A Tale of Two Textbooks: Experiments in Genre

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A Tale of Two Textbooks

Experiments in Genre

By David Kaiser*

ABSTRACT

Though the notion of a scientific textbook has been around for almost three centuries, the category has hardly been stable. The plasticity of the textbook genre may be illustrated by recent variations as well as long-term trends. In this brief essay I examine two idiosyncratic but highly successful physics books, each published in the mid 1970s, whose production, marketing, and adoption reveal some of the slippage between such categories as textbook, scholarly monograph, and popular best seller.

LONGUE DUREE VERSUS SHORT-TERM VARIATION

The English word “TEXTBOOK” DATES FROM 1730, about a century earlier than the word “scientist.”1 Books intentionally produced for didactic purposes—increasingly differentiated from handbooks, encyclopedias, and scholarly monographs on the one hand and popular books for nonspecialists on the other—helped to crystallize, over the eighteenth and nineteenth centuries, such familiar disciplines as chemistry, physics, geology, and biology. As several recent historical studies have illustrated, changing editorial conventions, marketing strategies, state supervision, and intellectual innovation all shaped a recognizable genre—the “scientific textbook”—over the longue durée.2

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My thanks to Professor Kip Thorne for generously sharing his personal files with me and for granting permission to quote from them; to Charles Greifenstein and Anne Harney of the American Philosophical Society for their assistance with the John A. Wheeler Papers; to Nora Murphy of the MIT Institute Archives for her assistance with the Victor F. Weisskopf Papers; and to Dr. Fritjof Capra for permission to quote from his correspondence. I would also like to thank Marie Burks, Michael Gordin, Yoshiyuki Kikuchi, Roberto Lalli, Bernard Lightman, David Singerman, Alma Steingart, Marga Vicedo, Benjamin Wilson, and Aaron Sidney Wright for helpful comments on an earlier draft.


The achievement of this long-term view is to be lauded, but what about short-term variations? What are the limits of the term “scientific textbook,” and how have the boundaries of the category been pushed even in recent times? To complement the diachronic insights offered by previous historical studies, I focus on two recent outliers. Each book dates from the mid 1970s—two centuries past Lavoisier’s great *Traité élémentaire de chimie* (1789) and one century removed from Mendeleev’s *Principles of Chemistry* (1868 –1870)—seemingly long past the time when textbooks had become clearly distinguished from reference monographs or popular books for the masses. Each of my examples treats recondite topics in modern physics, a century or more after physics had become a recognizable discipline. The two books betrayed enormous differences in outward appearance, physical size, narrative style, and internal organization, and yet both became—in their own ways—successful textbooks adopted for classroom use around the world.

Both *Gravitation* (1973) and *The Tao of Physics* (1975) highlight the disjunct between authorial intentions and readers’ responses, blurring the boundaries between scholarly monograph, specialized textbook, and mass-market best seller. They also highlight the many hands at work, often behind the scenes, in crafting a book and negotiating its form and contents, well beyond those of the named author alone. Perhaps most important, as intellectual products that are also objects of consumption, scientific textbooks like these bear the traces of broader changes in the institutions and political economy of science. Both books reveal some of the wrenching challenges that the physics discipline faced in the 1970s. In all these ways, these delightful outliers remind us of the continuing plasticity of the textbook genre.3

AN EXPERIMENT IN GRAVITATION

A remarkable publishing event occurred in September 1973: the release of a 1,279-page book, weighing more than six pounds, with the simple title *Gravitation*. Wags were quick to remark that the book was not just about gravitation, but a significant source of it. The book soon acquired several nicknames, including “the phone book” (another reference to its girth) and “the big black book” (for its sleek, modern cover). Most common became “MTW,” for the authors’ initials: Charles W. Misner, Kip S. Thorne, and John A. Wheeler.4


Princeton under Wheeler’s supervision in the late 1950s and early 1960s—those topics had been gaining traction in the physics community since the 1950s, having previously been eclipsed by more fashionable topics such as quantum theory and nuclear physics. Upon publication, Gravitation was the latest installment in a series of new books about general relativity, including Steven Weinberg’s Gravitation and Cosmology (1972) and Stephen Hawking and George Ellis’s The Large Scale Structure of Space-Time (1973).³ Unlike those other books, however, MTW defied many people’s expectations for a textbook. Some just didn’t know what to make of it.

