Darrell Huff

How to Lie with Statistics

Darrell Huff, a freelance writer, expanded this article into a book with the same title (Norton, 1954).

"The average Yaleman, Class of '24," *Time* magazine reported last year after reading something in the New York *Sun,* a newspaper published in those days, "makes $25,111 a year."

Well, good for him!

But, come to think of it, what does this improbably precise and salubrious figure mean? Is it, as it appears to be, evidence that if you send your boy to Yale you won't have to work in your old age and neither will he? Is this average a mean or is it a median? What kind of sample is it based on? You could lump one Texas oilman with two hundred hungry freelance writers and report *their* average income as $25,000-odd a year. The arithmetic is impeccable, the figure is convincingly precise, and the amount of meaning there is in it you could put in your eye.

In just such ways is the secret language of statistics, so appealing in a fact-minded culture, being used to sensationalize, inflate, confuse, and oversimplify. Statistical terms are necessary in reporting the mass data of social and economic trends, business conditions, "opinion" polls, this year's census. But without writers who use the words with honesty and understanding and readers who know what they mean, the result can only be semantic nonsense.

In popular writing on scientific research, the abused statistic is almost crowding out the picture of the white-jacketed hero laboring overtime without time-and-a-half in an ill-lit laboratory. Like the "little dash of powder, little pot of paint," statistics are making many an important fact "look like what she ain't." Here are some of the ways it is done.

The sample with the built-in bias. Our Yale men—or Yalemen, as they say in the Time-Life building—belong to this flourishing group. The exaggerated estimate

of their income is not based on all members of the class nor on a random or representative sample of them. At least two interesting categories of 1924-model Yale men have been excluded.

First there are those whose present addresses are unknown to their classmates. Wouldn't you bet that these lost sheep are earning less than the boys from prominent families and the others who can be handily reached from a Wall Street office?

There are those who chucked the questionnaire into the nearest wastebasket. Maybe they didn't answer because they were not making enough money to brag about. Like the fellow who found a note clipped to his first pay check suggesting that he consider the amount of his salary confidential: "Don't worry," he told the boss. "I'm just as ashamed of it as you are."

Omitted from our sample then are just the two groups most likely to depress the average. The $25,111 figure is beginning to account for itself. It may indeed be a true figure for those of the Class of '24 whose addresses are known and who are willing to stand up and tell how much they earn. But even that requires a possibly dangerous assumption that the gentlemen are telling the truth.

To be dependable to any useful degree at all, a sampling study must use a representative sample (which can lead to trouble too) or a truly random one. If *all* the Class of '24 is included, that's all right. If every tenth name on a complete list is used, that is all right too, and so is drawing an adequate number of names out of a hat. The test is this: Does every name in the group have an equal chance to be in the sample?

You'll recall that ignoring this requirement was what produced the *Literary Digest*'s famed fiasco.* When names for polling were taken only from telephone books and subscription lists, people who did not have telephones or *Literary Digest* subscriptions had no chance to be in the sample. They possibly did not mind this underprivilege a bit, but their absence was in the end very hard on the magazine that relied on the figures.

This leads to a moral: You can prove about anything you want to by letting your sample bias itself. As a consumer of statistical data—a reader, for example, of a news magazine—remember that no statistical conclusion can rise above the quality of the sample it is based upon. In the absence of information about the procedures behind it, you are not warranted in giving any credence at all to the result.

The truncated, or gee-whiz, graph. If you want to show some statistical information quickly and clearly, draw a picture of it. Graphic presentation is the thing today. If you don't mind misleading the hasty looker, or if you quite clearly *want* to deceive him, you can save some space by chopping the bottom off many kinds of graph.

