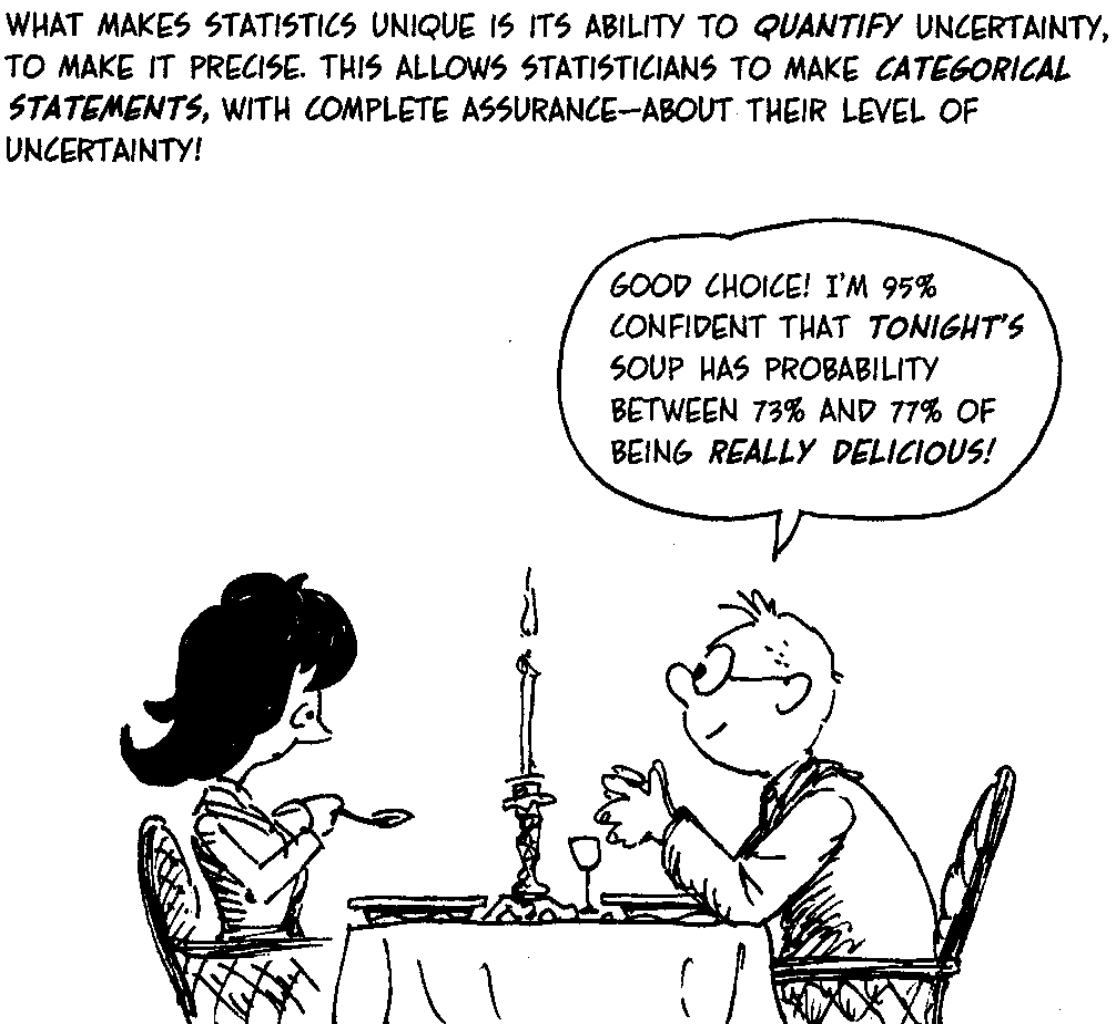
Cartoon Statistics

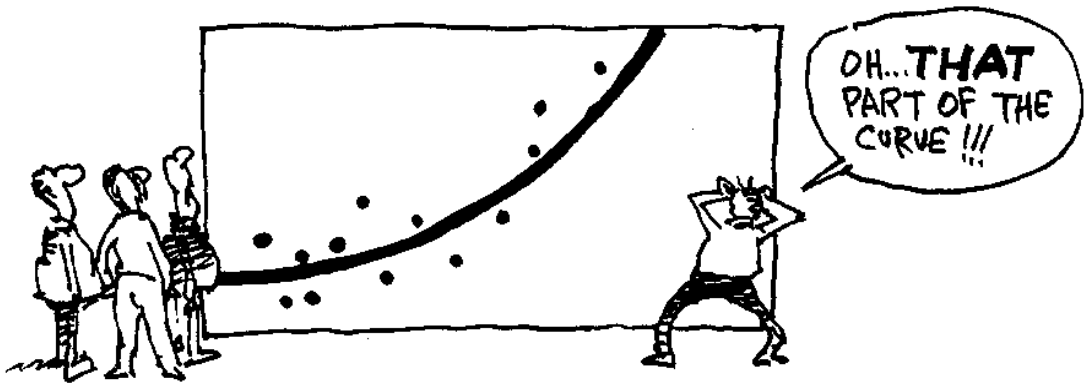
Introduction

The following cartoons have been taken, under the right to quote, from the book *The Cartoon Guide to Statistics*, by Larry Gonick and Woollcott Smith. With this selection (the book, completely written in this style, has more than two hundred pages), I have built a brief and informal introduction to Statistics and Probability – a sort of handrail without formulas, to show students with no background in Science the kind of tasks they have to face (for them to have a smile before the possible