Book Reviews

Experimental Psychology: Fechner's Great Work

In his own view Gustav Theodor Fechner was not primarily a psychophysicist. Before he coined the term he was well known as a physicist, and during 70 years of intellectual productivity he was a physiologist, doctor of medicine, poet, estheticist, and satirist as well. Most consistently, though, he aspired to be a philosopher. As Edwin G. Boring points out in his introduction to **Elements of Psychophysics**, volume 1 [Translated from the German edition (1860) by Helmut R. Adler. Davis H. Howes and Edwin G. Boring, Translation Eds. Holt, Rinehart, and Winston, New York, 1966. 320 pp., illus. $6], Fechner intended psychophysics merely to contribute to his philosophy. His aim was to overthrow materialism, and psychophysics would help by showing empirically the relationship between mind and body. However, Fechner is remembered for his psychophysics. From our vantage point his measurement of mental processes laid the foundation of experimental and quantitative psychology.

Fechner thought of the *Elemente der Psychophysik* as elementary, as "nothing but the paltry beginning of a start." Again, we have a different view. We can interpret the *Elemente* in his title to mean elementals, or essentials, for the concepts and methods developed in this book have remained central to the study of sensation and perception ever since. In fact, there is now renewed interest in the field Fechner began, as reflected in the recent creation by two major universities of professorships in psychophysics. The observance by the American Psychological Association and the Psychometric Society of the centennial of Fechner's publication also served to underscore his sustained impact [*Psychometrika* **26**, 3–63 (1961)]. There have been advances, but few that he did not anticipate.

Now Fechner's ideas were not wholly new when he published them, and he writes that "it would be a poor recommendation if they were." He himself believed that E. H. Weber should be called the father of psychophysics—for recognizing the generality of one of psychology's early "laws," namely, that the just noticeable difference in stimulus intensity bears a constant ratio to the basic intensity. Moreover, all three of the methods of measurement Fechner used had previously been used by others. What was it, then, that Fechner accomplished? He attacked frontally the inherent and unique difficulties of psychological measurement, specifically "the great variability of sensitivity due to individual differences, time, and innumerable internal and external conditions." Through great ingenuity and by perseverance in his experiments, he was able to stipulate the many considerations and precautions that were necessary and sufficient to yield reliable measures of sensitivity. He revealed the conditions required for accuracy in relation to the observations and to the calculations, and the dependency of these requirements upon the method used and upon the sensory system and sensory dimension under investigation. The evidence that his techniques worked came from data he reported on judgments of visual intensity and of color, of auditory intensity and pitch, of size and distance sensed visually and tactually, of pressure, lifted weights, temperature, time, and motion. He thus laid the groundwork for measuring discrimination capacity along various dimensions of sensation in most sensory domains, for measurements of the kind that have led to much of our present knowledge about the functioning of the sense organs. Fechner's techniques have also been used with more "interesting" stimuli—in the study, for example, of personality and social processes.

Though Fechner assures us, perhaps 50 times, that more detail on experimental techniques will be made available in a supplement (which probably never appeared), there is plenty of detail in the present volume. And while the substance has long since been incorporated into the science of psychology, the flavor of how psychology became a science is nowhere so adequately illustrated. Be warned, however, that Fechner is not easy to read, even in English. His sentence structure is long and involved, and Adler's foreword justly characterizes his style as diffuse and redundant. Still, the leisurely approach contributes to the charm of the book, if only for the personal vignettes it permits. Fechner writes that one experiment required him to hold a weight suspended long enough to cause a pain in the region of the spleen. He adds: "A mustard plaster seemed to be good for it." Again, after lifting heavy weights: "my blood rushed to my head, which is one of my weaker parts, due to some earlier ailment, whereas my very healthy chest suffered no ill effects."

Howes's preface to the text acknowledges that "Not many of the psychologists who pay tribute to Fechner as one of the founders of their field have been able to read its 350,000 words through from beginning to end." Now we have available the more important of his two volumes. We can see the basis for his immediate influence on such men as Helmholtz, Mach, and Wundt, and his eventual influence on many others, including Freud. We owe our thanks and congratulations to Adler, Boring, and Howes for their able performance of a valuable service.

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Change and Adaptation

A handful of medical researchers is currently working on ways to enable parents to choose the sex of their unborn children. If (or when) these researchers succeed, society will have to adjust to the various imbalances this procedure will create. Sociologists have considerable evidence that more boys than girls will be "ordered," especially among the lower classes. This imbalance, and others like it, may in fact upset many societal institutions, including the monogamous family structure, ethnic relations, and employment and vot-

ing patterns. (Democrats ought to be pleased, for men are significantly and systematically less inclined than women to vote Republican.) Some of my colleagues would argue that society would adjust "automatically" by increasing the value of women until a new demographic balance was found. In my judgment, there is little evidence that such an easy solution will be possible. Even after considerable costs, I expect, the adaptation would probably be as inadequate and confused as, to cite a present instance, our adjustment to the proliferation of the automobile.