The authors clearly intended Gravitation to be a textbook, pitched at advanced physics students. Wheeler’s notes from an early planning meeting with his coauthors made clear that they would write the book with “the committee planning graduate courses in U. of X” in mind. But while they were certainly thinking in terms of a textbook, from the start they treated the project as an experiment in the genre. The book was organized into two tracks: a core of introductory material occupying less than a third of the contents, surrounded by extensions, elaborations, and applications.⁶ The two tracks were not sequential; many chapters were divided, section by section, into one track or the other. Even more novel was the extensive use of “boxes” for complementary material. The boxes were set off from the main text by heavy black lines, interrupting the flow of ordinary chapter exposition, often for several pages at a time. Some of the boxes resembled the “sidebars” that had long been a staple of science textbooks aimed at younger students, featuring short biographies of famous physicists or brief descriptions of important experiments. But most of the boxes in Gravitation served a different purpose. According to Wheeler’s notes, the boxes were meant to constitute “a third channel of pedagogy,” beyond the two tracks. “They are distinguished from the main text by untidiness” and included “the kinds of things we would like to present in lecture hour to students who can be relied upon to learn tightly organized material and computational methods on their own from a systematic text.” The pedagogical aspirations were clear: as each author drafted a section of the book, the coauthors would “test a write up by asking if a student could use it to lecture from.”⁷ The authors devoted spectacular attention to the physical appearance and production of the book. Thorne traded detailed letters with the artists and layout designers at the publisher, W. H. Freeman in San Francisco, going over everything from the thickness of


the lines to set off the boxed material to arrow styles and shadings to be adopted in the hundreds of illustrations. Early on, Thorne alerted an editor at Freeman that “several features of the manuscript will require special typesetting problems.” Beyond the extensive figures, tables, and boxes, the authors anticipated the need for at least six distinct typefaces, perhaps as many as eight, in order to distinguish the plethora of symbols and equations they would be treating.8 (Before the book had even been published, Thorne worried that “the extreme complexity of the typography” would bedevil foreign-language publishers. He recommended that they simply photograph the equations from the English edition once it became available, rather than attempt to re-typeset them.) Given the book’s unusual organization, the authors also inserted thousands of marginal comments throughout the book. Some comments summarized the material under discussion, but many others were “dependency statements”: a road map spelling out at each point in the massive tome which other sections a given discussion depended on and which others would in turn depend on it.9

Having tackled every detail of composition and typesetting, imagine the authors’ surprise when—two years into the process, and just three weeks before they submitted their final edited manuscript—they learned that the publisher held a rather different conception of the book than they did. After meeting with their editor from the press, Thorne shot off a letter to his coauthors. “I was rather shocked to learn from Bruce [Armbruster, the editor] that the people at Freeman are so out-of-touch with our book that they have not been regarding it as a textbook, but rather as a technical monograph. I suppose that the enormous size of the book has something to do with it.” The publisher’s plan had been to produce an expensive hardcover edition, intended primarily for purchase by libraries; “Freeman had not been expecting to pick up the textbook market with this book” at all. Thorne worked hard to convince the editor that “there might be some hope of picking up student sales” as well, but that would require a complete overhaul of the publisher’s printing and pricing plans.10

Was \textit{Gravitation} a reference monograph for libraries or a textbook for classroom use? From that ontological difference sprang more immediate considerations. For example, how could they keep such a fabulous concoction from crumbling under its own weight? The book’s unusual trim size—each of its nearly 1,300 pages was more than an inch wider and taller than standard textbooks at the time—suggested hardcover rather than paperback binding. Hardcover binding seemed all the more appropriate to the authors, for whom \textit{Gravitation} was self-evidently a textbook, since (as Thorne explained) “it seems to me that paperback editions cannot hold up well enough with the heavy use that a student in a full year course would give the book.” But hardcover binding threatened to price the book beyond the reach of a student market.11 After assurances from the publisher that paperback binding could hold up just as ruggedly as hardcover, the authors struck a deal with W. H. Freeman: in exchange for reduced royalty rates on the paperback edition, the


11 \textit{Ibid.} See also Misner, Thorne, and Wheeler, form letter to colleagues, 13 June 1973 (cit. n. 6).
press would aim to keep the price of the paperback lower than the hardcover price of the recent textbook by Weinberg, *Gravitation and Cosmology*. Upon publication, the paperback edition of Misner, Thorne, and Wheeler’s *Gravitation* sold for $19.95 (about $100 in 2011 dollars) and the hardcover for twice that price. With the publisher now treating the book as a textbook rather than a reference monograph, and with the compromise pricing plan in place, Thorne was confident that the book could “capture one hundred percent of the textbook market in this field—or as nearly so as possible.”