puffs). Nevertheless, the book has a good theoretical level and a quite appropriate way of presenting the ideas underlying these subjects, something that is no easy to achieve with figures only...

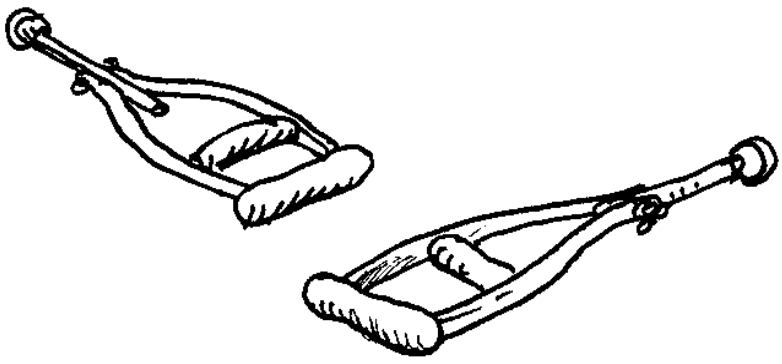


THIS IS NOT JUST A MATTER OR ORDERING SOUP! STATISTICS ALSO INVOLVES MATTERS OF *LIFE AND DEATH*...

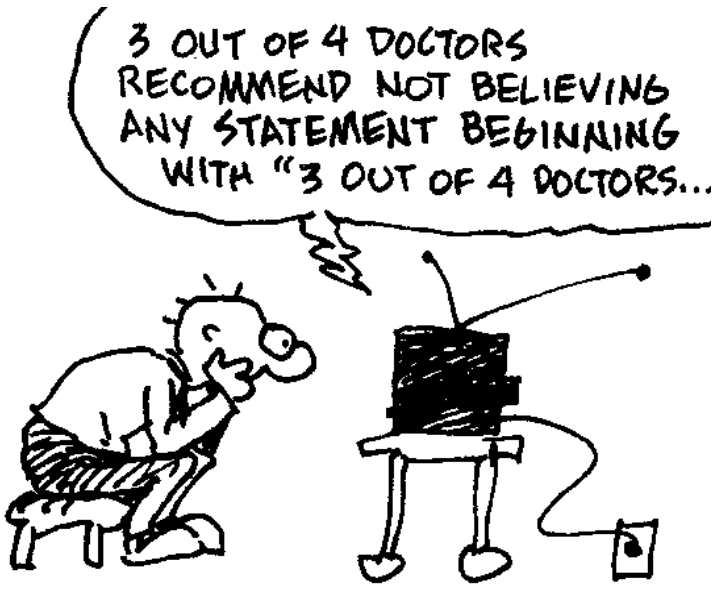
FOR EXAMPLE, IN 1986, THE SPACE SHUTTLE *CHALLENGER* EXPLODED, KILLING SEVEN ASTRONAUTS. THE DECISION TO LAUNCH IN 29-DEGREE WEATHER HAD BEEN MADE WITHOUT DOING A SIMPLE ANALYSIS OF PERFORMANCE DATA AT LOW TEMPERATURE.



