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SAMPLING TECHNIQUES

Sample Types and Sample Size

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In research, the term population refers to a well-defined set of **UNITS OF ANALYSIS** that are the focus of the study. The number of units that make up the population is symbolized by an upper-case *N*. These units of analysis can correspond to a set of individuals, countries, organizations, agencies, events, news items, years, scores, books, decisions, reforms, laws, etc. Let us consider a researcher interested in the study of how members of parliaments (MPs) conceive their roles as citizens' representatives. The population of the study (*N*) includes all members of parliaments in the world (46,552 according to the Global Parliamentary Report).[1]

However, researchers may restrict their data collection to a sample of that population for convenience or necessity if they lack the time and resources to collect data for the entire population. Therefore, a sample is 'any subset of units collected from a population' (Johnson and Reynolds 2012: 224). Its size is denoted by a lowercase *n*. The units that make up the sample are also referred to as 'elements' or 'individuals'. In our example, the researcher may lack the time, resources, or the willingness to collect data on all MPs in the world, and will proceed to select a number of MPs (*n*) from this population.

Research sampling techniques refer to **CASE SELECTION** strategy—the process and methods used to select a subset of units from a population (in our example, selecting MPs). While sampling techniques reduce the costs of data collection, they induce a loss in terms of comprehensiveness and accuracy, compared to working on the entire population. The data collected are subject to errors or **BIAS**. Two main decisions determine the size or margin of error and whether the results of a sample study can be generalized and applied to the entire population with accuracy: the choice of sample type and the sample size.

[1] http://archive.ipu.org/ (accessed 2 November 2017).

TYPES OF SAMPLES

In order to apply the findings derived from the sample to the general population (with a known sampling error), samples must be drawn using probability sampling methods.

A probability sample is a sample for which the probability of selecting each **UNIT OF ANALYSIS** (in the population) is known. In our example, probability sampling indicates the known probability that each MP in the world will be chosen for the subset of selected MPs. This allows the researcher to calculate how accurately the sample reflects the population and to infer or generalize the results to the population with a known margin of error. The four main probability sampling methods are: simple random sampling, systematic sampling, stratified sampling, and cluster sampling.

In a *simple random sample*, each **UNIT OF ANALYSIS** has an equal chance of being included in the sample. Units are randomly selected, preferably using a computerized system to reduce human interference, which may subconsciously introduce patterns, and therefore **BIAS** (Hibberts, Johnson, and Hudson 2012: 55–56). In our example, the researcher could use a random computerized technique to select MPs (from the world list) to include in the sample. (For additional examples of simple random techniques, see Johnson et al (2016).)

In a *systematic sample*, an interval *k* is determined by dividing the population size by the sample size (*N*/*n*). Then, a random starting point is selected from where the researcher selects every *k*th unit from the list of the population. This technique is sometimes easier to implement than computerized techniques. However, to avoid **BIAS**, it should not be used if the **UNITS OF ANALYSIS** are ranked in a list based on certain characteristics, or if they follow a certain pattern. In our example, the interval (*k*) would be determined by dividing the population size (46,552 MPs in the world) by the desired sample size (*n*), the number of MPs to include in the sample (for instance, 4,900). In this example, $k = 9.5$ (46,552/4,900). From the list of all MPs in the world, the researcher would randomly select a starting point (e.g. MP number 145) as the first unit in the sample. Then, the researcher selects every 9th MP on the list until they reach the necessary sample size or the required number of MPs to include in the sample (*n*). In this case, it is crucial to make sure that the list of MPs is not ordered according to specific characteristics, such as country or party of origin, gender, etc.

In a *stratified sample*, **UNITS OF ANALYSIS** are divided into groups based on one or more characteristics. If a sample is composed of individuals, these are usually socio-demographic characteristics. Then, units are selected within each group, using a simple random or systematic sample technique. Commonly, stratified samples are proportional—the sample size of each group is relative to their size and distribution in the population. Thus, the sample resembles the population as far as possible in terms of these characteristics. This is a way of avoiding **BIAS** when generalizing about the entire population, if we know from prior studies that these characteristics affect the object under study. Stratified samples can also be disproportional, so the sample size of each group differs from its proportion in the population. Here, certain groups may be over- or under-represented to compensate for small groups, which would generate a small *n* in the sample. It is used if the researcher intends to conduct analyses on the subgroups. In this case, the researcher uses weights to generalize about the population to compensate for these choices. In our example, all of the world's MPs could be grouped by country, and MPs to include in the sample could be randomly selected in each country. The number of MPs per country to include in the sample could be proportionate to the size of that country in relation to the total population of MPs in the world (proportionate stratified sample). However, the researcher could decide to over-represent MPs from smaller countries (e.g. Micronesia, which has just fourteen MPs) and under-represent MPs from larger countries (e.g. China, where the congress has 2,924 members) to ensure that there are enough MPs from each country (disproportionate stratified sample). In this case, when analysing the results, the researcher will have to use weights to correct the over- or under-representation of certain groups in the sample.