Like the authors and publisher, reviewers recognized the book as unusual. “A pedagogic masterpiece,” announced a reviewer in *Science*; “one of the great books of science, a lamp to illuminate this Aladdin’s cave of theoretical physics whose genie was Albert Einstein,” crowed another in *Science Progress*. A third reviewer challenged his readers: “Imagine that three highly inventive people get together to invent a scientific book. Not just to write it, but invent the tone, the style, the methods of exposition, the format.” Many reviewers lauded the rich set of illustrations and the innovative use of boxes. Others complained that the two-track-plus-box organization introduced too many redundancies. “This is a difficult book to read in a linear, progressive fashion,” concluded one reviewer; “there is needless repetition (indeed, almost everything is stated at least three times),” noted another. “The variety of gimmicks is bewildering—framed headings with quotations, marginal titles, ‘boxes’ sometimes extending over several pages, heavy type, light type, large type, small type,” reported a reviewer in *Contemporary Physics*. “Clearly the book is an experiment in presentation on a grand scale.”

Nearly all reviewers commented on the writing style. Wheeler was already well known among physicists for his catchy slogans and engaging prose. (Among other memorable contributions, he had coined the term “black hole.”) Wheeler’s early planning notes for the book insisted that he and his coauthors must “make clear the idea itself. But soberly, factually, no hyperbole, no enthusiasm.” If that had been the intention, not all reviewers agreed as to the outcome. The book featured a “prose style varying from the unusually colloquial to the unusually lyrical,” wrote one reviewer. But one person’s lyricism was another’s doggerel. “There is a commendable attempt at informality, but this reviewer found the breeziness irritating at times,” came one verdict. “A ‘poetical’ style is understandable if one deals with such [speculative] topics as ‘pregeometry.’ However, ‘poeti-


cal’ passages in differential geometry, for example, may obstruct the understanding of an ascetic reader,” concluded another.16 One reviewer huffed that the informal writing style “comes dangerously close to being patronisingly simplistic, to the point of insulting the reader’s intelligence.” Another was even more scandalized by the book’s tone. The intended reader, he scoffed, would be most at home with the book “if he is a regular subscriber to *Time* magazine—the writing of these authors has much in common with its breathless style.”17 Subramanyan Chandrasekhar, the famed astrophysicist and Nobel laureate who had grown up in India, trained in Britain, and settled in the United States, likewise noted that the book’s “style fluctuates from precise mathematical rigor to evangelical rhetoric.” He closed his review with the memorable observation: “There is one overriding impression this book leaves. It is written with the zeal of a missionary preaching to cannibals’ (as J. E. Littlewood, in referring to another book, has said). But I (probably for historical reasons) have always been allergic to missionaries.” (Thorne wrote to Chandrasekhar that the closing paragraph had left him “chuckling for about ten minutes.”)18

While acknowledging the book’s unusual organization, writing style, and pedagogical innovations (or “gimmicks”), most reviewers treated *Gravitation* as the authors had intended: as a textbook primarily for graduate-level coursework in the technical details of gravitational physics. The authors had set out to corner the market for textbooks on the topic, and they largely succeeded. A few years after publication, their book was still selling between 4,000 and 5,000 copies per year, while their main competitor, Weinberg’s *Gravitation and Cosmology*, had dropped to around 1,000 copies per year. Thorne noted to the publisher—with fanfare but not much hyperbole—that by the late 1970s “a large fraction of the physics graduate students in the Western world bought a copy of *Gravitation*.” The book sold 50,000 copies during its first decade, at a time when institutions in the United States graduated about a thousand Ph.D.’s in physics per year and no other country came close to that number.19

Yet from the start, some readers saw much more in *Gravitation* than a vehicle for training soon-to-be specialists. The publisher, for one, reversed course in a dramatic way. A decade after having written off the book as merely a reference work for library purchase, editors at W. H. Freeman decided to advertise a specially reduced price on the book—nearly 25 percent off list price—to subscribers to the popular magazine *Scientific American*. Thorne countered that a better way to test “the elasticity in the demand” for the

book would be to offer that reduced price to “that portion of the market which concerns me most”: students and young academics. He urged the publisher to offer the reduced price to university bookstores rather than Scientific American devotees.