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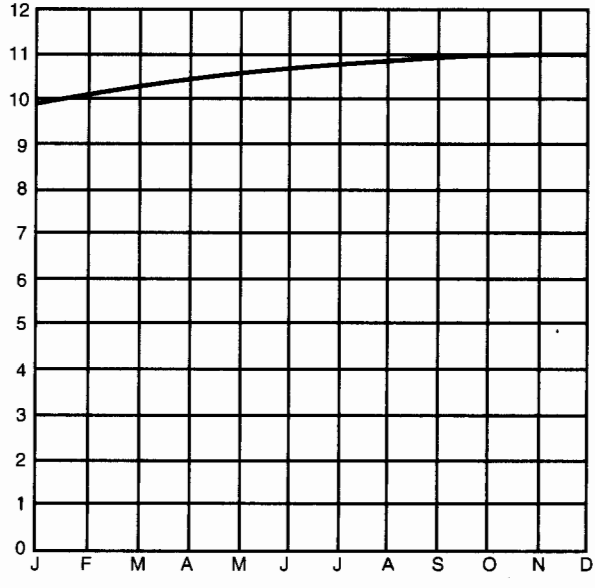
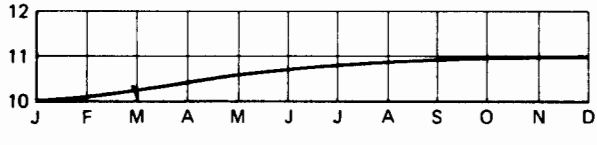
*Editor's note: The *Literary Digest* predicted that Alfred Landon would defeat Franklin Roosevelt in the 1936 presidential election. Landon carried only two states.

Suppose you are showing the upward trend of national income month by month for a year. The total rise, as in one recent year, is 7 percent. It looks like this:



That is clear enough. Anybody can see that the trend is slightly upward. You are showing a 7 percent increase, and that is exactly what it looks like.

But it lacks schmaltz. So you chop off the bottom, this way:

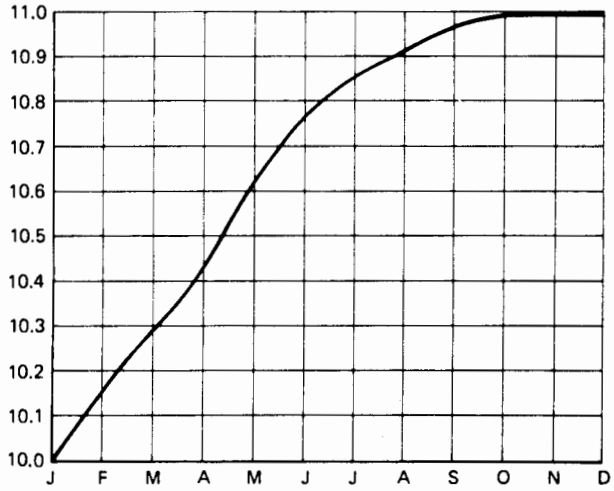


The figures are the same. It is the same graph and nothing has been falsified—except the impression that it gives. Anyone looking at it can just feel prosperity throbbing in the arteries of the country. It is a subtler equivalent of editing "National income rose 7 percent" into ". . . climbed a whopping 7 percent."

It is vastly more effective, however, because of that illusion of objectivity.

The souped-up graph. Sometimes truncating is not enough. The trifling rise in something or other still looks almost as insignficant as it is. You can make that 7 percent look livelier than 100 percent ordinarily does. Simply change the proportion between the ordinate and the abscissa. There's no rule against it, and it does give your graph a prettier shape.

But it exaggerates, to say the least, something awful:



The well-chosen average. I live near a country neighborhood for which I can report an average income of $15,000. I could also report it as $3,500.

If I should want to sell real estate hereabouts to people having a high snobbery content, the first figure would be handy. The second figure, however, is the one to use in an argument against raising taxes, or the local bus fare.

Both are legitimate averages, legally arrived at. Yet it is obvious that at least one of them must be as misleading as an out-and-out lie. The $15,000-figure is a mean, the arithmetic average of the incomes of all the families in the community. The smaller figure is a median; it might be called the income of the average family in the group. It indicates that half the families have less than $3,500 a year and half have more.

Here is where some of the confusion about averages comes from. Many human characteristics have the grace to fall into what is called the "normal" distribution. If you draw a picture of it, you get a curve that is shaped like a bell. Mean and median fall at about the same point, so it doesn't make very much difference which you use.

But some things refuse to follow this neat curve. Income is one of them. Incomes for most large areas will range from under $1,000 a year to upward of $50,000. Almost everybody will be under $10,000, way over on the lefthand side of that curve.

One of the things that made the income figure for the "average Yaleman" meaningless is that we are not told whether it is a mean or a median. It is not that one type of average is invariably better than the other; it depends upon what you are talking about. But neither gives you any real information—and either may be highly misleading—unless you know which of those two kinds of average it is.

In the country neighborhood I mentioned, almost everyone has less than the average—the mean, that is—of $10,500. These people are all small farmers, except for a trio of millionaire week-enders who bring up the mean enormously.