In a *cluster sample*, units that share one or more characteristics are put into groups. Then, only certain groups are randomly selected. Within each selected group, units are selected using random sampling. In our example, the researcher could randomly select a certain number of countries and then randomly select MPs in those countries. Cluster samples increase error, but can be useful to reduce the costs of data collection (e.g. when the **UNITS OF ANALYSIS** are geographically spread out). In our example, only selecting MPs from certain countries would reduce the costs of data collection. Cluster samples can also be used if information about the full population is not available.

Non-probability sampling

Probability samples are generally preferred because they increase accuracy and allow inference or generalization about the population. However, they are more expensive and not always an option because they require a list of all the units of analysis included in the population (and their characteristics, for stratified and cluster samples). In contrast, non-probability samples are samples in which each element in the population has an unknown probability of being included in the sample. In this case, inference or generalization cannot be conducted with a known margin of error or **STATISTICAL SIGNIFICANCE**. Therefore, they are generally not recommended in **SURVEY RESEARCH**. However, they may be useful for **EXPERIMENTS**, **INTERVIEW TECHNIQUES**, exploratory and qualitative research, or if the target population is impossible to identify. The four main non-probability sampling methods are: convenience sampling, purposive sampling, quota sampling, and snowball sampling.

In a *convenience sample*, **UNITS OF ANALYSIS** are included in the sample because they are available, as well as easy and convenient to select in the study. In our example, the researcher could include in the sample MPs from their country of origin and from neighbouring countries.

In a *purposive sample*, the researcher determines the characteristics of the target population and identifies units that match these characteristics to include in the sample. In our example, this would mean identifying all MPs from European parliamentary democracies and targeting them for the sample.

In a *quota sample*, units of analysis are divided into groups based on one or more characteristics. Then, units are selected within each group, using a purposive or convenience technique, which may or may not be in proportion to their distribution in the population. This technique is similar to a (dis)proportionate stratified sample, except that units are not randomly selected within the groups, but selected by purposive or convenience methods. In our example, this would mean dividing MPs into subgroups based on their country or party of origin, and then conveniently selecting MPs in these groups (the sample may or may not be proportional to their size in the population).

Lastly, in a *snowball sample*, the **UNITS OF ANALYSIS** (which must be individual respondents) identify potential additional respondents to include in the sample. In our example, this would mean targeting one MP and then asking them (in an interview) to identify colleagues to add to the sample. This is particularly useful for populations or worlds that are not easy to penetrate.

SAMPLE SIZE

When building a sample, a key decision relates to sample size. The larger the sample, the smaller the errors. At full sample size (i.e. when the entire population is included in the study), there is no error.

Contrary to common belief, sample size is not usually determined by population size, unless the population is rather small. In fact, the relationship between sample and population size is exponential (see Table 9). The factors that do determine sample size, however, are: the degree of heterogeneity of the population (more heterogeneity requires a larger sample); the expected differences between groups in the population (smaller expected differences require a larger sample); the sampling technique used (more complex sampling techniques require a larger sample); the type of analyses to be conducted (subgroup analyses require a larger sample); the margin of error the researcher is prepared to tolerate (lower margin of error requires a larger sample); and the expected response rate (in the case of a survey, a low response rate calls for a large sample).

Overall, thus sample type and sample size are two crucial pieces of information that researchers should have in mind when selecting a sample or using existing samples in their studies.

TABLE 9 **Relationship between population size and sample size, based on margin of error (simple random sampling)**

Population	Size of the sample needed based on a margin of error of … (based on simple random sample)		
	10%	5%	1%
100	50	80	99
500	81	218	476
1,000	88	278	906
10,000	96	370	4,900
100,000	96	383	8,763
1,000,000 and more	97	384	9,513

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SCIENTIFIC REALISM

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Metaphysical realists have long maintained that the world is real, and while reality may be independent of concepts, our concepts can make references to it and its essences. Medieval nominalists denied this and maintained instead that abstract concepts or universals are names only. For a nominalist, only particular or concrete beings exist. Thus to name a particular four-legged creature a 'dog' is just a human convention.

The debate between realism and nominalism assumed new meanings after pragmatically successful breakthroughs in physics, chemistry, biology, and medicine from Newton to Maxwell and from Jenner to Darwin. Especially since the nineteenth century, nominalists have been allied with modern-day empiricists, who tend to treat scientific theories instrumentally (theories are just tools indicating means to achieve ends), while realists have fixed their eyes on the realisticness of scientific theories (the task of theories is to depict reality). Both parties agree that modern scientific theories work better than earlier forms of human understanding. The question is: is this because they capture real essences and properties of the world? Or is it because we can formulate theories that may work and accord with observations, but have no necessary bearing on any deeper understanding of reality? Is the success of our theories just a miracle?

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After the heyday of empiricism in the interwar period and its immediate aftermath (see **POSITIVISM AND POST-POSITIVISM**), many critical reactions to empiricism seemed to suggest scientific realism. For instance, Quine (1951) contested the idea of atomistic facts and Bunge (1959) the idea that **CAUSATION** is only or mainly about