Nonetheless, the publisher was on to something. Upon the book’s publication, reviews had run not just in venues such as Science and Physics Today; the Washington Post devoted a full-page review to the book, and a daily newspaper in San Antonio, Texas, likewise recommended it. The reviewer in the Post, himself a physicist at Williams College, acknowledged that “perhaps it is strange to review here a textbook full of mathematics, a book, moreover, whose 6.7-pound bulk the young, the old and the infirm can scarcely lift. But,” he declared, “those who read like to know what is being published and discussed.” And Gravitation certainly warranted discussion. The book’s engaging prose “awakens hope that the fuzzy and lugubrious ‘style’ that still spreads its gloom over so much of American science may not be in fashion forever.” The book’s unusual organization, moreover, seemed akin to recent trends in avant-garde filmmaking, such as the French nouvelle vague. “There are very few stories that should be told sequentially,” the reviewer avowed. All the better that Gravitation, like the hip filmmakers, had discovered “strategies for breaking up a linear narrative.” The San Antonio reviewer likewise encouraged his readers, “I am not a mathematician, and the 200 or so pages I’ve read are not all that formidable,” he explained. “If you’re curious and have an imagination, you won’t be cowed. The challenge is stiff, but fascinating.” The organization of the book was “phenomenal,” the topic inspiring. He concluded, “This is a fabulous, rewarding book.” A novelist could scarcely hope for a more enthusiastic review.

Fan letters also streamed in to the authors from a wide assortment of readers. Many came from colleagues who reported how much they enjoyed teaching from the book in their formal classes. But others came from further afield. One reader wrote from a hospital in Italy—it is not clear whether the handwritten letter came from a patient or a physician—to press the authors as to whether their views about the cosmos had changed during the three years since the book’s publication. (The letter writer had been keeping up with more recent discussions of the field by reading the Italian-language version of Scientific American.) He had more specific questions, too. In particular, what was the fate of life in a universe that cycled from big bang to big crunch? He was so desperate for a response that he promised $200 to anyone (the authors or their graduate students) who might take the time to answer. “Don’t be offended by my proposal. Time = Money.”

An engineer in Brussels turned to the book for a different reason. He decided to pick up Gravitation to help him learn English before beginning military service. “My hopes have been completely fulfilled: Gravitation is worth reading to learn English because it

20 Thorne to Renz, 10 Aug. 1983, Thorne Papers, Folder “MTW.”

21 Park, “Ups and Downs of ‘Gravitation’” (cit. n. 13), p. 4; and Robert Pincus, “Gravity Theory Excites the Mind,” clipping in Thorne Papers, Folder “MTW: Reviews.” The clipping does not indicate date, publication title, or page number, but advertisements on the same page as the review clearly indicate that the newspaper was based in San Antonio.


makes enjoy Physics [sic]!” The book so inspired him that he drew seven full-page whimsical cartoons in the style of Antoine de Saint-Exupéry’s *The Little Prince* to illustrate concepts he had learned from *Gravitation* such as the Nordtvedt effect, a hypothetical consequence of the violation of Einstein’s equivalence principle between gravitational and inertial mass.24

Readers closer to home wrote to the authors as well. Especially poignant was a letter that Thorne received from a reader in Portland, Oregon. “I stumble here, fall down there, and generally make a fool of myself as I wander about your textbook,” the correspondent explained, “but I am gaining a sense of balance and a few tools with which to deal with the subject.” His dedication to the book was impressive:

> When friends ask me about what I am doing I have made the mistake of telling them the truth [about his attempts to read *Gravitation*]. Sometimes I think they are right, I feel as though I am on the brink of madness. I go out to have a beer and listen to someone talk about his love affairs, the clutch in his pick-up truck, the problems with his children, the plumbing, the bus service. I look at him and see him dealing with all these important issues and I ask myself why do I care if I ever understand the difference between leptons and leprosy?

