RESEARCH YOU CAN USE

A "New" (250-Year-Old) Way of Thinking about Statistics

My last column (October) was critical of a recent *JAPA* article by Echenique et al., which, in my view, neglected mountains of evidence in order to make the case that changes in urban form would have little effect on regional sustainability. This month, I will pivot to two more publication-worthy articles coming up in *JAPA* and *JPER*, and promise never again to return to the offending study. But first I want to make one more point.

When I wrote the October column, I was unaware that I was arguing for a Bayesian approach to planning research. Bayesian theory and its inventor are the subjects of a best-selling book by Nate Silver called *The Signal and the Noise: Why So Many Predictions Fail—but Some Don't*. The book describes the work of a statistician named Thomas Bayes, who lived in 18th century England and who came up with a dramatically new way of thinking about probability. After hearing Silver on NPR and the *Daily Show* talking about the odds of victory for the two candidates in last month's presidential election, I ran out and bought the book. But it wasn't until I read it that I realized that there is an alternative to the conventional way of testing research hypotheses.

Bayes's theory is concerned with conditional probability—the probability that a hypothesis is still true even after an event has taken place that provides evidence to the contrary. In short, a single event isn't likely to dramatically change the odds because the probability after the event depends not only on the event but on prior probabilities, or "priors." Another characteristic of Bayesian statistics is that predictions are constantly being refined as new events occur, new data become available, and prior probabilities change. In our times, presidential election odds change with new polls, new economic news, and new debate performances. Thus, Silver had to repeatedly revise his priors and his election predictions.

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BAYES'S THEOREM APPLIED TO URBAN FORM

Prior probability that urban form matters		
• Initial estimate of likelihood	x	95%
New simulation concludes that urban form does not matter		
• Probability of simulation result if it matters	y	20%
• Probability of simulation result if it does not matter	z	100%
Posterior probability that urban form matters		
• Revised estimate of likelihood that urban form matters, in light of simulation	$\frac{xy}{xy+z(1-x)}$	79%

Reid Ewing

Now check out typical quantitative studies published today. The only nod to prior research—or to any sort of context—is found in an article's literature review or, occasionally, in its conclusion. In the table above, I have applied Bayes's theorem to the urban form question. The prior probability that urban form matters is very high. Considering more than 200 land-use travel studies and 100 regional scenario studies, I set the prior probability at 95 percent. Then along came a simulation and a *JAPA* article that concluded the opposite.

Under reasonable assumptions, Bayes's theorem tells us that, even after the simulation, there is still a 79 percent chance that urban form matters. This kind of probabilistic thinking is entirely absent from the Echenique article. Instead, its authors make sweeping conclusions about the inconsequence of urban form ("overconfident conclusions," Silver would say).

Moving on (let it go, Reid), let's look at two recent articles that, while well-constructed and admirable in many ways, illustrate a non-Baysian view of probability. The *JAPA* article, by Bernadette Hanlon, Marie Howland, and Michael McGuire, evaluates Maryland's smart growth program. Using conventional statistics in the manner of R.A. Fisher (another English statistician who was a critic of Bayes), they model farmland conversion under the state's program and then use the model to "predict" conversions. They conclude that "Maryland's incentive-based strategy is not completely effective at preventing sprawl."

The *JPER* article, by Aaron Golub, Subhrajit Guhathakurta, and Bharath Sollapuram, addresses the effects on property values of light-rail transit in Phoenix. Using Fisher's approach, they develop a hedonic price model that also passes a conventional significance test. They then create price profiles and confirm "the value of proximity" to light-rail stations. Mind you, I am not suggesting that these conclusions are wrong. I suspect they are right. I am just saying that they ignore prior probabilities in making statistical inferences.

According to Silver, hypothesis testing without regard to prior research is on the way out. "Some professions," he writes, "have considered banning Fisher's hypothesis test from their journals. In fact, if you read what's been written in the past ten years, it's hard to find anything that does not advocate a Bayesian approach." But you wouldn't know that from reading planning journals. Why are planners the last to know? ■

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