A MORE POSITIVE EXAMPLE IS THE *SALK POLIO VACCINE*. IN 1954, VACCINE TRIALS WERE PERFORMED ON SOME 400,000 CHILDREN, WITH STRICT CONTROLS TO ELIMINATE BIASED RESULTS. GOOD STATISTICAL ANALYSIS OF THE RESULTS FIRMLY ESTABLISHED THE VACCINE'S EFFECTIVENESS, AND TODAY POLIO IS ALMOST UNKNOWN.



FINALLY, IN DISCUSSING STATISTICS, IT'S HARD TO AVOID MENTIONING ONE OTHER THING: THE WIDESPREAD *MISTRUST* OF STATISTICS IN THE WORLD TODAY. EVERYONE KNOWS ABOUT "LYING WITH STATISTICS," WHILE GOOD STATISTICAL ANALYSIS IS NEARLY IMPOSSIBLE TO FIND IN DAILY LIFE. WHAT'S ONE TO DO?



In statistical work, the following related areas are usually involved:

Data analysis

THE GATHERING, DISPLAY, AND SUMMARY OF DATA;

Probability

THE LAWS OF CHANCE, IN AND OUT OF THE CASINO;

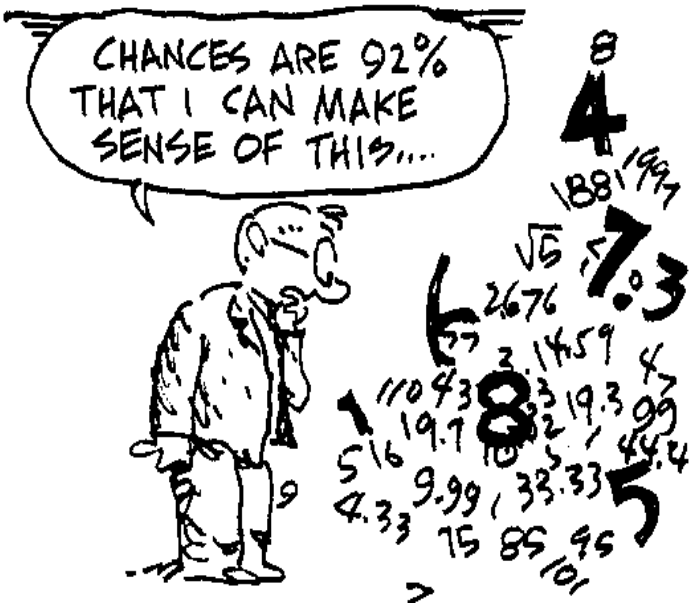
Statistical inference

THE SCIENCE OF DRAWING STATISTICAL CONCLUSIONS FROM SPECIFIC DATA, USING A KNOWLEDGE OF PROBABILITY.

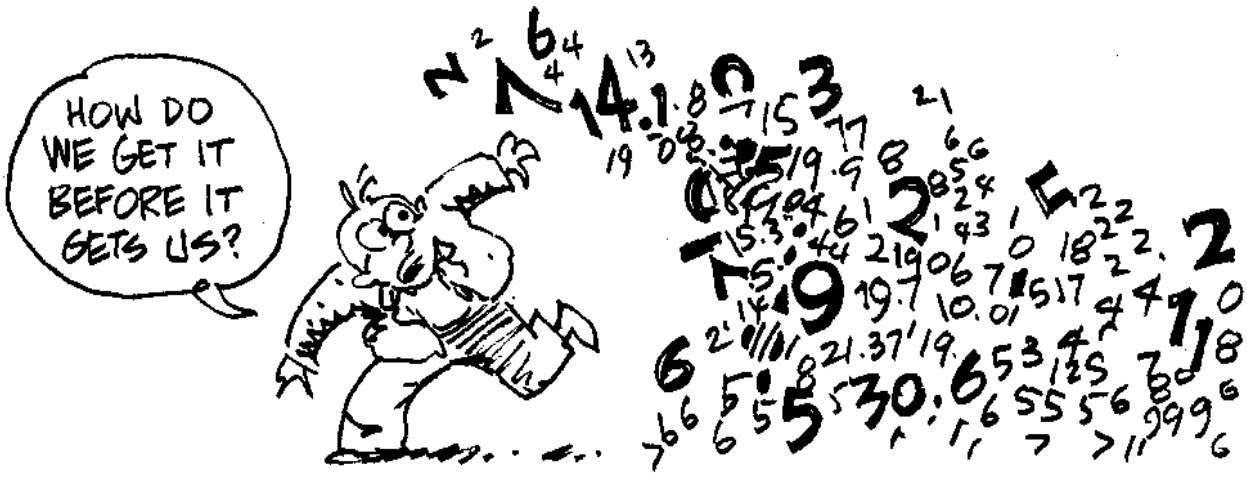
If you have a look at the index of many books and subjects, they usually have a similar structure of contents. First of all, it is considered how to gather and interpret data; after this, how to fit a mathematical model to them (a "suit"); and, finally, how to deduce or infere new information.

