



Taking It to 11

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A mathematics professor once told me about a successful motivational ploy he had used. He had super-sized his grading scale from 25-point quizzes and 100-point tests to 100-point quizzes and 400-point tests. He was laughing about overhearing students in the hall saying, “No way, I can’t do anything tonight, I have a **400-point test** tomorrow!”

When I told this story at home, my wife and kids laughed and said, “Mine goes to 11.” This quote from the movie *This Is Spinal Tap* nicely summarizes the superficiality and effectiveness of the new grading scale. For the final grade, all that matters mathematically is the relative weight attached to each grading item, not the actual numbers used. However, the students felt a powerful emotional response to the larger numbers, strong enough to give a higher priority to studying for that course.

The movie quote is more enlightening and more entertaining than the overly professorial discourse that filled out the rest of the preceding paragraph. The larger context of the movie adds nuances to the quote that would require multiple paragraphs to capture. As well, the movie reference summons up associations to numerous other adventures of the Spinal Tap group. You may already be laughing about the group getting lost in the arena. “Rock and roll!”

Of course, “Mine goes to 11” does nothing for you if you have not seen the movie. I have provided little explanation to help because the point I want to make is that it is enjoyable to be on the inside of an inside joke, and annoying to be on the outside. My answer to the question “Why Should I Take This Course?” is that this course will put you on the inside of astonishing discoveries, fascinating theories and insightful connections that will make life more enlightening and more entertaining. This statement applies to all of the Intellectual Inquiry (INQ) courses at Roanoke College.

The college’s “Goals for Liberal Learning” express the same idea using a different image. “A liberal arts education leads us out from small, safe worlds into larger, more interesting ones ...” The goal is not to reach an arbitrary standard of “educated person” or to improve your status. The goal is to expand your world and live the richest, most fulfilling life possible.

You have undoubtedly experienced one of the surprising results of expanding your world. To take two examples from students of mine, after learning in class about something called the Banzhaf power index you see two references to it in the news media the next week. After reading about Bill James on Thursday, you see him on television on Friday and realize that the young woman you are talking with on Saturday is his daughter. Once you have become sensitized to “new” information, it suddenly appears everywhere. Your world has expanded to recognize and respond to everything related to your new information.

Because I teach mathematics, you may make the logical deduction that I see mathematics everywhere. Guilty as charged. This, in fact, is a goal of each major at Roanoke College, to start to see the world in terms of the fundamental concepts and methodologies of

that major. Mathematics lets me see connections and patterns that are below the surface. I feel like I have inside information that gives me a deeper understanding of a situation. With that deeper understanding comes greater enjoyment of a complex, amazing world.

By expanding on the above examples, I hope to illustrate this point.

The Banzhaf power index alluded to above is central to one of the oddities of modern mathematical analysis. Imagine that you are a minority stock holder in a small corporation. You have some power to influence decisions, but not as much as you would like. The obvious solution is buy some stock from the majority share holder. The problem is that power (which can be measured by the Banzhaf power index) is what mathematicians call “nonlinear” in that a change in one variable is not always proportional to a change in the other variable. Increasing your percentage of shares can sometimes *reduce* your power, even to the point of having no voting power. That is not a typo: you can increase your number of shares and lose all of your power.

Nonlinear processes are at the heart of numerous complex phenomena. Weather prediction is difficult because of the “butterfly effect” that results from the nonlinear dynamics of the weather: a small change in some aspect of the weather can have dramatic long-term effects. An understanding of the butterfly effect gives you inside information about a staggeringly diverse set of phenomena. The seemingly random appearance of traffic jams, the unpredictable ups and downs of the stock market, and the apparent “paradox” of more shares costing you voting power are all basic nonlinear effects.

When a process is nonlinear, our intuition is often useless or even counterproductive. The process then appears to be hopelessly confusing, and we see it as a random blur. With the appropriate mathematical background, you can see the relationships and patterns. A small set of basic elements and simple, but nonlinear, connections produces a fascinating kaleidoscope of intricate behaviors. The inside view is spectacular.

Bill James, mentioned above, is considered the father of modern baseball statistics. He published a number of books in the 1980’s that changed the way that fans and (eventually) baseball executives view the game. His basic idea should not have been controversial. He believes that you can learn about the worth of players and strategies by looking at numbers. For example, he found that the performance of baseball players in college was a good indicator of how well they would perform in professional baseball. For years, baseball had relied on a system of professional scouts who would watch the players and evaluate their potential for improving into major leaguers.

The statistical methodologies that James and others introduced challenged the authority of the scouts and managers who lived baseball and were steeped in the wisdom of decades of baseball lore. This conflict between modern number crunchers and traditional gurus is representative of many changes brought about by computers.

Can you learn more about a car from the experts in the car magazines or by reading reviews online from actual customers? Do you look for book reviews from experts in the newspaper or do you go online for customer reviews? Is it possible that a simple formula incorporating weather and soil conditions and other variables can predict the quality of a vintage of wine? Should politicians trust their own instincts and those of close advisors or should they carefully follow the latest public opinion polls? Should movie producers use

mathematical predictions of potential hit movies (which, by the way, indicate that success does not especially depend on whether the main actors are well known) or follow their instincts?

A sound statistical view is that some data is better than other data. Bill James never said or believed that statistical analysis should replace the system of scouts. There is a middle ground in which the statistical data that is the most reliable is given the most weight. A good statistics class, such as INQ 240, will discuss the limitations of the techniques learned. For answering the above questions, and the hundreds of related questions, knowing the limitations of your data and opinions is crucial.

The most important questions in life are not all-or-nothing questions. You need good inside information to help you sort useful advice from useless drivel. That is one of the reasons to take this course. The inside information will make your world larger. You will be able to better understand some of life's complex questions. More importantly, you will have access to ideas that are used daily as inside jokes or references for understanding the world. You will be able to take yours to 11.