# The Wisdom of the Crowd

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The Best Undergraduate Submission

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## Abstract

*Wisdom of the crowd is the collective opinion of a group of individuals rather than that of a single expert. This paper will address why this phenomenon occurs, its strategic implications, and how companies use this area of mathematics to do many things, including predicting the future with extreme accuracy.*

Wisdom of the crowd is a relatively new phenomenon that began at a county fair. It began in 1906 when a statistician named Francis Galton studied a "guess the weight" competition of a butchered ox. With over eight hundred participants, Galton ran statistical tests on their guesses. Very few people came close to the actual weight of the butchered ox, but that is not the true significance as the mathematical phenomenon presents itself


Jar of Candy Corn used for this research study. Courtesy of Matthew Blair

in the collective average of all the guesses. When Galton summed and then divided by the number of participants, he obtained the mean, or average, of the group. Shockingly the average of the group came extremely close to the actual weight of the

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butchered ox. With over eight hundred participants, the average guess of the group was 1,197 pounds, while the actual weight of the ox was 1,198 pounds. This is the foundation of what we now call the wisdom of the crowd [1].

The importance of the wisdom of the crowd is to show that as a group, we are extremely accurate while the individual is not. The more people that make a guess, the more accurate the wisdom of the crowd becomes. That is, the accuracy of the mean will be better in a group of eight hundred than in a group of fifty. A downside to this, however, is when the group skews the result. An example of groups turning against each other is common in politics. When a group analyzes a situation and gives an answer justified by their reasoning, the average result becomes accurate, [3] however when groups do not analyze a situation and act based on personal bias the results become skewed. In politics, many people do not vote based on their beliefs, but rather on the party to which they more closely align. This makes predicting political outcomes difficult as a "herd mentality" arises and affects the results [3].

After reading about this phenomenon, I decided to conduct a mathematical experiment of my own. I purchased a fairly large jar (9.5" x 4.5") and a few bags of candy corn. I counted out 690 pieces of candy corn and placed them all within the jar [2]. I then proceeded to go around my company and take their guesses on the number of candies in the jar. I was skeptical of this phenomenon being true, but after going around to fifty-six people, I totalled all their guesses together and then divided by fifty-six. Of these guesses, there were some as low as 200 and some were over 1000, but it turns out that the average of the group was 686.4 which is less than one percent error off from the actual number of candy corn within the jar. Additionally, no one guessed the correct answer and the average is more accurate than the closest individual guess of 680. This is interesting. So why does this happen?

Well, we can create a graph to keep track of the guess and how frequently that guess appears. When we do this, we will obtain a graph that will look roughly like the graph in Fig [1]. With more guesses, we can see that the average guess will be to the left or right of the actual value, but become closer with each iteration.

Mathematical calculations like this become very important because we can use the data in

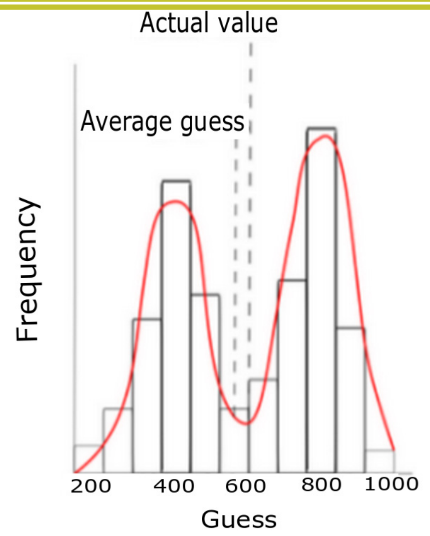


Figure 1. Guess Frequencies,
Courtesy of Matthew Blair

many different ways. One way that this has proved useful is by using these numbers to predict the future.

By converting Figure 1 to a normal distribution like the graph in Figure 2, big companies like Google can analyze patterns to guess when a certain event will happen. An example of this is when Google uses internet searches to predict an outbreak of disease. Let us say that people are searching for flu-related terms like flu, vaccine, or cough syrup then a pattern is presenting itself. Google can then look at data from previous years and when this search term reaches the average ($\mu$) of the previous years, Google can predict that enough people have contracted the flu and will spread it [2].

Another excellent example comes from the famous television show *Who Wants to be a Millionaire?* The importance of this show comes from a specific lifeline that the contestant has in which he/she is able to poll the audience. It turns out that in most cases, the answer that the group favors is the correct answer [3]. This is because the participants in the crowd do not communicate. So their guess is independent. The incorrect guesses are distributed among three incorrect answers, while the correct responses concentrate on one choice [3]. This allows the group to focus its knowledge onto one choice, which is statistically correct [3].

This is not the only application of wisdom of the crowd. Unintentionally, people leave patterns in everything they do. With enough resources and participants, we are able to predict the future with shocking accuracy. This simple set of mathematics that people learn in middle school can be applied to countless situations and produce reliable information. Imagine using this simple phenomenon to recognize social unrest, political unrest, or even to plan an expected number of applicants to a college. Therefore, no matter how good or bad at mathematics one person may be, the accuracy of the group will always prevail.

## Works Cited

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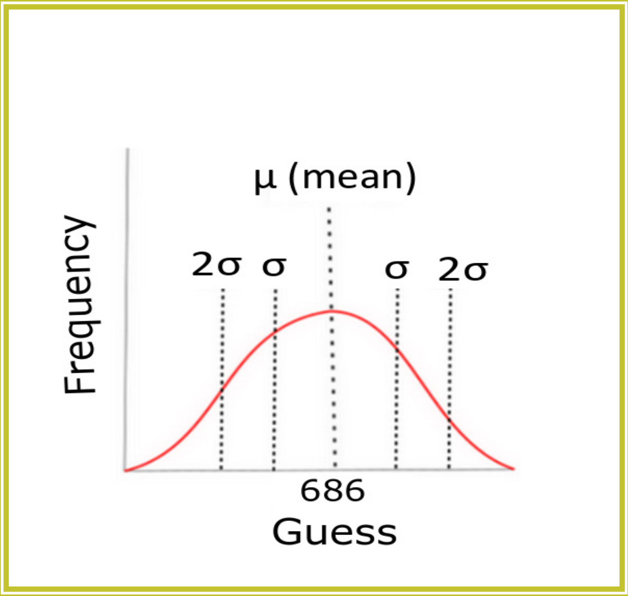


Figure 2. Normalized Distribution of Frequency Guesses, Courtesy of Matthew Blair



Lovelock Bridge by James Jeffcoat