Data Analysis

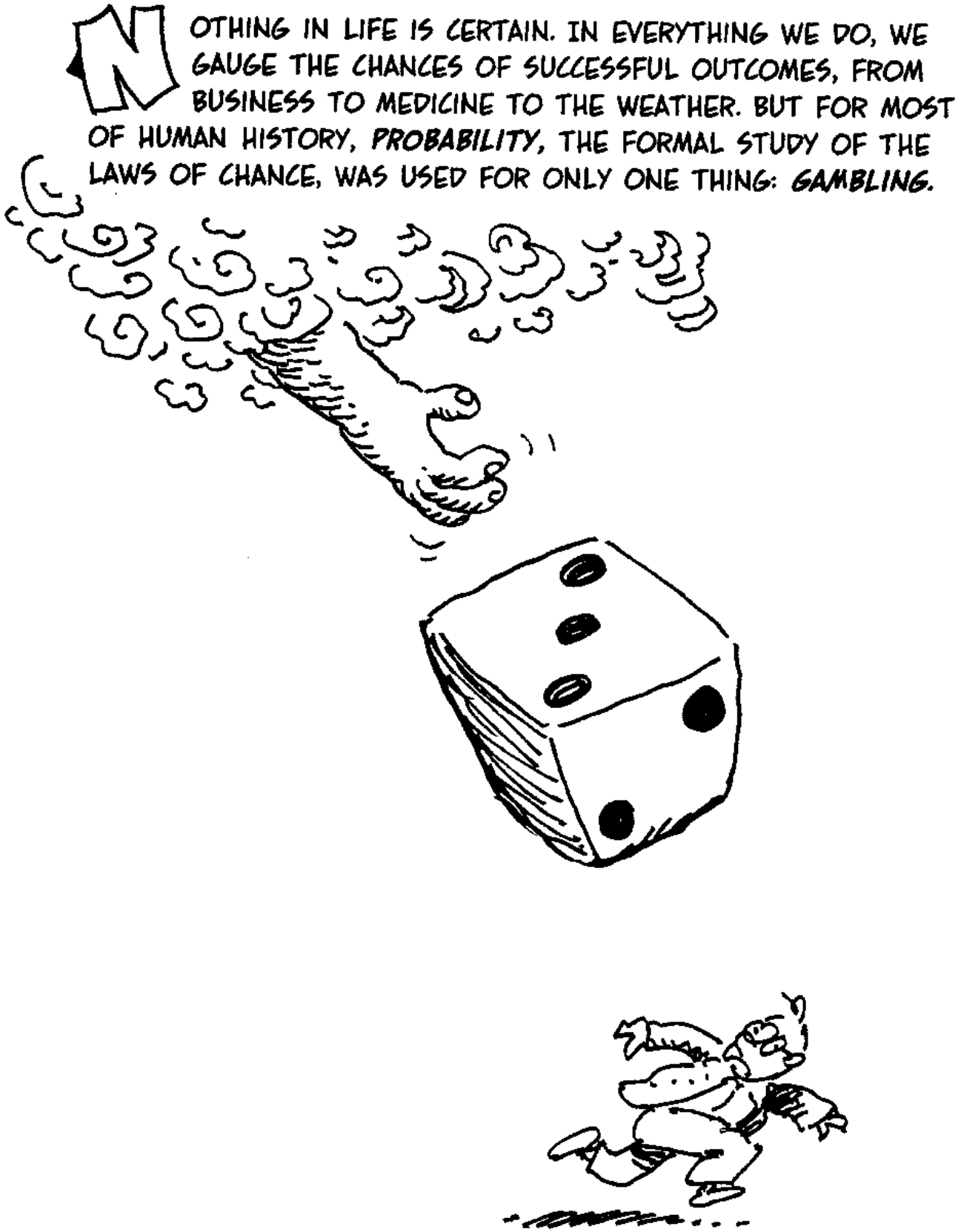
DATA ARE THE STATISTICIAN'S RAW MATERIAL, THE NUMBERS WE USE TO INTERPRET REALITY. ALL STATISTICAL PROBLEMS INVOLVE EITHER THE COLLECTION, DESCRIPTION, AND ANALYSIS OF DATA, OR ***THINKING*** ABOUT THE COLLECTION, DESCRIPTION, AND ANALYSIS OF DATA.