Yet still he could not shake his “obsession” with Einstein’s own question, “whether or not God had any choice in the creation of the Universe.” He needed to know: “Could God be a traveling technician whose responsibility is to supervise gravitational collapses and big bangs?”25

Six years after publication, with annual sales still brisk, John Wheeler tried to assess the reasons for the book’s success. Writing to his editor, Wheeler surmised that “many people buy the book who are attracted by the mystique, the boxes, the interesting illustrations, the ideas but who don’t expect to and never will get deep into the mathematics.” He figured about half the purchasers fell into that category—and he was eager not to lose them. In thinking about revising and updating the book, Wheeler concluded that “I think we can add a few things and take away a lot of things to keep this group ‘on board.’”26 Those plans fell through—Misner, Thorne, and Wheeler never did undertake a revision of their massive masterpiece—but Wheeler’s observation nonetheless rang true. In their effort to write a specialized textbook they had produced a hybrid work, as attractive to *Scientific American* subscribers for its “mystique” as to doctoral students struggling to enter the field.

**THE ONCE AND FUTURE TEXTBOOK**

*Gravitation* started out as a textbook, was mistaken (by its publisher) for a reference monograph, and made surprising headway in a popular market. My second example, Fritjof Capra’s *The Tao of Physics* (1975), was published at around the same time and followed an even trickier trajectory. It began as a straightforward textbook project, was transformed into a self-consciously popular book, blossomed into a publishing sensation,

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and was smuggled back in for classroom use. Even more than *Gravitation*, Capra’s *Tao* illustrates the porosity of such categories as “textbook” and “popular book.”27

Capra had completed his Ph.D. in 1966 in theoretical particle physics at the University of Vienna, in his native Austria, then took up a postdoctoral fellowship in Paris. From there he was invited for a second postdoc at the University of California at Santa Cruz, where he studied between 1968 and 1970. His fellowship expired just as the worst cuts began to befall the physicists’ job market. He returned to Europe and borrowed a desk in the theoretical physics group at Imperial College, London, where he remained an unpaid affiliate for three years. (He had met the director of Imperial’s particle theory group during his fellowship at Santa Cruz.)28

With no formal position, Capra took on odd jobs, desperate to make ends meet. He tutored high school students in math and physics and translated abstracts of English-language physics articles into German for the *Physikalische Berichte*. He also hatched a plan to help pay the bills—and perhaps even break back into a paying physics position; he would write a textbook under the working title “Current Concepts in Particle Physics.” He reached out to the physicist Victor Weisskopf for advice. Like Capra, Weisskopf originally hailed from Vienna, and the two had met at a physics summer workshop a few years earlier. Weisskopf was by that time a senior physicist at the Massachusetts Institute of Technology, former director of the CERN laboratory in Geneva, and a beloved author of textbooks and popular books about physics.29

Capra sought two different kinds of advice from Weisskopf when tackling his new textbook project. First, he wondered how best to explain tricky concepts like Heisenberg’s uncertainty principle. Even more important, given Capra’s financial straits, he hoped that Weisskopf could use his extensive contacts in the textbook-publishing world to help him find a publisher and secure a much-needed advance. The two traded letters and chapter drafts throughout 1972 and 1973, Weisskopf offering compliments on Capra’s exposition and encouragement for the textbook project, but each time skipping over the question of publishers or finances. After several such exchanges, Capra made his situation plain: he was living hand-to-mouth and simply could not squeeze enough time from his poorly paid day jobs to complete the textbook without immediate assistance from a publisher. “As you know, the problem of financial support has become vital for me,” Capra wrote to Weisskopf in January 1973. “I wonder whether I could approach a publisher for a contract”—perhaps with Weisskopf’s help or a letter of introduction. At last Weisskopf got the hint. Writing back a few months later, he explained, “I like your style and find many things well expressed” in the latest chapter drafts that Capra had sent; he again encouraged Capra to try to complete the textbook. “I understand your need for financial support but I suppose you are aware of the fact that a book like this is not going to bring

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...in much money because of the nature of the subject. The best that one can hope is something like $1,000 the first year and less thereafter.”

