



## The Flaw of Averages

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**C**onsider the case of the statistician who drowns while fording a river that he calculates is, on average, three feet deep. If he were alive to tell the tale, he would expound on the “flaw of averages,” which states, simply, that plans based on assumptions about average conditions usually go wrong. This basic but almost always unseen flaw shows up everywhere in business, distorting accounts, undermining forecasts, and dooming apparently well-considered projects to disappointing results.

Let’s say that a company I’ll call HealthCeuticals sells a perishable antibiotic. Although demand for the drug varies, for years the average monthly demand has been 5,000 units, so that’s the quantity the company currently stocks. One day, the boss appears. “Give me a forecast of demand for next year,” he says to his product manager. “I need it to estimate inventory cost for the budget.” The product manager responds, “Demand varies from month to month. Here, let me give you a distribution.” But the boss doesn’t want a “distribution.” “Give me a number!” he insists. “Well,” the manager says meekly, “the average demand is 5,000 units a month. So, if you need a single number, go with 5,000.”

The boss is asking for a model.

The boss wants a simpler -- but perhaps more error prone -- model.

The product manager wants to give the boss a more complex model.

## Show Me the Number

Executives' desire to work with "a number," to plug in an average figure, is legendary. But whenever an average is used to represent an uncertain quantity, it ends up distorting the results because it ignores the impact of the inevitable variations. Averages routinely gum up accounting, investments, sales, production planning, even weather forecasting. Even the Generally Accepted Accounting Principles sanction the "flaw," requiring that uncertainties such as bad debt be entered a single number.

In one celebrated, real-life case, relying on averages forced Orange County, California, into insolvency. In the summer of 1994, interest rates were low and were expected to remain so. Officials painted a rosy picture of the county's financial portfolio based on this expected future behavior of interest rates. But had they explicitly considered the well-documented range of interest-rate uncertainties, instead of a single, average interest-rate scenario, they would have seen that there was a 5% chance of losing \$1 billion or more—which is exactly what happened. The average hid the riskiness of their investments.

More recently, a failure to appreciate the flaw led to \$2 billion in property damage in North Dakota. In 1997, the U.S. Weather Service forecast that North Dakota's rising Red River would crest at 49 feet. Officials in Grand Forks made flood management plans based on this single figure, which represented an average. In fact, the river crested above 50 feet, breaching the dikes, and unleashing a flood that forced 50,000 people from their homes.

## Fixing the Flaw

Some executives are already attuned to the importance of acting on a range of relevant numbers—a distribution—rather than single values, and they employ statisticians who estimate the distributions of everything from stock prices to electricity demand.

Had the average-obsessed boss at HealthCeuticals relied on other models of the data, he would have seen that he shouldn't have been stocking 5,000 units in the first place. For executives like him who are still fond of single values, it's time for a shift in mind-set. Rather than "Give me a number for my report," what every executive should be saying is "Give me a distribution."

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