Cherry-picking Data and Improper Comparisons

1 Cherry-picking Data

Cherry-picking of data involves selectively presenting data that supports a particular argument while ignoring data that contradicts it. This practice leads to misleading conclusions and poor decision-making. Cherry picking is not only dishonest and misleading to the public, but it reduces the credibility of experimental findings.

2 Examples of cherry-picking data

2.1 Example 1: Do 80% of dentists really recommend colgate?

Back in 2007, a UK advertising campaign for Colgate toothpaste declared that; 'More than 80% of dentists recommend Colgate.'

Figure 1: This was not the actual billboard. Billboard is recreated only for illustrative purposes.

The Advertising Standards Authority ("ASA") received two complaints regarding the poster, namely that the claim "More than 80% Of Dentists recommend Colgate" misleadingly implied dentists recommended Colgate over all other toothpastes. It was understood by readers to mean that 80% of dentists recommended Colgate over and above other brands and the remaining 20% of dentists would recommend different brands rather than Colgate. This is indeed a reasonable interpretation of the claim. However, this is not a question that the research survey actually asked dentists. What the survey asked for in part was for dentists to recommend several toothpastes and brands, not just a single choice.

To further illustrate the point, let us assume that we asked 10 dentists top three brands of toothpaste they would recommend. 8 out of 10 dentists recommended Colgate, 9 out of 10 recommended Crest, and all of them recommended Sensodyne. Now, we can say that 80% of dentists recommend Colgate, 90% of dentists recommend Crest, and 100% of dentists recommend Sensodyne. Al three are correct statements, but now you see the problem with the headline that 80% of dentists recommend Colgate. This is cherry-pikcing data. Full context of the data being presented is the key.

2.2 Example 2: Which is a better investment: Gold or Stocks?

Let's say we want to compare whether Gold or Stocks are a better investment. To do so, let's look at the interactive chart of historical data for (not inflation adjusted) gold prices per ounce after March, 2020 (COVID-19 pandemic). Similarly, we will look at the chart of the S&P 500 stock market index for the same time duration.

The price per ounce of Gold in March, 2020 was around $1600 and it was around $2445 in August 2024. So that's a 52% increase. Similarly, the S&P-500 index in March, 2020 was around $2585 and it was around $5446 in August 2024. So that's a 110% increase. So it's clear that recently Stocks are a better investment than Gold.

However, let's look at interactive chart of historical data for (not inflation adjusted) gold prices per ounce vs S&P-500 index since the start of this century.

Doing the same comparison as above, we have around 718% increase in value of gold since 2000 to 2024, and 274% increase in the value of S&P-500 index.

Now I can present either of the two arguments if I want to convince the readers whether gold or stocks would be a better investment. It is easy to manipulate the audience with cherry-picking of the data. Like always, the takeaway is that context is imperative.

3 Improper Comparisons

Making comparisons is an integral and important part of life. Some comparisons are best made on subjective grounds whereas some comparisons are dependent upon—statistics of some kind. In this chapter we examine several ways in which improper statistical comparisons are made. This concept is better illustrated with examples, hence we will study many examples of improper comparisons.

Example 1: Back in the early 1960's, Hollywood Bread was one of the famous breads in the country. The advertising claims of Hollywood Bread got into a legal dispute on the grounds that they made a misleading statistical comparison. The claim made was that Hollywood Bread contains fewer calories per slice than other brands of standard commercial bread. However, the Federal Trade Commission maintained that Hollywood has as high a caloric content as any other bread—about 276 calories per 100 grams—and that the only reason a slice of Hollywood Bread contains fewer calories is that it is more thinly sliced; the comparison, therefore, was based on unequal units of bread. Like was not being compared with like, and we call this apples-to-oranges comparisons. This is one of the most common improper comparisons in statistics.

Example 2: Child abuse cases soared in the decades following the 1960s. For example, there were about 150,000 abused children reported in 1963, but nearly three million in 1995. Does the interpretation that child abuse became much more common after 1960s is a reasonable interpretation?