THIS CHAPTER CONCENTRATES ON DATA ***DESCRIPTION***. HOW CAN WE REPRESENT DATA IN USEFUL WAYS? HOW CAN WE SEE UNDERLYING PATTERNS IN A HEAP OF NAKED NUMBERS? HOW CAN WE SUMMARIZE THE DATA'S BASIC SHAPE?

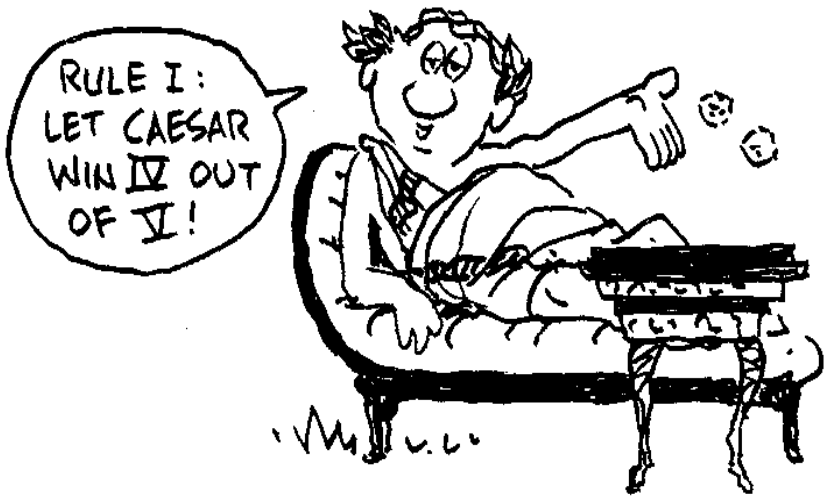


Probability

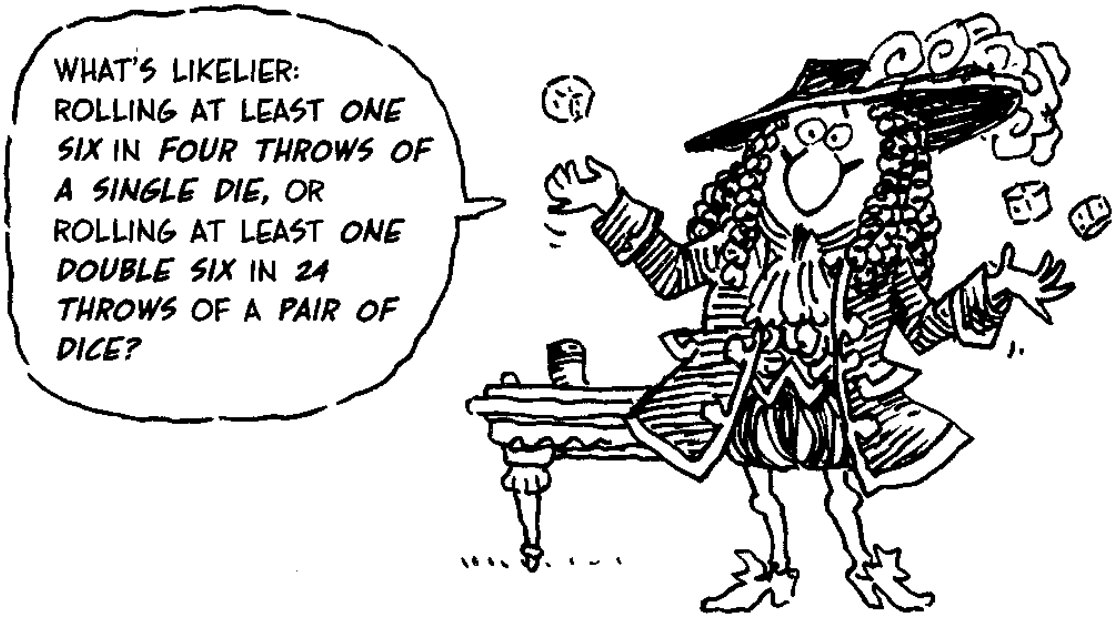


NOBODY KNOWS WHEN GAMBLING BEGAN. IT GOES BACK AT LEAST AS FAR AS *ANCIENT EGYPT*, WHERE SPORTING MEN AND WOMEN USED FOUR-SIDED *"ASTRAGALI"* MADE FROM ANIMAL HEELBONES.

