphysical, mathematical, or experimental problems to their respective domains, and if one observes the operations by which solutions are sought for,

it will become apparent that notwithstanding the differences, the sampling concept is exemplified in all of them. Samples, regardless of the language in which they are described, are judged according to some criterion of adequacy. Critics contend that certain samples are inadequate to the domains which they purport to represent, and that domains are extended or confused without justification. The controversies of the experts in these respective fields leads one to the suspicion, in the light of the sampling concept, that the alleged certainties, necessities and universalities of the abstract domains are just as contingent in their way as the pronouncements of the experimentalists are in their way. Remove the boundaries in any of these domains and the domain simply disappears, and nothing meaningful can be said.

The world stands wide open to us. We are free to operate upon it and within it. We are at liberty to carve out for exploration any domains we please and to sample them in any way we please. But we cannot dictate the results. As time goes on we discover some things which work within limits as well as things which don't seem to work at all. It is hoped that the concept of sampling will be useful in keeping constantly before us this sample-adequacy-domain relationship. The simplicity of the concept, the wide scope which it covers, as well as the relationships which it exhibits among a large number of apparently diverse fields should recommend it. It should help one to view as impersonally as possible relationships so often obscured by terminology which through the accretion of sentimental flavor serves largely to sanctify or to damn while it purports to describe objectively. It should be of assistance in keeping our domains of operations distinct so that what may be appropriate to one domain shall not be dragged into another where it may not hold. Since our psychological concepts have long represented a confusion of theological, metaphysical, and experimental domains, it is hoped that this concept of sampling will bring clarity in its insistence upon respect for the boundaries of domains.

Such in bare outline is the concept of Sampling, itself but a skimpy sample of the extensive range of its applica-

tions. It is merely the framework, not the development. The main elements in it simply have been mentioned. Although it is offered as a basic psychological operation, it does not pretend to be the only one. There are others. The relations envisaged are significant relations but they do not purport to be the only significant ones. There are others. It should be regarded as a conceptual tool among others, all of which are of limited scope, all of which stand or fall on the basis of the service they render in the clarification and the solution of our problems.