explosion of communications theories and methods, as well as vast new databases. Government sponsorship, Simpson proves, led to significant innovations or refinements in content analysis, survey research, scaling techniques, diffusion studies, development theories, reference group theories, and motivation research, all of which helped to institutionalize mass communications as a viable academic discipline.

More problematic is Simpson's largest claim: that psychological warfare helped shape the very construction of what communication "is" by encouraging social scientists to conceptualize their subject as a top-down power relationship, a relationship emphasizing communication as domination, communication as control. Without government pressure, Simpson suggests, American researchers might not have developed such a narrowly instrumentalist and largely quantitative conception of their field. This hypothesis is in many ways intriguing, but not entirely convincing, for earlier research suggests that an academic model promoting social science as social control was already being institutionalized prior to both world wars. Similar political and ethical questions, for instance, are raised in studies examining the early uses of both advertising and industrial psychology to suppress labor dissent, among them Loren Baritz's *The Servants of Power*—a work whose very title suggests a broad continuity with Simpson's Cold War study.

Even so, Simpson's research adds a crucial international dimension to the history of American social science. By piercing through the subterfuges, euphemisms, and outright deceptions of the Cold War era, he has recovered a portion of history long forgotten or suppressed. In the process, he has produced an original and important contribution to the sociology of science which brings to the forefront key questions about the deeper connections between knowledge and power.

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The Industrialization of Chemistry

The Rainbow Makers. The Origins of the Synthetic Dyestuffs Industry in Western Europe. ANTHONY S. TRAVIS. Lehigh University Press, Bethlehem, PA, 1993 (distributor, Associated University Presses, Cranbury, NJ). 335 pp., illus. $49.50 or £41.95.

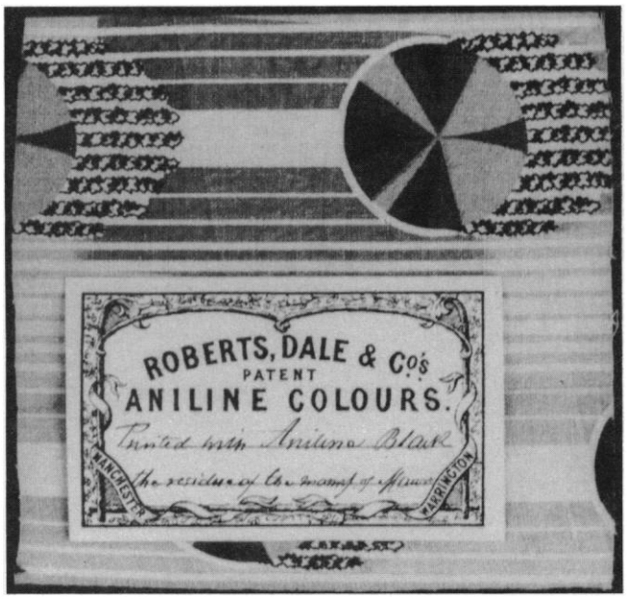
It is easy to take dyes for granted. Omnipresent in the consumer products that surround us, they are so reliable in their hues and fastness that we are surprised when a color fades under the insult of bright sun or strong detergents. They are cheap, their chemistry is for the most part understood, their production is based on technologies that are a century old.

Generally considered a low- or middle-tech industry today, when considered at all, the manufacture of dyestuffs was decidedly high-tech in the 19th century. Indeed, the production of dyes from coal tar was, in many respects, the prototype of science-intensive industry. In the late 19th century, the synthesis of colors brought together scientific knowledge and industrial technology, the research laboratory and the modern business firm. The makers of dyestuffs diversified into photographic supplies, insecticides, rayon, synthetic rubber, resins, fixed nitrogen, and, not least important, pharmaceuticals. They supplied much of the know-how that made Germany a formidable adversary in commerce and war and, by stimulating investment in universities, a commanding presence in the sciences. The dyestuffs industry had much the same strategic importance in the early 20th century as the semiconductor industry has for us—and perhaps greater importance for historians, since the close and complex relationships between science and technology that we take for granted first emerged in the manufacture of dyes.

Thirty-five years ago, a young historian taught us about the history and significance of this industry in a strikingly succinct, vivid, and penetrating book. The historian was John J. Beer; the book was his now-classic *The Emergence of the German Dye Industry* (University of Illinois Press, 1959; reprint, Arno, 1981). Commencing with William Henry Perkin's discovery of mauve in 1856 and ending with the formation of the German trust I. G. Farben after World War I, Beer's work provided both an engrossing narrative of the growth of the synthetic dyestuffs industry and a generous framework for thinking about the relationship between science and technology in the modern era. He was concerned to understand how an industry that grew out of serendipitous discovery came to be dominated by systematic research of battalions of chemists. He was interested, too, in the relationship between patent legislation and the pace of technological innovation, the role of universities in industrial development, and the reasons for the ascendancy of German and Swiss firms during the 1870s and 1880s—an ascendancy that had far-reaching implications for modern economic and political history. Beer's superb book had the intended effect of informing a broad audience about a critical episode in the history of modern science and modern industry; it also had the unintended effect of discouraging further historical work on the history of the dyestuffs industry itself. Beer, quite simply, was a hard act to follow.

