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Politician A (the challenger): "Our schools are getting worse! Sixty percent of our schools had lower test scores this year than last year."

Politician B (the incumbent): "Our schools are getting better! Eighty percent of our students had higher test scores this year than last year."

Here's a hint: The schools do not all necessarily have the same number of students. If you take another look at the seemingly contradictory statements, what you'll see is that one politician is using schools as his *unit of analysis* ("Sixty percent of our schools . . ."), and the other is using students as the unit of analysis ("Eighty percent of our students . . ."). The unit of analysis is the entity being compared or described by the statistics—school performance by one of them and student performance by the other. It's entirely possible for most of the students to be improving and most of the schools to be getting worse—if the students showing improvement happen to be in very big schools. To make this example more intuitive, let's do the same exercise by using American states:

Politician A (a populist): "Our economy is in the crapper! Thirty states had falling incomes last year."

Politician B (more of an elitist): "Our economy is showing appreciable gains: Seventy percent of Americans had rising incomes last year."

What I would infer from those statements is that the biggest states have the healthiest economies: New York, California, Texas, Illinois, and so on. The thirty states with falling average incomes are likely to be much smaller: Vermont, North Dakota, Rhode Island, and so on. Given the disparity in the size of the states, it's entirely possible that the majority of states are doing worse while the majority of Americans are doing better. The key lesson is to pay attention to the unit of analysis. Who or what is being described, and is that different from the "who" or "what" being described by someone else?

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The telecommunications companies AT&T and Verizon have recently engaged in an advertising battle that exploits this kind of ambiguity about what is being described. Both companies provide cellular phone service. One of the primary concerns of most cell phone users is the quality of the service in places where they are likely to make or receive phone calls. Thus, a logical point of comparison between the two firms is the size and quality of their networks. While consumers just want decent cell phone service in lots of places, both AT&T and Verizon have come up with different metrics for measuring the somewhat amorphous demand for "decent cell phone service in lots of places." Verizon launched an aggressive advertising campaign touting the geographic coverage of its network; you may remember the maps of the United States that showed the large percentage of the country covered by the Verizon network compared with the relatively paltry geographic coverage of the AT&T network. The unit of analysis chosen by Verizon is geographic area covered—because the company has more of it.

AT&T countered by launching a campaign that changed the unit of analysis. Its billboards advertised that "AT&T covers 97 percent of Americans." Note the use of the word "Americans" rather than "America." AT&T focused on the fact that most people don't live in rural Montana or the Arizona desert. Since the population is not evenly distributed across the physical geography of the United States, the key to good cell service (the campaign argued implicitly) is having a network in place where callers actually live and work, not necessarily where they go camping. As someone who spends a fair bit of time in rural New Hampshire, however, my sympathies are with Verizon on this one.

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Our old friends the mean and the median can also be used for nefarious ends. As you should recall from the last chapter, both the median and the mean are measures of the "middle" of a distribution, or its "central tendency." The mean is a simple average: the sum of the observations divided by the number of observations. (The mean of 3, 4, 5, 6, and 102 is 24.) The median is the midpoint of the distribution; half of the observations lie above the median and half lie below. (The median of 3, 4, 5, 6, and 102 is 5.) Now, the clever reader will see that there is a sizable difference between 24 and 5. If, for some reason, I would like to describe this group of numbers in a way that makes it look big, I will focus on the mean. If I want to make it look smaller, I will cite the median.

Now let's look at how this plays out in real life. Consider the George W. Bush tax cuts, which were touted by the Bush administration as something good for most American families. While pushing the plan, the administration pointed out that 92 million Americans would receive an average tax reduction of over $1,000 ($1,083 to be precise). But was that summary of the tax cut accurate? According to the *New York Times*, "The data don't lie, but some of them are mum."

Would 92 million Americans be getting a tax cut? Yes.

Would most of those people be getting a tax cut of around $1,000? No. The median tax cut was less than $100.

A relatively small number of extremely wealthy individuals were eligible for very large tax cuts; these big numbers skew the mean, making the average tax cut look bigger than what most Americans would likely receive. The median is not sensitive to outliers, and, in this case, is probably a more accurate description of how the tax cuts affected the typical household.

Excerpts from Wheelan, C. (2013). *Naked Statistics*. New York, NY. W. W. Norton and Company.

The federal minimum wage—the number posted on the bulletin board in some remote corner of your office—is set by Congress. This wage, currently $7.25, is a nominal figure. Your boss does not have to ensure that $7.25 buys as much as it did two years ago; he just has to make sure that you get a minimum of $7.25 for every hour of work that you do. It's all about the number on the check, not what that number can buy.

Yet inflation erodes the purchasing power of the minimum wage over time (and every other nominal wage, which is why unions typically negotiate "cost of living adjustments"). If prices rise faster than Congress raises the minimum wage, the real value of that minimum hourly payment will fall. Supporters of a minimum wage should care about the real value of that wage, since the whole point of the law is to guarantee low-wage workers some minimum level of consumption for an hour of work, not to give them a check with a big number on it that buys less than it used to. (If that were the case, then we could just pay low-wage workers in rupees.)

Hollywood studios may be the most egregiously oblivious to the distortions caused by inflation when comparing figures at different points in time—and deliberately so. What were the top five highest-grossing films (domestic) of all time as of 2011?[5]

1. *Avatar* (2009)
2. *Titanic* (1997)
3. *The Dark Knight* (2008)
4. *Star Wars Episode IV* (1977)
5. *Shrek 2* (2004)

Now you may feel that list looks a little suspect. These were successful films—but *Shrek 2*? Was that really a greater commercial success than *Gone with the Wind*? *The Godfather*? *Jaws*? No, no, and no. Hollywood likes to make each blockbuster look bigger and more successful than the last. One way to do that would be to quote box office receipts in Indian rupees, which would inspire headlines such as the following: "Harry Potter Breaks Box Office Record with Weekend Receipts of 1.3 Trillion!" But even the most dim-witted moviegoers would be suspicious of figures that are large only because they are quoted in a currency with relatively little purchasing power. Instead, Hollywood studios (and the journalists who report on them) merely use nominal figures, which makes recent movies look successful largely because ticket prices are higher now than they were ten, twenty, or fifty years ago. (When *Gone with the Wind* came out in 1939, a ticket cost somewhere in the range of $.50.) The most accurate way to compare commercial success over time would be to adjust ticket receipts for inflation. Earning $100 million in 1939 is a lot more impressive than earning $500 million in 2011. So what are the top grossing films in the U.S. of all time, *adjusted for inflation*?[6]

1. *Gone with the Wind* (1939)
2. *Star Wars Episode IV* (1977)
3. *The Sound of Music* (1965)
4. *E.T.* (1982)
5. *The Ten Commandments* (1956)

In real terms, *Avatar* falls to number 14; *Shrek 2* falls all the way to 31st.

Excerpts from Wheelan, C. (2013). *Naked Statistics*. New York, NY. W. W. Norton and Company.