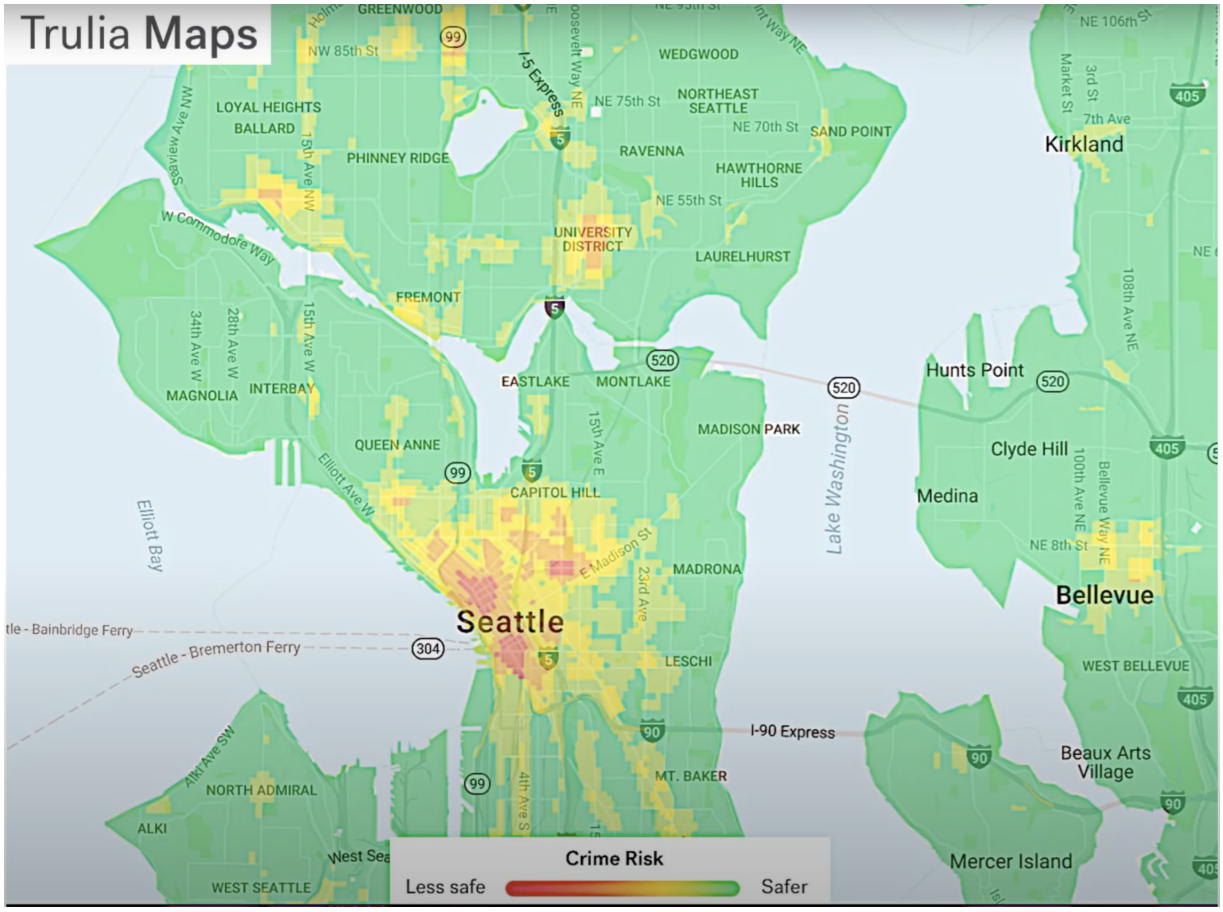
At first glance, these numbers might suggest that child abuse became much more common over those decades. However, this interpretation overlooks significant changes in how child abuse was defined and addressed in the U.S. During the 1960s, the new laws requiring mandatory reporting of suspected abuse by professionals like doctors, teachers, and daycare workers. Additionally, the definition of abuse expanded to include not just physical beatings but also neglect, sexual abuse, and emotional abuse. As a result, the increase in reported cases may reflect these broader definitions and improved reporting practices rather than an actual rise