Anthony Travis's *The Rainbow Makers* is the first book-length study of the history of the synthetic dyestuffs industry to appear in English since Beer's. It is, on the whole, a worthy and useful successor. This is not so much because its questions are new; in fact, Travis traverses much the same terrain as Beer and focuses on many of the same issues. Nor does he revise the main contours of the story that Beer told. Like Beer, he sees the early years of the

"A 'sumptuous book' is how an American described BASF's latest color swatch in 1880. This sample case of dyestuffs by the same firm was another of the elaborate sales aids provided to representatives and consumers in Europe, the United States, the Far East, and elsewhere." [From the dust jacket of *The Rainbow Makers*; courtesy of BASF Archives, Ludwigshafen]



"Roberts, Dale & Co. label in notebook of Heinrich Caro. This firm manufactured mauve on a large scale from around 1862, using the copper sulfate–sodium chloride process invented by Caro; the residue of the oxidation reaction afforded a black that was suited to cotton printing. Direct printing of black with aniline in the presence of copper and an oxidising agent was discovered by John Lightfoot of Accrington in 1859. His patent of 1863 and the improved process of Charles Lauth (1864) passed into the hands of J. J. Müller & Co. of Basle, who previously marketed Caro's black. The great success of aniline blacks contributed to the increasing demand for aniline." [From *The Rainbow Makers*; courtesy of the Deutsches Museum, Munich]

synthetic dyestuffs industry as guided by a rough-and-ready empiricism; like Beer, he dates the transition to research guided by structural theory as occurring in the 1870s; and, like Beer, he sees German firms as being far more adept than their rivals at integrating scientific research into their operations. This is not a work that overturns existing scholarship; it is, however, one that supplies texture and resolution to an essentially familiar story. By so doing, it significantly enlarges our understanding of a crucial episode in the relations between science and industry.

Travis's contributions are most evident in his treatment of the decade or so following Perkin's synthesis of mauve. Drawing upon trade publications, patents, and court records, as well as retrospectives and the scientific literature, Travis reconstructs the scientific, engineering, and market uncertainties facing both Perkin and his rivals as they sought to mine colors from coal tar. He emphasizes, rightly I think, the continuities between the young industry and the traditional manufacture of dyes from natural products, showing, for example, how practical chemists could draw upon an existing inventory of reagents and mordants to find new colors, to lower production costs, and to adapt the new dyes to a variety of fabrics. His exploration of the machinery used in dye production illustrates the importance of craft know-how to the new industry; his account of efforts by academic chemists to make sense of the new compounds enlarges our understanding of the history of organic chemistry during the period when the fundamental principles of structural theory were beginning to take shape. Throughout, Travis takes pains to show how retrospective accounts composed in the early 20th century exaggerated the role of formal knowledge, especially of organic chemistry, in the early development of the industry—an exaggeration that Travis bluntly attributes to chemists intent on advancing their professional interests.

Travis gives academic chemists their due when he turns to the exploitation of alizarin, the azo dyes, and the synthesis of indigo—all of which depended upon theories of molecular architecture evolving in university laboratories, especially those of Germany. But, as Travis points out, by the time science truly began to guide product innovation Germany had already emerged as the dominant power in dye production. German supremacy in organic chemistry helped consolidate the nation's control over an industry in which it had already attained leadership. That leadership was won, in Travis's view, not so much through the rational exploitation of formal knowledge as through the painstaking imitation and improvement of foreign methods, aggressive salesmanship, a willingness to assume risks that intimidated French and British investors, and a methodical attentiveness to quality control rooted not so much in national character as in the insecurity of firms lacking the reputations, domestic markets, and raw materials of foreign competitors. Although Travis does not make comparisons with the history of other industries in other times, readers will surely draw their own.

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Unlikely Contrivances

Zipper. An Exploration in Novelty. ROBERT FRIEDEL. Norton, New York, 1994. xiv, 288 pp., illus. $23 or $C29.99.

How can we account for the ordinary and unnecessary gadgetry of 20th-century life? And what does our hesitant embrace of this stream of mechanical novelty reveal about our culture and its values? These are the questions Robert Friedel has posed in his engaging history of the zipper, one of the century's most improbable devices.

As Friedel is at pains to remind us, the zipper has contended with better-known substitutes since its introduction at the beginning of this century. These familiar fasteners did the same job, usually at far lower cost. The button, for instance, has been used in Europe since the 13th century. Strictly speaking, the zipper is superfluous, and today it is everywhere. The firm YKK alone added 1.25 million miles to the world's supply in 1991—enough to zip the planet's girdle 50 times over. Yet the zipper's progress from insight to ubiquity was as chancy as the task of doing up its ancestor, the notoriously unreliable Plako.

Friedel calls his book an exercise in "anonymous history," the name given by architectural critic Siegfried Giedion to the history of the mundane contrivances of modern mass culture. But whereas the heroes of Giedion's book *Mechanization Takes Command* are the artifacts themselves—from the Yale lock to the great American bathroom—Friedel's heroes include an overwrought inventor struggling doggedly through the 1890s to fit a mechanical slider to a fragile row of hook-and-eye clasps and his small-town business partner trying to market this hopelessly fallible device. As an example of the unpredictability of invention, the head of Bell Laboratories in 1943 could do no better than cite the zipper: "I have often thought of how infinitesimally small would have been the chance of any man or group of men, except the one who actually had the idea, planning to invent the common zipper" (p. 75). *Zipper* is a sustained assault on the belief that the imperatives of hardware rule society or that large-scale social and economic forces dictate technological outcomes. Instead, Friedel emphasizes the contingent, almost accidental course of innovation: how a salesman's hucksterism, a small-town Pennsylvanian's boosterism, and a Swedish-American engineer's persistence transformed the hapless hook-and-eye fastener into the symmetrically dimpled zipper. But even after World War I, when these men had protected their ingenious device with patents held by their firm, Talon, their success was by no means assured.

In the Jack Finney novel *Woodrow Wilson*