

Cook's thesis about the empirical character of the scientific revolution goes beyond the statements made by earlier scholars. For he concludes that—even if most people preferred to “read” the 17th and 18th centuries as an age in which increasing knowledge and decreasing “superstition” resulted from the rise of “experimental science and philosophical enlightenment, with a growing material economy merely providing the means to sustain the lives of those who wished to devote themselves to advancing thought”—this revolution was not just coincidental in time with the development of the first global economy (by the Dutch and English) but also causally linked to that process. The new form of global commercial culture established by the Dutch more than any other Western nation emerges here as the key stimulus and shaping factor in generating the “so-called scientific revolution.”

The inevitable implication of this argument is that the “new philosophy” and the advancing Enlightenment have been generally overrated as factors shaping the new culture of science, and religious factors have been as well. Perhaps Cook is right. But one does not need to be wholly convinced of his thesis to admire his achievement. *Matters of Exchange* is a book that will undoubtedly be fruitful, not least in stimulating fresh debate about the sources of the scientific revolution and the exact role of the strict empiricism so cherished by the Dutch and so famously theorized by Locke.

10.1126/science.1142456

## PSYCHOLOGY

# Diversity Paradoxes

Philip E. Tetlock

**T**he *Difference* is brimming with so many intriguing insights and findings that I cannot do justice to them all. But this engaging book is also fated to be misinterpreted in so many different ways that I despair of preempting them all.

For analytical convenience, let's start by dividing the world into two types of people: those who divide the world into two types and those who do not. And let's suppose that this reviewer falls into the former group. I divide readers of Scott Page's book into two categories: cognitive egalitarians (who downplay standardized ability-test scores in college admissions and employment and who stress the need to include the previously excluded)

The reviewer is at the Haas School of Business, University of California, Berkeley, 2220 Piedmont Avenue, Berkeley, CA 94720-1900, USA. E-mail: tetlock@haas.berkeley.edu

**Valuing multiple perspectives.**  
Sandra Dionisi's *Cubist Skyline*.

and cognitive elitists (who have mirror-image priorities).

Casual readers could easily conclude that Page (a professor of economics and political science at the University of Michigan) has clinched the argument for the egalitarians. Indeed, Page arguably invites the interpretation that there may be no awkward efficiency-equality tradeoffs when he repeatedly declares that “diversity trumps ability.” Careful readers will, however, heed the qualifications that Page attaches to his “diversity-trumps-ability” theorem—and the massive inferential gap between Page's elegant thought experiments and the messy real-world situations to which Page generalizes with varying degrees of caution.

Page focuses on two tasks, problem-solving and prediction, and relies on two explanatory concepts, perspectives and heuristics. Perspectives “are representations that encode objects, events, or situations so that each gets its own unique name.” The more diverse the causal perspectives, the wider the range of potentially viable solutions a collection of problem-solvers can find. Heuristics are problem-solving tactics that tell problem-solvers working within a perspective how to search for potential improvements on solutions.

Page deploys computational models—populated with agents that interact in time and space according to computer-coded rules—to illustrate the power of diversity. The agents can represent virtually anything: from viruses to politicians.

Page's car-mileage thought experiment is representative of the challenges of moving from computer code to hypercharged real-world debates. Imagine a lot with 1000 cars. We want the car with the best gas mileage but only have data bearing on three perspectives on the causes of gas mileage: vehicle weight, height, and wheelbase. Solving the problem empirically—test driving each car—is prohibitively costly, so we must solve it heuristically. Page arrays the cars along each of the three causal-perspective axes and plots the mileage of each car tested. His program directs agents, each endowed with a particular one-dimensional perspective, to start their search with a randomly selected car and then move to the neighboring car. If that car has better mileage, the agent continues until reaching a local peak. If the second car gets worse mileage, the agent reverses direc-



tion and searches until reaching a local peak.

Imagine three such simple-minded agents working as a group. Each of their landscapes has local peaks, but a local peak on one dimension is rarely the local peak on the other dimensions. If the three agents cooperated, they could converge on a better solution faster and at less expense in effort. And, indeed, large populations of agents can—when aggregated—reliably reach solutions as good or better than those found by elite subsamples of the “smartest” agents.

In brief, diversity appears to trump ability—at least when we equate high ability with drawing lucky starting points in sharply constrained searches for solutions. But elitists will argue that the game was rigged. Would diversity still trump ability if we defined ability as capacity to scan all three dimensions simultaneously for peaks and spot promising starting points based on those scans (rather than randomly), or as capacity to see beyond one's immediate neighbors, or as capacity to resist premature closure and avoid confusing local optima with the global optimum? I suspect that the result would look more like the chess match between Kasparov and the 50,000 Internet challengers. The challengers did well, but they still lost. Moreover, we need to consider the cost of mobilizing 50,000 moderately to extremely skilled chess players to strategize almost as well as a grandmaster. The boundary conditions on diversity-trumps-ability may be longer—perhaps a lot longer—than Page acknowledges.

I conclude Page's pro-diversity argument applies to his own research program. If his agent-based models had been informed by a more diverse set of disciplinary perspectives (especially by work on expert systems and cognitive styles), he would have reached a more appropriately nuanced set of conclusions about the costs as well as the benefits of diversity. Ironically, therefore Page could be wrong in one respect because he is right in another. Readers should keep this paradox in mind before they export his research findings into messy policy debates over how much weight to give identity diversity in hiring university faculty—or, to switch perspectives, how much weight to give ideological diversity in hiring social scientists.

conclusions about the costs as well as the benefits of diversity. Ironically, therefore Page could be wrong in one respect because he is right in another. Readers should keep this paradox in mind before they export his research findings into messy policy debates over how much weight to give identity diversity in hiring university faculty—or, to switch perspectives, how much weight to give ideological diversity in hiring social scientists.

10.1126/science.1142673

### The Difference

How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies

by Scott E. Page

Princeton University Press,  
Princeton, NJ, 2007.  
448 pp. \$27.95, £17.95.  
ISBN 9780691128382.