STATISTICAL INSINUATION

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At least since Daryl Huff followed up on Disraeli's gibe about "lies, damn lies, and statistics" with a primer on *How to Lie with Statistics*, alert readers and scrupulous authors have been wary of certain statistical manipulations. Truncated axes on graphs, bar diagrams with three-dimensional figures, and overuse of such verbal sleight-of-hands as "fully 12 percent" or "only 97 million" bring on knowing nods and smiles of derision.

Far subtler and more interesting is the statistical distortion discussed by Philip J. Cook in his "Insight" about "Guns and Crime: The Perils of Long Division" in the first issue of JPAM. Cook begins by quoting the statistic that "the odds of any gun being criminally used are roughly on the order of one in 400" per year. This statistic is intriguing because it illustrates not flagrant deception, but subtle implicational distortion—so insidious that the various researchers who have compared the *rate* of crime with the *stock* of guns have probably been unaware of the misleading nature of that kind of comparison. Cook shows that it is equally factual—and, he suggests, more informative—to conclude that "at least 33 crimes involving 1977-vintage handguns will eventually be committed for every 100 sold in that year."

On further reflection, the issue becomes more complex. Although Cook's statistic may be the more informative, the other statistic is not without interest: The two statistics together communicate a fuller picture of the truth than either does alone. Both statistics are policy relevant, but neither is policy decisive. The undercurrent of the first statistic drags the unresisting reader toward the conclusion that handgun control can hardly be cost effective; Cook's statistic pulls in the opposite direction. Neither of these policy conclusions is justified, as many other factors have to be weighed. For instance, how successfully could handgun control be enforced? To what extent would knives and brute force be substituted for handguns in crimes? How many murders would handgun control avert? Furthermore, in addition to estimating such empirical relationships, various value tradeoffs have to be assessed. For instance, in social terms, do the lawful benefits of handgun ownership outweigh the costs of the murders and mayhem that are generated by the lack of control?

Consider a second example. As part of a study of the possible health hazards of eating eggs,[1] I calculated an array of decision-relevant statistics, presented in Table 1. All of the statistics are of limited value because they are "prudent overestimates" based on two questionable assumptions: that increased consumption of cholesterol will raise blood cholesterol levels, and that elevated blood cholesterol levels increase the likelihood of coronary artery disease. Furthermore, all except the last estimate assume that the foods that would be consumed instead of eggs are harmless. What is interesting about the estimates is that they are all based on the same body of statistical evidence: They are consistent and equally valid, but they convey very different implications.

Which of the statistics is the most useful and reliable in measuring the harmfulness (or harmlessness) of eggs? None of the

Table 1. Some prudent overestimates of the health hazards of eating eggs.

—Each egg that the average American cuts out of his or her weekly consumption of eggs will reduce the yearly chances of dying from coronary heart disease by about one-third of 1 percent.

—For a U.S. male, this one-third of 1 percent reduction would lower the chances of death at age 40 by about one in 1,000,000 and at age 80 by about one in 10,000.

—The addition of one egg per day to the typical U.S. diet would result in more than a 5-percent increase in the incidence of coronary heart disease.

—Totally eliminating eggs from our diet might increase life expectancy by 20 days.

—Each egg consumed reduces average life expectancy by roughly one minute.

—Totally eliminating eggs from our diet might reduce the number of deaths from coronary heart disease in the United States by 10,000 per year.

—One death occurs for every 6 million eggs eaten.

—Eating four eggs is about as hazardous as smoking a cigarette.

—Eating seven dozen eggs is about as hazardous as smoking a single pack of cigarettes.

—Eating two eggs is about as hazardous as eating two ounces of frankfurter, cheese, or steak.

various groups of people with whom I have discussed this question has been able to agree on a single, best statistic. Taken together, the estimates comprise an informative mosaic, but any one of them, by itself, is condemned by at least some people as misleading.

Nearly all statistics used in policy analyses are really vectors: They not only summarize a body of data, but they also imply a policy thrust. If they did not, they would not be relevant or interesting. What is disturbing about the two examples discussed above is that the vector can be redirected merely by reexpressing the statistic. This possibility, although largely unrecognized, seems to be the rule rather than an anomaly.[2] Accordingly, statistical analysis for policymaking is fundamentally different from, and more difficult than, statistical analysis for descriptive scientific research.

Hardly any effort has been devoted to uncovering the laws and patterns of statistical implication. Recently, however, some cognitive psychologists have begun to study how the "framing" of a decision problem affects choice.[3] In a decade or two, an enterprising scholar will probably be able to write a primer on *How to*

Insinuate with Statistics. Policy analysts will want to keep abreast of research in this area and perhaps participate in it.

In any case, in doing policy research, in teaching public policy students, and in reviewing research submitted to policy journals, more attention should be given to calculating alternative expressions of a fact and then to consider which statistic or set of statistics conveys the fact with appropriate richness. Since most important policy facts are multifaceted, sightings from several perspectives are needed. Furthermore, scrupulous authors should take pains to alert readers to lurking, unjustified policy insinuations. This would help reduce the risk of misleading implications as well as factual error.

Despite all efforts to raise statistical consciousness and analytical standards, implicational bias in statistical presentation can be expected to continue. The bias may be deliberate or unconscious; it may be the result of rationalization or of a desire to be interesting; or it may be the outcome of researcher's set of personal values. Because bias is so close to unavoidable in policy analysis, a balanced view may more likely emerge from adversarial confrontation than from the unduplicated efforts of even the best-intentioned analyst.

It has long been recognized that policy analysis differs from scientific research because, in addition to requiring estimates of causal relationships, it also requires tradeoffs among competing values.[4] That the very presentation of policy facts can be insidiously colored by value implications makes the separation of the universes of fact and value extraordinarily difficult and heightens the advantages of the democratic institutions of review, redundancy, and debate.

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NOTES

1. Vaupel, James W., and Graham, John D., "Egg in your bier?," *The Public Interest,* No. 58 (Winter 1980): 3.
2. Tversky, Amos, and Kahneman, Daniel, "The framing of decisions and the psychology of choice," *Science, 211* (January 30, 1981): 453; and Slovic, Paul, Fischoff, Baruch, and Lichtenstein, Sarah, "Informing people about risk," in M. Mazis, L. Morris, and I. Barofsky, Eds. *Product Labeling and Health Risks,* Banbury Report 6 (Cold Spring Harbor, NY: The Banbury Center, 1980).
3. *Ibid.*
4. Shils, Edward A., and Finch, Henry A., Eds. *Max Weber on the Methodology of the Social Sciences* (Glencoe, IL: The Free Press, 1949).