Around that time Capra was invited for a brief visit with the theoretical physics group at the Lawrence Berkeley National Laboratory in Berkeley, California. He took advantage of the trip to catch up with his former postdoctoral advisor, the physicist Michael Nauenberg, at nearby Santa Cruz. The two talked about Capra’s financial difficulties, his passion for the textbook project, and something else: Capra’s growing interest in Eastern religion and spirituality, a topic he had first encountered in the countercultural hotbed of Santa Cruz during his postdoctoral fellowship. In fact, Capra recalled a “transcendental experience” on the Santa Cruz beach, during which the ocean waves, the flutter of air around him, and even the sand and rocks on which he sat had become transformed into the Dance of Shiva from Hindu mythology. While in Santa Cruz as a postdoc, Capra had attended workshops and lectures on Eastern religions—topics that were making inroads in Santa Cruz and the wider San Francisco Bay Area at the time—and he had avidly read everything he could find on the topic since then. He had even become convinced that important ideas from quantum theory and particle physics showed unmistakable parallels with key teachings from Buddhism, Hinduism, Taoism, and Confucianism. His former advisor, Nauenberg—by Capra’s own lights, “a rather hard-headed and pragmatic physicist,” not one easily swayed by the hippie enthusiasms for which Santa Cruz was becoming famous—advised Capra to combine his two passions into one. Why continue down the difficult path of writing yet one more textbook, which (as Weisskopf had confirmed) hardly promised financial security, when he could write a much more original book exploring the parallels between modern physics and Eastern thought?

Capra returned to London inspired by the new plan. He composed several new chapters—treating themes like holism in Eastern religions, the complementarity of yin and yang, and the Eastern emphasis on dynamism and flow rather than static entities—and interleaved them with the physics textbook chapters he had already written. He thus transformed his textbook project into a book aimed at nonspecialists and the “general reader.” Even in its new guise, the odd little book took some time to find a home. Capra suffered through a dozen rejections from publishers until a small press in London took a chance. Capra also had luck with a niche publisher in the United States, Shambhala Press, which specialized in Eastern mysticism and spirituality. The two presses published Capra’s The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism simultaneously in 1975.

Very quickly, the book began to take off. Capra’s curious experiment had been well timed, and the book sailed along on a wave of interest in all things Eastern, occult, and “New Age.” Shambhala’s first edition of 20,000 copies sold out in about a year. A year


after that, the huge New York–based commercial publisher Bantam released a paperback edition of 150,000 copies. Multiple foreign-language editions soon followed. By 1983 half a million copies of the English-language edition alone were in print. The Washington Post lavished attention on Capra’s Tao of Physics not long after running its full-page review of Misner, Thorne, and Wheeler’s Gravitation. Whereas Gravitation’s mammoth size and unusual organization had inspired analogies to nouvelle vague filmmaking, Capra himself seemed more newsworthy than his book. “Tall and slim with curly brown hair skirting the nape of his neck,” the Post reporter cooed, “Capra, with California tan, shoulder bag, and a Yin Yang button pinned to his casual jacket, seems more a purveyor of some new self-awareness scheme than a physicist.”

Just like Gravitation, Capra’s Tao become something of a hybrid. Scholarly journals in every field from history and philosophy to sociology and religious studies devoted extensive space to assessing the book, some even arranging special forums with multiple essays by specialists, thereby treating the broad-market paperback as if it were a scholarly monograph. (Isis published a highly complimentary review in 1977.) A journalist later observed that Capra’s book had sold “amazingly well, not only to the usual Shambhala devotees of Eastern religion but also to engineers, Caltech grad students and people of the general population who, a few years later, would be reading Carl Sagan.”

The reference to “Caltech grad students” was no mere journalistic excess. The most surprising reaction to Capra’s Tao of Physics, in fact, came from the physics community. Some physicists certainly panned the book as we might expect, denigrating the effort as mere mystification or vulgarization. One stormed, for example, that “I agree with Capra when he writes, ‘Science does not need mysticism and mysticism does not need science but man needs both.’ What no one needs, in my opinion, is this superficial and profoundly misleading book.”

