Description

The Scientific Method

Modern science is built on a foundation of the assumed purity of the *scientific method*.

The approach has remained unchanged—identify and define a problem, gather relevant data, develop a tentative hypothesis, conduct experiments to test that hypothesis, interpret the results from those experiments, and repeat the process until a satisfactory solution is found.

Very simple in construct and equally simple in application! Why then is there so much concern today about the accuracy of modern research?

Descartes Vs. Bacon: Deductive Vs. Inductive Generalizations

Philosopher and mathematician Rene Descartes argued in favor of observed science as a solution to what he saw as the unsystematic methods of medieval science that passed beliefs from one generation to the next. He began with the question of how we know (epistemology) and how we arrive at an undisputed “truth” through an orderly sequence of observation and analysis.

Descartes’ contemporary, Francis Bacon, questioned this adherence to deductive reasoning by criticizing the practice of jumping from rudimentary observations to extreme axioms and then going back and filling in with intermediate axioms based on generalizations. He argued for a more empirical approach with mathematical validation as opposed to deductive generalizations and the first controlled experiment where only one variable is changed is accredited to Bacon.

Led Astray by Statistics?

The close relationship between science and mathematics has been around since the days of Galileo and Newton.

In recent years, however, the growing dependence on statistics to parse ever larger blocks of data into manageable data points has brought that relationship into question. The universal application of P values to establish the extent to which the result from a tested hypothesis reflects a real result that can be generalized, or is merely a fluke, now has the power to dictate future research directions.

Critics argue that the pursuit of statistical significance over validation via replication may facilitate the management of larger studies where *n* can run into the tens of thousands.

But the assumption that statistical significance equates to the normal use of the root word “significant” is dangerously erroneous. For example, testing a new drug may produce statistically significant results, but in terms of clinical significance, that result may only equate to one or two additional successful treatments for every one thousand patients.

Recognizing Limitations and Walking Together

So, is the Scientific Method outdated? Well, the traditional scientific method ceased to be only method generations ago. Science now operates with a multitude of methodologies that reflect the nature of the problem and population being studied.

However, as technology continues to advance and produce ever-increasing volumes of data to be tested, the basic principles of the scientific method appear to be increasingly outdated.

If our dependence on statistical analysis remains unquestioned, and we begin to go in search of data trends within these vast aggregated databases, the potential for further misdirection based on flawed methodologies seems even greater. Change is permanent, but let all methodologies, evolved or rudimentary, work toward the progress of mankind.

Category

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