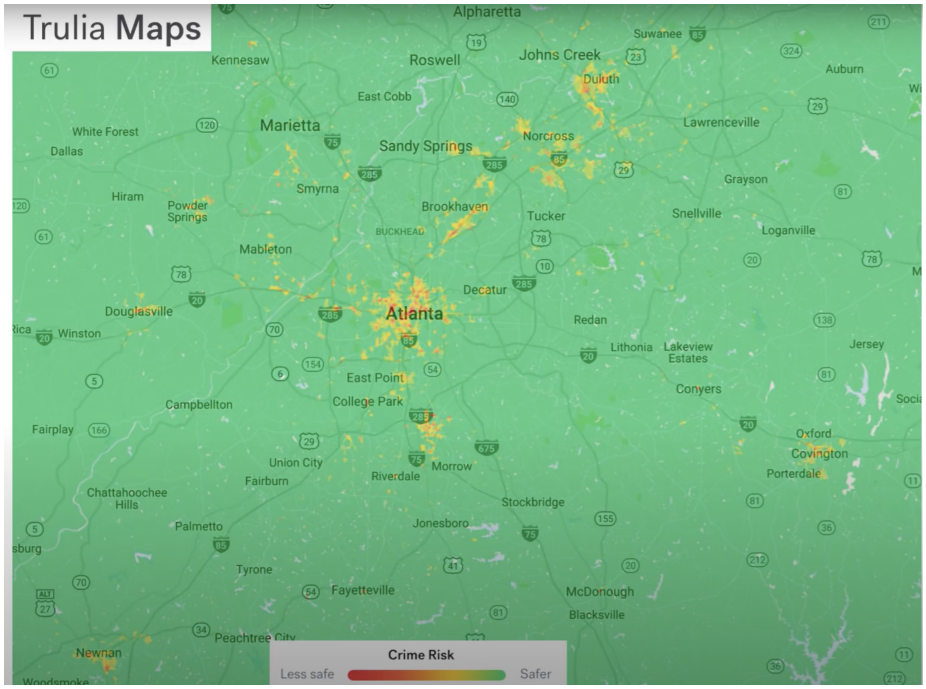
in abuse. Comparing such statistics across different time periods without considering these contextual changes is like comparing apples to oranges and can lead to misleading conclusions. This pattern is common in social issues where increased awareness and better reporting often result in a sharp rise in recorded cases, which doesn't necessarily indicate that the problem itself has worsened.

(Taken from www.callingbull.org) Example 3: One form of list that continuously reappears is some variant of "America's Most Dangerous Cities." Recently we came across such a list, released by financial news outlet 24/7 Wall St. and based on a compilation by the FBI. At the top of the list were

1. St. Louis, MO
2. Detroit, MI
3. Birmingham, AL
4. Memphis, TN
5. Milwaukee, WI

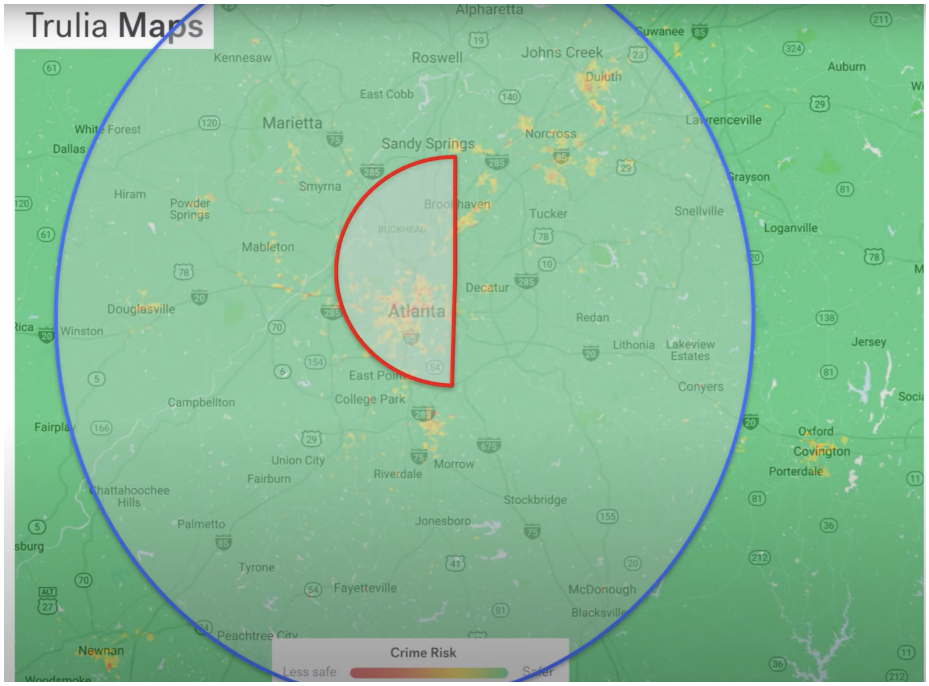
Before we explore, why this would be an improper comparison, let us look at the crime map of Seattle and Atlanta as an example.