THE ROMAN EMPEROR *CLAUDIUS* (10 BCE-54 CE) WROTE THE FIRST KNOWN TREATISE ON GAMBLING. UNFORTUNATELY, THIS BOOK, "HOW TO WIN AT DICE," WAS LOST.



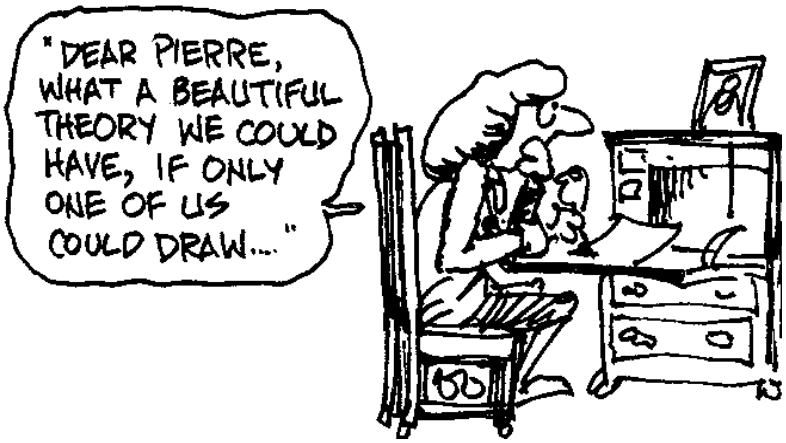
MODERN DICE GREW POPULAR IN THE MIDDLE AGES, IN TIME FOR A RENAISSANCE RAKE, THE *CHEVALIER DE MERE*, TO POSE A MATHEMATICAL PUZZLER:



DE MERE PUT THE QUESTION TO HIS FRIEND, THE GENIUS *BLAISE PASCAL* (1623-1666).

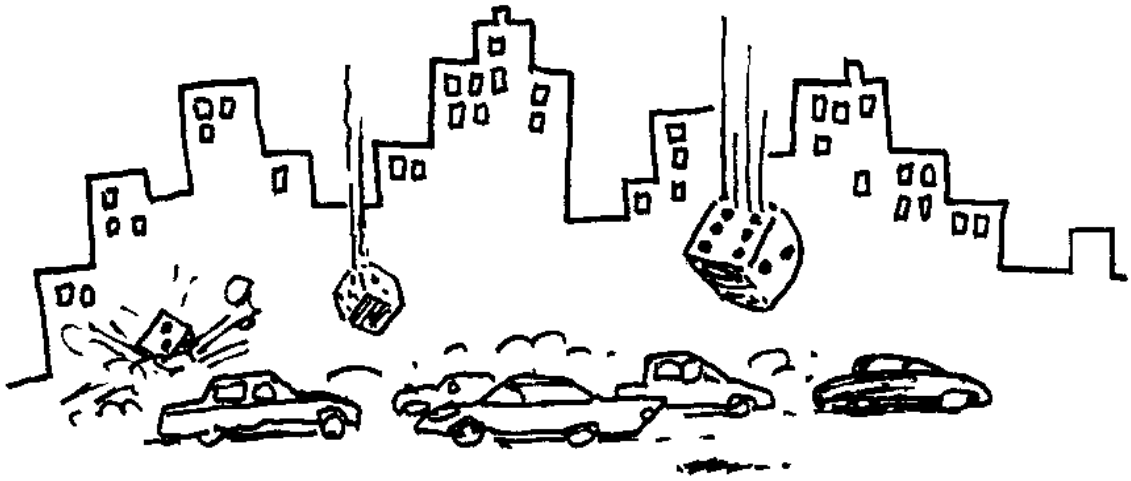
ALTHOUGH PASCAL HAD EARLIER GIVEN UP MATHEMATICS AS A FORM OF SEXUAL INDULGENCE (!), HE AGREED TO TACKLE DE MERE'S PROBLEM.