Yet other physicists rallied around the book, seeing in Capra’s inventive mixing of styles and themes a useful symbol that might help to attract students back to physics classrooms. A reviewer in Physics Today praised the book in part because it couched physics in “the immediate, feeling-oriented vision of the mystic so attractive to many of our best students.” Articles describing undergraduate courses that adopted The Tao of Physics—some expressly for physics majors, not just for nonscientists who needed to fulfill a distribution requirement—began to appear in the American Journal of Physics, a journal dedicated to improving the teaching of physics. When critics complained that

Capra’s book might just as likely confuse students as enlighten them—why becloud difficult concepts from quantum physics with equally difficult concepts from Eastern religion?—one of the physicists who had adopted Capra’s book for his course retorted: “It should be emphasized that most of these students would not have taken an offering in the Physics Department if it were not this one.”38 Inspired by the book, that physicist went on to publish some of the earliest lesson plans for important topics like quantum entanglement and nonlocality, topics that mainstream physics textbooks had not yet incorporated. Indeed, Capra’s *Tao of Physics* remained on physics department syllabi across North America as late as 1990.39

**BOUNDARY-CROSSING BOOKS**

What are we to make of these two unlikely success stories? Upon publication, the two books could hardly have seemed more different: a hulking book stuffed to overflowing with equations so complicated they required multiple typefaces and elaborate marginal notes; and a diminutive essay, less than a quarter the other book’s length, in which Buddhist *koans* or riddles took the place of equations. Though the authors of both books had harbored ambitions to publish a textbook at the start of their respective projects, they quickly learned that textbooks, like any publication, were the negotiated outcome among several competing parties, including editors and marketing experts in publishing houses. Neither authors nor publishers, moreover, could control what readers would make of the books once they got out into the world.

*Gravitation* narrowly escaped the pigeonhole of library-only reference work and went on to sell tens of thousands of copies. *The Tao of Physics* exploded into a cult sensation before it was reappropriated for classroom use and sold about a hundred times more copies than *Gravitation* ever did. Amazingly, they shared many common points of reception. Both received extensive analysis and review in specialist journals, as if they were scholarly monographs; both inspired passion, even ecstasy, among journalists and other nonspecialist readers; and both were enrolled in the formal effort to train the next generation of physicists.

Their spectacular appeal reveals much about the time, not just about the books. Both were conceived and published during a moment of tremendous institutional uncertainty for physicists in the United States. The quarter-century consensus that had ruled since the end of World War II about how to fund graduate education and what topics and styles to inculcate in doctoral training had come in for jarring reassessment. Internal auditors at the Pentagon and campus protesters against the Vietnam War alike had agitated in recent years against unlimited military spending for the physical sciences; détente and the first stirrings of stagflation had further slashed spending on defense and education, sending the

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57:687–692. On similar courses for science undergraduates that used *The Tao of Physics* as a textbook see also Capra to Weisskopf, 8 July 1976 (cit. n. 33).


job market for physicists into a tailspin. During that stark period of reassessment, topics that showed the least connection to instrumental or pragmatic aims could signal (to physics students themselves, as well as to wary neighbors on campus) that not all physicists were tools of the Pentagon. Capra announced that goal in the opening pages of his book, explaining that many people tended to see physics “as an unimaginative, narrow-minded discipline which is responsible for all the evils of modern technology.” He aimed to demonstrate instead that “physics can be a path with a heart, a way to spiritual knowledge and self-realization.” Though the authors of *Gravitation* did not push their “evangelical rhetoric” quite as far as Capra did, their choice of topics—the otherworldly and cosmic—clearly resonated with readers gripped by the same urge for metaphysical clarity, whether about God or the fate of life in an evolving universe.

What counts as a “scientific textbook” thus can shift dramatically over a time-scale of years, not just centuries. Wide-scale fluctuations from the norm, such as *Gravitation* and *The Tao of Physics*, illustrate not just the porosity between categories like monograph, textbook, and popular best seller. They also serve as an invaluable tool for charting intellectual trends, political economy, market forces, and even scientific personae, especially during moments of uncommon institutional change. Perhaps Thomas Kuhn was correct to say that textbooks cannot teach budding scientists all they need to know to become full-fledged practitioners. But they still hold fascinating lessons for historians.