You can be pretty sure that when an income average is given in the form of a mean nearly everybody has less than that.

The insignificant difference or the elusive error. Your two children Peter and Linda (we might as well give them modish names while we're about it) take intelligence tests. Peter's IQ, you learn, is 98 and Linda's is 101. Aha! Linda is your brighter child.

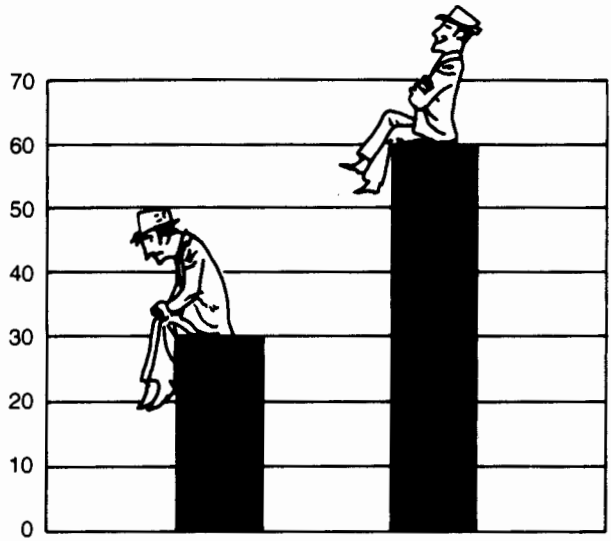
Is she? An intelligence test is, or purports to be, a sampling of intellect. An IQ, like other products of sampling, is a figure with a statistical error, which expresses the precison or reliability of the figure. The size of this probable error can be calculated. For their test the makers of the much-used Revised Stanford-Binet have found it to be about 3 percent. So Peter's indicated IQ of 98 really means only that there is an even chance that it falls between 95 and 101. There is an equal probability that it falls somewhere else—below 95 or above 101. Similarly, Linda's has no better than a fifty-fifty chance of being within the fairly sizeable range of 98 to 104.

You can work out some comparisons from that. One is that there is rather better than one chance in four that Peter, with his lower IQ rating, is really at least three points smarter than Linda. A statistician doesn't like to consider a difference significant unless you can hand him odds a lot longer than that.

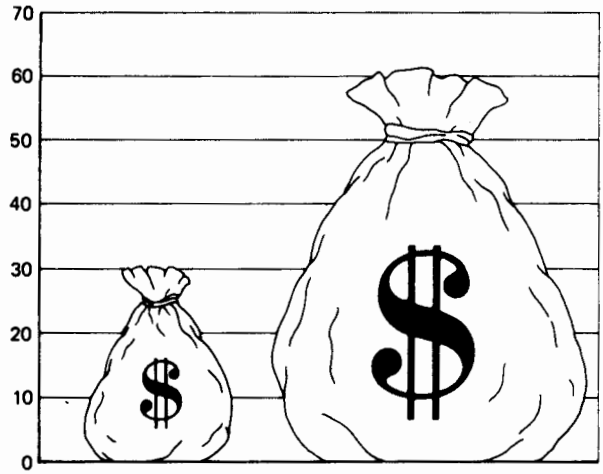
Ignoring the error in a sampling study leads to all kinds of silly conclusions. There are magazine editors to whom readership surveys are gospel; with a 40 percent readership reported for one article and a 35 percent for another, they demand more like the first. I've seen even smaller differences given tremendous weight, because statistics are a mystery and numbers are impressive. The same thing goes for market surveys and so-called public opinion polls. The rule is that you cannot make a valid comparison between two such figures unless you know the deviations. And unless the difference between the figures is many times greater than the probable error of each, you have only a guess that the one appearing greater really is.

Otherwise you are like the man choosing a camp site from a report of mean temperature alone. One place in California with a mean annual temperature of 61 is San Nicolas Island on the south coast, where it always stays in the comfortable range between 47 and 87. Another with a mean of 61 is in the inland desert, where the thermometer hops around from 15 to 104. The deviation from the mean marks the difference, and you can freeze or roast if you ignore it.

The one-dimensional picture. Suppose you have just two or three figures to compare—say the average weekly wage of carpenters in the United States and another country. The sums might be $60 and $30. An ordinary bar chart makes the difference graphic.