This recurring problem of the interaction between society and technology is the subject of Elting Morison's **Men, Machines, and Modern Times** (M.I.T. Press, Cambridge, Mass., 1966. 245 pp. $5.95). Morison, a fine historian and M.I.T. professor of management, first tells us a set of stories about the introduction of certain 19th-century inventions, including naval guns capable of continuous-aim firing, indexing procedures for office filing, and the Bessemer process for making steel rails. He examines the personalities of the innovators (usually eccentric trouble-makers of the sort few government agencies or large corporations would hire today), their first allies and devoted disciples, and the resistance they met from the organizations and societies to which they offered their discoveries. In each case the new machines or methods were vastly superior to the old (the improved naval gun was 3000 percent more effective), and in ways which were easily demonstrable. This on the one hand makes the resistances to the innovations stand out sharply in their absurdity, and adds much to Morison's narrative; but the demonstrable superiority also explains, in my judgment, why these new technologies did not face still more opposition.

Discussing the difficulties posed by society to the inventors and their inventions provides Morison with an opportunity to present an informal but highly sensitive and insightful study of the way society and its organizational arms function. He shows, for instance, what a tightly knit community the United States Navy is, with its own culture, institutional fears, and worked-out mechanisms to repel those suggestions that force change, as the newly improved gun threatened to do. It took outside intervention, in the form of a different "big gun" and former naval person turned President—Theodore Roosevelt—to scuttle the opposition.

Morison is very much aware that the innovations he reviews do have harmful side effects. He correctly warns that the bureaucrat who comes upon new ways of collating information (once index card systems, today computers) may gain disproportional and otherwise unjustifiable control over the activities of his organization. Morison sees in computers the danger that they may deepen the tendency toward a fragmented and unduly quantified view of life and in so doing strengthen the illusion that what cannot be measured is insignificant. He does not deal with innovations whose *main* effects are harmful.

More than the details of the inventions or the resistances they faced, which he outlines masterfully, Morison is concerned with Thomas Huxley's deceptively simple question: "What are you going to do with all these things?" He stresses that we cannot reverse the process and return to a pretechnological age, any more than we can arrest the march of new technologies—nor should we try. He suggests rather the creation of a new culture (I think he means morality) to guide us. He hopes that new technologies, rather than be allowed to restructure society to their own demands, will be adapted to the varying human and societal requirements. Urbanely he presents these general views as modest afterthoughts, although they vibrate through the case studies which are the core of the book.

Morison's one weakness is his implicit acceptance of the prevailing liberal approach to his subject. New cultures do not spring up because modern times demand them: a more deliberate, rational, and in this case political expression of societal will is necessary. If technologies are to be adapted to societies and not the other way around, some specific institutional arrangements will have to be made. Morison can be readily exempted from having to provide details of the nature of these institutions, but he must realize that a societal guidance of technology is required similar in scope to that now provided to the economy. Surprisingly, many liberals who have fully accepted Keynesian economic controls take a laissez-faire view of technology. Theirs are the arguments once used to defend laissez-faire economics: that any attempt to control technology would stifle innovation and initiative. Morison does sense a vague need for societal guidance to accelerate beneficial technologies, to curb harmful side effects, and to block destructive technologies. But his studies do not as yet include anything like the marketing of thalidomide, the proliferation of nuclear weaponry, and LSD-triggered psychoses—and they do not lead him to fully face three key questions: Are the unlimited freedom of research and unlimited implementation of findings not outweighed by the sufferings they inflict upon millions? Is technology really a neutral tool, or is some of it manifestly dangerous? And how—politically—will society express itself to regain control of technology?

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Aid to Education Abroad

Papers, speeches, and discussion remarks which were timely at conferences held in 1961 and 1962 frustrate and irritate the reader of a book carrying a 1966 publishing date. As I read into **Education and Training in the Developing Countries: The Role of U.S. Foreign Aid** (Praeger, New York, 1966. 415 pp., $7.50), edited by William Y. Elliott, the sensation was like that when one inadvertently launches into an old newsmagazine in a doctor's waiting room.

The trouble is that most of the contributions are on very specific problems, with recommendations for organizational steps and tactics that have decreased in relevance now that the context has changed. For example, the editor speculates on how the then new organization Education and World Affairs might develop; but meanwhile it has developed through several years of experience. A piece on "The Peace Corps: problems and potentialities" conveys the information that, "As of March, 1962, we had about 919 people in training or overseas," whereas now there are about ten times that many overseas, thousands of returnees, and very extensive experience on which penetrating studies already exist, such as Robert Textor's *Cultural Frontiers of the Peace Corps.*

Some of the papers do offer analysis