QnAs with Gary King

Gary King, a professor of social science at Harvard University and a member of the National Academy of Sciences, fashions tools that harness the power of statistics, machine learning, and informatics to make sense of the numbers that matter to society. From evaluating the efficacy of a Mexican health policy reform to predicting the fate of the US Social Security trust fund, King's sophisticated number crunching has important practical implications for disciplines as diverse as social, political, and health sciences. King tells PNAS how quantitative social science research can extend from academic journals into real-world scenarios.

Gary King.

PNAS: You designed a health policy experiment to evaluate the Mexican health care program, *Seguro Popular*, which was aimed at reducing health care costs for the poor. What was new about this experiment, and what did you find?

King: Most large-scale public policy experiments fail mainly because study participants prefer to be in the treatment group rather than in the control group. Also, there is often political opposition to the random assignment of people to different groups because that's not how government projects are typically executed. After all, the job of politicians is to try to ensure that their constituents benefit from policy measures, not to conduct scientific research. However, breaking the randomization of subject assignment destroys the scientific validity of the evaluation of a program's effectiveness. So we designed an experiment to evaluate *Seguro Popular* that could withstand many types of political intervention. The goal of the evaluation was to determine if the program led the poor to spend less money out of pocket on medical expenses. We compared matched pairs of communities that were similar in age, health and economic indicators, physical infrastructure, etc., and then randomly assigned each community within a pair to treatment or control groups. We showed that using matched pairs—rather than complete randomization—was a more efficient, powerful, robust, and economical way to evaluate the program's effectiveness. We found that the program on the whole was a success—and that the money did make it to the poor.

PNAS: You developed statistical procedures for the *New York Times* investigation of the counting of absentee ballots during the 2000 US presidential election. How did the procedures help?

King: Absentee ballots were crucial to George W. Bush's victory over Al Gore by 537 votes in Florida. There are rules governing the appropriate casting and counting of absentee ballots. For example, if the return address on an overseas absentee ballot envelope is a domestic one, obviously, the ballot should not be counted. However, it is not always possible to link every absentee ballot to its envelope because the ballots are separated from the envelopes for counting. So we knew the number of votes cast in each Florida county for Bush and for Gore, and we knew the total number of invalid votes cast—but not the number of invalid votes cast *for each candidate.* We performed statistical modeling to determine the percentage of valid votes that each candidate received using a method called "ecological inference." The model proved helpful to the *Times* investigation; it showed that the actual margin of Bush's victory was probably half of 537—and that's considering only absentee ballots.

PNAS: Let's talk about the political implications of your work. How can statistics help predict political turmoil?

King: One example of this work is state failure, a situation where a government loses its ability to impose the rule of law on its citizens, and, as a result, chaos, civil war, and high mortality rates typically ensue. This may be what's happening in Egypt at the moment. There have been many past examples of state failure, such as in Sudan, Iraq, and Afghanistan. Determining which countries are at a risk of implosion is important from the points of view of military intervention and humanitarian aid. Starting in the mid-1990s, the US State Failure Task Force made forecasts of state failure based on data they had collected. We evaluated their forecasts, corrected their methods, and showed how we could improve their accuracy. A number of the task force's estimates were off by a wide margin. For example, the task force predicted that Brazil had a 72% probability of failing, whereas, in reality, the probability was about 11%.

PNAS: In your PNAS inaugural article you describe a computer-assisted clustering method to analyze text. What sorts of text?

King: The digital revolution has made enormous amounts of unstructured text—such as e-mails, social media posts, speeches—available to researchers for analysis. We've developed automated methods to better discover, extract, and summarize information from unstructured text. For example, reports on the activities of Members of Congress have long been categorized as advertising, position taking, or credit claiming. Our method of computer-assisted cluster analysis of press releases from Members of Congress helped group the documents into the three recognized categories. However, we also found a fourth category we call "partisan taunting." A classic example of partisan taunting is the infamous "You lie!" comment addressed to President Obama. It turns out there's a lot of taunting going on in the form of explicit attacks with no real policy content—about 27% of Congressional press releases, we found, were partisan taunts. This is a kind of Congressional behavior that political scientists had missed for decades. Now that we can measure it, we can begin to address it.

PNAS: Your statistical analysis has made worrisome predictions about the solvency of the Social Security trust fund. How grim are these predictions?

King: This analysis was an application of our method to forecast mortality rates by taking into account a lot more information than was previously possible to include. Our method helped predict that there will be about 730 billion dollars less than the amount the Social Security Administration originally projected in the trust fund by the year 2030. The policy implications are clear: To avoid the fund's insolvency, taxes will need to be raised, or benefits might have to be reduced.

PNAS: Your work spans a range of disciplines. How do you choose your research topics?

King: I try to choose projects that require original contributions to abstract methodology development and to real-world implementation of statistical concepts. For each of the applications we've discussed there was a new statistical theory or method that was translated into a practical application—often with accompanying software that people can use. These are the projects that interest me most.

Prashant Nair, *Science Writer*