So we notice that the urban core has a much higher crime rate and the outer suburbs have a much lower crime rate. For complex reasons, crime rates within many US cities tend to be high in the historical urban core of a city and lower in the suburbs.

Now let us see what constitutes Atlanta Metropolitan area and the city of Atlanta.



The bigger circle is the Atlanta Metropolitan area and the red semi-circle is the city of Atlanta. The point is that different cities have a different size relative to their metro area. If a city has a very large metro area but a relatively very small "city" within that, they are more likely to have a higher crime rate in the city as less of the suburbs are included in the "city" compared to other cities.

As we suspected, the higher the fraction of the metropolitan area that lies within the city

limits, the lower the violent crime rate tends to be. Cities that have narrow boundaries tend to have higher crime rates, and cities with expansive boundaries tend to have lower crime rates. The overall amount of crime in a metropolitan area influences whether a city appears dangerous or safe—but so does the way in which the city's boundaries are drawn. People are making apples-to-oranges comparisons when comparing cities such as St. Louis or Detroit, which include only the urban core, with cities such as Anchorage or Laredo, which include the suburbs as well. This example of violent crime rates serves to illustrate a more general principle: Ranked lists are meaningful only if the entities being compared are directly comparable.

Example 4: The Fallacy of the Sheep: There was an old story about the discovery being made that white sheep eat more than black sheep. Further investigation revealed why: There are more white sheep. Admittedly, the story isn't very funny, but it is uncommonly incisive. No small number of mistakes have been made over the centuries because people have overlooked the fact that there were originally more things in one category than in another. Let's explore that more with the help of an example.

The National Safety Council informs us that **nearly half of the automobile fatalities occur at speeds of 40 miles per hour or less and that 65 percent of all accidents occur within 25 miles of home.** Using these facts, much public service advertising points out that accidents are not solely the result of traveling at high speeds and are not limited to long trips. The conclusion drawn is that seat belts should be worn no matter how short the trip or slow the speed. So far, so good.

However, what these ads don't mention is that most driving actually happens within 25 miles of home and at speeds of 40 miles per hour or less. So, it's no surprise that more accidents occur under these conditions because there are simply more opportunities for accidents. This missing information could cause someone to misinterpret the message and think that the best way to avoid accidents is to always drive more than 25 miles away from home and at speeds over 40 miles per hour. Of course, this would be a ridiculous conclusion, but I've seen similar flawed reasoning applied to other situations.

Example 5: Watch this commercial for Cheerios by scanning the QR code below or click on this link here and pay close attention to the wording that they use with their claims.

The exact wording of the claim in the Cheerios commercial is that people who choose whole grains tend to weigh less. Now, "choose" can mean picking whole grains on a survey about which foods are healthiest, or picking whole grains on a survey about which foods they are most likely to eat, or picking whole grains in a focus group about healthy foods, or even purchasing whole-grain foods at the grocery store. Similarly, "tend to weigh less" could mean that the fiber in whole grains help you to lose weight or people who chose whole grains are probably also doing other healthy things like eating more fruits and vegetables and getting regular exercise. Similarly, they mention that multigrain Cherrios has five whole grains and 110 lightly sweetened calories per serving. But compared to what? How does that compare to refined grains cereals. This is an example of a imporper statistical comparison which now you are well aware of.