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The Profits and Risks of Simplification

Curious circumstances trigger trains of thought. Glancing across an airplane aisle recently I read the headline "The Lure of False Doctrine." The student reading the article was evidently intrigued by this headline, for he turned repeatedly to the title page. I have no idea what was in the article but I would like to read what Bruno, Galileo, Joan of Arc, and all the other victims of organized violence, both ancient and modern, would have written under the same title. What a monstrous, melancholy medley of misunderstanding it would make. This setting of individuals and peoples on a collision course ordinarily arises from ideological conflicts growing out of uncritical acceptance of half truths. "The Rescue of the Holy Sepulcher," "Death to the Infidel," and "Workers Unite" are slogans each of which conjures up its own special nightmare.

Interestingly enough, scientists are galvanized into action by similar slogans. The crash program on the atomic bomb grew out of groundless fears that our antagonists would get the atomic bomb first. The vast sums being spent at present on a crash program for an early landing on the moon have their own somewhat obscure, psychological basis. If the moon program is really the most effective means of staving off all-out war, expensive as it is, it is still a bargain. On the other hand, the attempts which are sometimes made to sell the moon program on its scientific merits alone, in competition with other scientific uses of the money, are less convincing. The charitable conclusion is that in public affairs it is deemed necessary to oversimplify actual objectives so that the general public will best serve its own interests for the wrong reasons. This oversolicitude is probably neither necessary nor desirable.

Oversimplification also plays a conspicuous role in many scientific matters. Anyone who would start a course in valence theory by listing all the exceptions to the rules of valence before first developing the rules themselves would deserve the adverse criticism he would surely get. On the other hand, the doctrine that atoms with filled shells, such as the rare gases, are chemically inert was a simplification too well learned. People hesitated to do experiments running counter to such a self-evident truth. Equally slow to die was the dictum that coupled oscillators are always necessary to make a molecule optically active; this dictum had adherents even after the optical activity of single electrons had been clearly demonstrated. In fact, one of the greatest hindrances to scientific discovery is the necessary preliminary uprooting of the hallowed simplifications that everyone knows but that just happen to be untrue. After all, Aristotle said that it took force to keep a body moving at a steady rate. Why then should one accept the contradictory experiments of Galileo, who showed that force is necessary only when a body is to be accelerated?

If scientific progress is to be made, one must invent scientific models using those simplifications which make the best compromise between the infinite detail of reality and the present limits of tractability. It really isn't too bad that, after 250 years, Newtonian mechanics was amended by a Planck and an Einstein. Ultimate scientific rigor, like the pot of gold at the end of the rainbow, always lies over the ridge, fortunately.

—HENRY EYRING, *University of Utah, Salt Lake City*