PASCAL WROTE HIS FELLOW GENIUS *PIERRE DE FERMAT*, AND WITHIN A FEW LETTERS, THE TWO HAD WORKED OUT THE THEORY OF PROBABILITY IN ITS MODERN FORM—EXCEPT, OF COURSE, FOR THE CARTOONS.

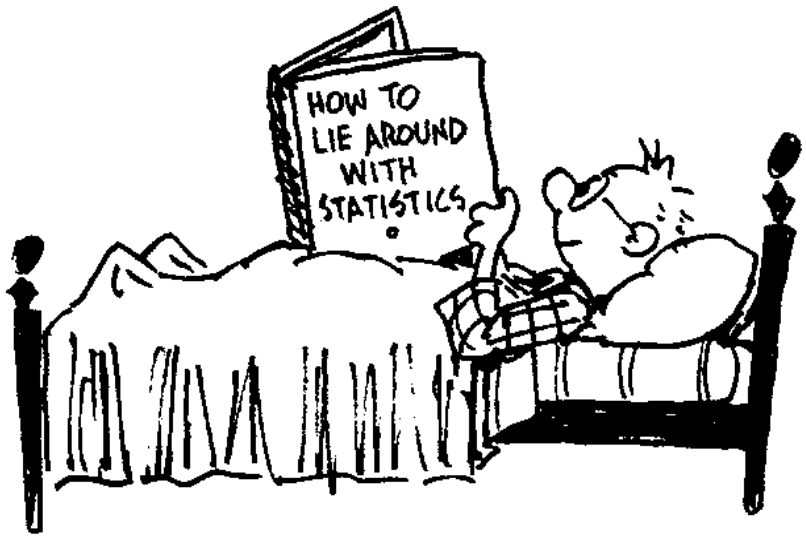


Statistical Inference

BY NOW, AFTER A STEADY DIET OF COINS, DICE, AND ABSTRACT IDEAS, YOU MAY BE WONDERING WHAT ALL THIS STATISTICAL EQUIPMENT WE'VE BEEN BUILDING HAS TO DO WITH THE *REAL WORLD*. WELL, NOW WE'RE FINALLY GOING TO FIND OUT...



IN THIS CHAPTER, WE BEGIN LOOKING AT THE *REAL* BUSINESS OF STATISTICS, WHICH IS, AFTER ALL, TO SAVE PEOPLE *TIME* AND *MONEY*. PEOPLE HATE TO WASTE TIME DOING *UNNECESSARY WORK*, AND ONE THING STATISTICS CAN DO IS TELL US EXACTLY HOW LAZY WE CAN AFFORD TO BE.



IN *DEDUCTIVE REASONING*, WE REASON FROM A HYPOTHESIS TO A CONCLUSION: "IF LORD FASTBACK COMMITTED MURDER, THEN HE WOULD WIPE THE FINGER-PRINTS OFF THE GUN."

INDUCTIVE REASONING, BY CONTRAST, ARGUES *BACKWARD* FROM A SET OF OBSERVATIONS TO A REASONABLE HYPOTHESIS:

IN MANY WAYS, SCIENCE, INCLUDING STATISTICS, IS LIKE DETECTIVE WORK. BEGINNING WITH A SET OF OBSERVATIONS, WE ASK WHAT CAN BE SAID ABOUT THE SYSTEMS THAT GENERATED THEM.