That is an honest picture. It looks good for American carpenters, but perhaps it does not have quite the oomph you are after. Can't you make that difference appear overwhelming and at the same time give it what I am afraid is known as eye-appeal? Of course you can. Following tradition, you represent these sums by pictures of money bags. If the $30 bag is one inch high, you draw the $60 bag two inches high. That's in proportion, isn't it?



The catch is, of course, that the American's money bag, being twice as tall as that of the $30 man, covers an area on your page four times as great. And since your two-dimensional picture represents an object that would in fact have three

dimensions, the money bags actually would differ much more than that. The volumes of any two similar solids vary as the cubes of their heights. If the unfortunate foreigner's bag holds $30 worth of dimes, the American's would hold not $60 but a neat $240.

You didn't say that, though, did you? And you can't be blamed, you're only doing it the way practically everybody else does.

The ever-impressive decimal. For a spurious air of precision that will lend all kinds of weight to the must disreputable statistics, consider the decimal.

Ask a hundred citizens how many hours they slept last night. Come out with a total of, say, 781.3. Your data are far from precise to begin with. Most people will miss their guess by fifteen minutes or more and some will recall five sleepless minutes as half a night of tossing insomnia.

But go ahead, do your arithmetic, announce that people sleep an average of 7.813 hours a night. You will sound as if you knew precisely what you are talking about. If you were foolish enough to say 7.8 (or "almost" 8) hours it would sound like what it was—an approximation.

The semiattached figure. If you can't prove what you want to prove, demonstrate something else and pretend that they are the same thing. In the daze that follows the collision of statistics with the human mind, hardly anybody will notice the difference. The semiattached figure is a durable device guaranteed to stand you in good stead. It always has.

If you can't prove that your nostrum cures colds, publish a sworn laboratory report that the stuff killed 31,108 germs in a test tube in eleven seconds. There may be no connection at all between assorted germs in a test tube and the whatever-it-is that produces colds, but people aren't going to reason that sharply, especially while sniffling.

Maybe that one is too obvious and people are beginning to catch on. Here is a trickier version.

Let us say that in a period when race prejudice is growing it is to your advantage to "prove" otherwise. You will not find it a difficult assignment.

Ask that usual cross section of the population if they think . . . [Blacks] have as good a chance as white people to get jobs. Ask again a few months later. As Princeton's Office of Public Opinion Research has found out, people who are most unsympathetic to . . . [Blacks] are the ones most likely to answer yes to this question.

As prejudice increases in a country, the percentage of affirmative answers you will get to this question will become larger. What looks on the face of it like growing opportunity for . . . [Blacks] actually is mounting prejudice and nothing else. You have achieved something rather remarkable: the worse things get, the better your survey makes them look.

The unwarranted assumption, or *post hoc* rides again. The interrelation of cause and effect, so often obscure anyway, can be most neatly hidden in statistical data.

Somebody once went to a good deal of trouble to find out if cigarette smokers make lower college grades than non-smokers. They did. This naturally pleased many people, and they made much of it.

The unwarranted assumption, of course, was that smoking had produced dull minds. It seemed vaguely reasonable on the face of it, so it was quite widely accepted. But it really proved nothing of the sort, any more than it proved that poor grades drive students to the solace of tobacco. Maybe the relationship worked in one direction, maybe in the other. And maybe all this is only an indication that the sociable sort of fellow who is likely to take his books less than seriously is also likely to sit around and smoke many cigarettes.

Permitting statistical treatment to befog casual relationships is little better than superstition. It is like the conviction among the people of Hebrides that body lice produce good health. Observation over the centuries had taught them that people in good health had lice and sick people often did not. *Ergo,* lice made a man healthy. Everybody should have them.

Scantier evidence, treated statistically at the expense of common sense, has made many a medical fortune and many a medical article in magazines, including professional ones. More sophisticated observers finally got things straightened out in the Hebrides. As it turned out, almost everybody in those circles had lice most of the time. But when a man took a fever (quite possibly carried to him by those same lice) and his body became hot, the lice left.

Here you have cause and effect not only reversed, but intermingled.

There you have a primer in some ways to use statistics to deceive. A well-wrapped statistic is better than Hitler's "big lie": it misleads, yet it can't be pinned onto you.

Is this little list altogether too much like a manual for swindlers? Perhaps I can justify it in the manner of the retired burglar whose published reminiscences amounted to a graduate course in how to pick a lock and muffle a footfall: The crooks already know these tricks. Honest men must learn them in self-defense.