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SUNDAYREVIEW

# Scientific Pride and Prejudice

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Gray Matter

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SCIENCE is in crisis, just when we need it most. Two years ago, C. Glenn Begley and Lee M. Ellis reported in *Nature* that they were able to replicate only six out of 53 “landmark” cancer studies. Scientists now worry that many published scientific results are simply not true. The natural sciences often offer themselves as a model to other disciplines. But this time science might look for help to the humanities, and to literary criticism in particular.

A major root of the crisis is selective use of data. Scientists, eager to make striking new claims, focus only on evidence that supports their preconceptions. Psychologists call this “confirmation bias”: We seek out information that confirms what we already believe. “We each begin probably with a little bias,” as Jane Austen writes in “Persuasion,” “and upon that bias build every circumstance in favor of it.”

Despite the popular belief that anything goes in literary criticism, the field has real standards of scholarly validity. In his 1967 book “Validity in Interpretation,” E. D. Hirsch writes that “an interpretive hypothesis,” about a poem “is ultimately a probability judgment that is supported by evidence.” This

is akin to the statistical approach used in the sciences; Mr. Hirsch was strongly influenced by John Maynard Keynes's "A Treatise on Probability."

However, Mr. Hirsch also finds that "every interpreter labors under the handicap of an inevitable circularity: All his internal evidence tends to support his hypothesis because much of it was constituted by his hypothesis." This is essentially the problem faced by science today. According to Mr. Begley and Mr. Ellis's report in *Nature*, some of the nonreproducible "landmark" studies inspired hundreds of new studies that tried to extend the original result without verifying if the original result was true. A claim is not likely to be disproved by an experiment that takes that claim as its starting point. Mr. Hirsch warns about falling "victim to the self-confirmability of interpretations."

It's a danger the humanities have long been aware of. In his 1960 book "Truth and Method," the influential German philosopher Hans-Georg Gadamer argues that an interpreter of a text must first question "the validity — of the fore-meanings dwelling within him." However, "this kind of sensitivity involves neither 'neutrality' with respect to content nor the extinction of one's self." Rather, "the important thing is to be aware of one's own bias." To deal with the problem of selective use of data, the scientific community must become self-aware and realize that it has a problem. In literary criticism, the question of how one's arguments are influenced by one's prejudgments has been a central methodological issue for decades.

Sometimes prejudgments are hard to resist. In December 2010, for example, NASA-funded researchers, perhaps eager to generate public excitement for new forms of life, reported the existence of a bacterium that used arsenic instead of phosphorus in its DNA. Later, this study was found to have major errors. Even if such influences don't affect one's research results, we should at least be able to admit that they are possible.

Austen might say that researchers should emulate Mr. Darcy in "Pride and Prejudice," who submits, "I will venture to say that my investigations and decisions are not usually influenced by my hopes and fears." At least Mr. Darcy acknowledges the possibility that his personal feelings might influence his investigations.

But it would be wrong to say that the ideal scholar is somehow unbiased or dispassionate. In my freshman physics class at Caltech, David Goodstein, who later became vice provost of the university, showed us Robert Millikan's lab notebooks for his famed 1909 oil drop experiment with Harvey Fletcher, which first established the electric charge of the electron.

The notebooks showed many fits and starts and many "results" that were obviously wrong, but as they progressed, the results got cleaner, and Millikan could not help but include comments such as "Best yet — Beauty — Publish." In other words, Millikan excluded the data that seemed erroneous and included data that he liked, embracing his own confirmation bias.

Mr. Goodstein's point was that the textbook "scientific method" of dispassionately testing a hypothesis is not how science really works. We often have a clear idea of what we want the results to be before we run an experiment. We freshman physics students found this a bit hard to take. What Mr. Goodstein was trying to teach us was that science as a lived, human process is different from our preconception of it. He was trying to give us a glimpse of self-understanding, a moment of self-doubt.

When I began to read the novels of Jane Austen, I became convinced that Austen, by placing sophisticated characters in challenging, complex situations, was trying to explicitly analyze how people acted strategically. There was no fancy name for this kind of analysis in Austen's time, but today we call it game theory. I believe that Austen anticipated the main ideas of game theory by more than a century.

As a game theorist myself, how do I know I am not imposing my own way of thinking on Austen? I present lots of evidence to back up my claim, but I cannot deny my own preconceptions and training. As Mr. Gadamer writes, a researcher "cannot separate in advance the productive prejudices that enable understanding from the prejudices that hinder it." We all bring different preconceptions to our inquiries, whether about Austen or the electron, and these preconceptions can spur as well as blind us.

Perhaps because of its self-awareness about what Austen would call the "whims and caprices" of human reasoning, the field of psychology has been most

aggressive in dealing with doubts about the validity of its research. In an open email in September 2012 to fellow psychologists, the Nobel laureate Daniel Kahneman suggests that “to deal effectively with the doubts you should acknowledge their existence and confront them straight on, because a posture of defiant denial is self-defeating.” Everyone, including natural scientists, social scientists and humanists, could use a little more self-awareness. Understanding science as fundamentally a human process might be necessary to save science itself.

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