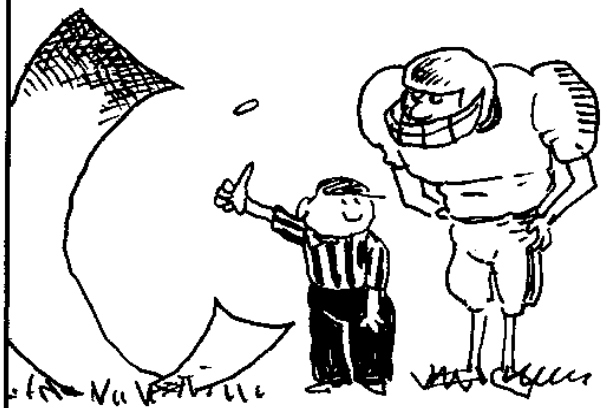
LIKE A CLEVER POLITICIAN, WE HAVE AVOIDED CERTAIN ***UNPLEASANT QUESTIONS,*** SUCH AS A) WHAT DOES PROBABILITY ***MEAN?*** AND B) ***HOW*** DO WE ASSIGN PROBABILITIES TO OUTCOMES?

HERE ARE SOME APPROACHES THAT HAVE BEEN TAKEN:

Classical PROBABILITY: BASED ON GAMBLING IDEAS, THE FUNDAMENTAL ASSUMPTION IS THAT THE GAME IS FAIR AND ALL ELEMENTARY OUTCOMES HAVE THE SAME PROBABILITY.

Relative Frequency:

WHEN AN EXPERIMENT ***CAN*** BE REPEATED, THEN AN EVENT'S PROBABILITY IS THE PROPORTION OF TIMES THE EVENT OCCURS IN THE LONG RUN.

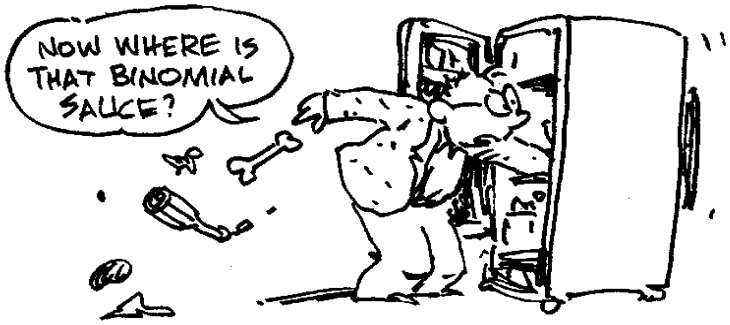


Personal PROBABILITY: MOST OF LIFE'S EVENTS ARE ***NOT REPEATABLE.*** PERSONAL PROBABILITY IS AN ***INDIVIDUAL'S PERSONAL ASSESSMENT*** OF AN OUTCOME'S LIKELIHOOD. IF A GAMBLER BELIEVES THAT A HORSE HAS MORE THAN A 50% CHANCE OF WINNING, HE'LL TAKE AN EVEN BET ON THAT HORSE.

AN ***OBJECTIVIST*** USES EITHER THE CLASSICAL OR FREQUENCY DEFINITION OF PROBABILITY. A ***SUBJECTIVIST*** OR ***BAYESIAN*** APPLIES FORMAL LAWS OF CHANCE TO HIS OWN, OR YOUR, PERSONAL PROBABILITIES.

BUT WHAT MAKES STATISTICS ALMOST AS CHALLENGING AS COOKING IS THE VARIETY. LIKE AN EXPERT COOK, THE STATISTICIAN CAN "TASTE" THE INGREDIENTS IN A PROBLEM AND THEN FIND THE MOST EFFECTIVE WAY TO COMBINE THEM INTO A STATISTICAL RECIPE.

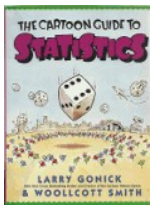
(THE REASON COOKBOOKS AND STATISTICAL METHODS TEXTS ARE SO HEAVY IS THAT THEY BOTH PROVIDE SOLUTIONS IN A GREAT VARIETY OF SITUATIONS!)



Now, you have a *good* knowledge of Statistics and Probability... Apply it!

Reference

The Cartoon Guide to Statistics
Larry Gonick and Woollcott Smith
Collins, 2005



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