Book Reviews

A Variable Reexamined

Birth Order. Its Influence on Personality. CÉCILE ERNST and JULES ANGST. Springer-Verlag, New York, 1983. xviii, 344 pp., illus. $29.80.

Historically, research on the psychological effects of birth order has often involved little more than the mere inclusion of this convenient subject variable at the data analysis stage of a particular psychological investigation. The likelihood of a statistically significant relationship between birth order and the current variables of interest was duly probabilistic; the psychological utility was usually minimal—Adlerian objections notwithstanding. As one might guess from that account of the situation, positive, negative, and neutral effects of birth order on a wide range of psychological variables have been reported. Initial reports of striking relationships of birth order with X come cheap in the literature; follow-up replications for reliability come dear, if at all.

It is in this arena of volatile and ephemeral effects that Ernst and Angst attempt to bring order and integrity. The undeviating standard by which all reports of birth order effects are measured in their book is method, not magnitude. Careful scrutiny is applied to several areas of current birth order research, and precious little of any group's dogma is left standing.

Chapter 1 introduces the reader to some recognized pitfalls in birth order research, and chapter 2 provides an application of this methodological rigor to relationships of birth order to several biological factors (for example, birth weight, prematurity, minimal brain damage). Chapters 3, 4, and 5 examine intellectual outcomes of birth order and twin status for intellectual functioning; chapters 6, 7, and 8 review influences on occupation, socialization and personality, and mental illness. Chapter 9 allows the authors a chance to summarize the findings of their literature review spanning the years 1946 to 1980, and chapters 10 and 11 report data on scholastic achievement, personality, and drug consumption from a representative sample of 19- to 20-year-olds from Zurich, Switzerland.

Ernst and Angst's conclusion across a broad array of personality characteristics is that birth order has essentially *no* influence on personality. Time and time again, superficial birth order effects dissolve to insignificance when (i) a comprehensive review of the literature is accomplished and (ii) reports containing fundamental problems of method are given their proper weight—zero. Terms such as "slightly higher," "did not contribute," "negligible," "very much reduced," and "no influence" punctuate Ernst and Angst's concluding descriptions of the psychological impact of birth order on the reviewed variables. Perhaps Ernst and Angst's title for their book is a misnomer!

On the other hand, Ernst and Angst spare little verbal rope in hanging what they feel are egregious examples of shoddy research or theory. "It may be a sign of a general lack of adequate theorizing in birth order research that Zajonc's confluence model has won wide recognition in spite of such evident weakness" (p. 42). "The many investigations in which birth order is the independent variable are methodologically inadequate. By neglecting social variables, they have contributed to a mythology of the firstborn" (p. 73).

In summary, Ernst and Angst make two general contributions to birth order research. First, their literature review, though not exhaustive, is comprehensive for the years identified and provides an excellent new reference for the field. Second, their emphatic call for stringent methodology in birth order research is both expertly exemplified and timely. Some of the authors reviewed by Ernst and Angst have taken premature findings regarding birth order and IQ and have advocated in newspapers and popular magazines the curtailment of family size nationally to only two children spaced many years apart. Other authors have espoused quite radical parenting styles to compensate for what they felt were necessary personality outcomes for sibs of certain birth order positions. These approaches may or may not prove to be the correct ones for a given family. One clear message from Ernst and Angst's work is that far greater methodological rigor must be exacted in this area before any family-related decision, private or public, can be proffered as sound.

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Graphical Presentation

The Visual Display of Quantitative Information. EDWARD R. TUFTE. Graphics Press, Cheshire, Conn., 1983. 198 pp., illus. $32.

Statistical Graphics. Design Principles and Practices. CALVIN F. SCHMID. Wiley-Interscience, New York, 1983. xii, 212 pp., illus. Paper, $24.95.

These two books attest to a growing interest in graphical presentation over the past dozen years, following a half century of virtual neglect. Otherwise, they have little in common, aside from general agreement on some do's and don't's for graphical designers. The books are written from different perspectives and have different purposes. Tufte's work—ambitious, innovative, and idiosyncratic—is especially concerned with graphics as a tool of analysis and with the development of a theory of data graphics. Schmid's book—conventional, well balanced, and highly instructive—stresses the presentation function of graphics and tries to take stock of the discipline, its practices, problems, and research needs.

The most engaging part of Tufte's work is his historical review. He calls his book "a celebration of data graphics," and his first chapter in particular is just that. The centerpiece of the chapter—which he thinks may be "the best statistical graphic ever drawn"—is Charles Joseph Minard's map depicting the decimation of Napoleon's army on its march to Moscow and back. The line of march, battle sites, troop losses, and temperature readings during the cold and disastrous retreat are all imaginatively combined. Other memorable examples include E. J. Marey's rendering of the train schedule for the Paris–Lyon run (which is adapted attractively for the book's jacket), the life cycle of the Japanese beetle, a chart of radio emissions from

Jupiter recorded on the Voyager 2 space flight, and a map of central London in 1854, showing the proximity of cholera cases to a contaminated water pump. A reproduction of William Playfair's pioneering time chart shows Britain's exports and imports. It is a splendid example of how far graphics had progressed before the 19th century (and a reminder of how far it has slipped in the hands of some practitioners since that time). The evolution is completed with a showing of abstract graphics no longer dependent on the geographical and other analogies that shaped earlier work. Collectively, these illustrations show the rich possibilities of graphics: their power to display information and to show relationships that could not be as effectively communicated by words or tables alone.

Tufte is also concerned with the frontier of graphic design, including new variations on box plots, rug plots, and others introduced for analytical purposes. Visually, they look rather like schematic diagrams. They contrast sharply with the conventional charts to which the public is accustomed. Whether they will achieve the widespread use that Tufte envisions for them is arguable. Tufte recognizes that they may appear strange to people outside a small group of converts but thinks that they are not difficult to understand. They will catch on, he believes, as soon as communicators and readers get used to them, since it is largely familiarity that accounts for the popularity of bar charts, time series, pie charts, and so on.

In this discussion, as in many other places in the book, Tufte fails to distinguish between expert and lay audiences and to take into account the various purposes served by graphics. If he means that the new graphics will come to dominate scholarly and professional journals and textbooks, he is on reasonable ground. If he means that these graphics will take over the mass media, his argument is not persuasive. Indeed, the reader may frequently be confused about which function of graphics he is discussing—graphics as an analytical tool or graphics for presentation. Sometimes the distinction is not important; sometimes it is crucial. Tufte may not accept this distinction, emphasized by Schmid, but his position is not clear. Most of his examples of bad practice are taken from the mass media, and many of his judgments are based on the assumption that what is appropriate for a scientific journal is equally appropriate for the popular press. The history of journalism suggests otherwise, and Tufte seems disdainful of efforts to use graphics to engage the reader's attention, to illustrate, to emphasize, to make comparisons, and so on.

Indeed, a needlessly peevish tone pervades Tufte's criticisms of others that is quite out of keeping with his style in most of the book. He blames artists (and publishers who put design school graduates in positions of authority) for most shortcomings in graphical presentations. ("Why do artists lie in their graphical presentations?") He quotes scornfully the views of the art director of *Time*, though they read remarkably like those of William Playfair, whom he quotes approvingly in an earlier context. Schmid finds fault elsewhere, in "clumsy and amateurish charts produced by or under the direction of statisticians." Similar charges can be made against some editors and some authors who have no feel for the use of graphics. The difficulty is not so much one of a particular profession as of particular people. By and large, superior graphics are most likely to result from intelligent collaboration, since there are few gifted people who combine the knowledge and skills of statisticians, artists, scholars, and editors. Tufte is to be faulted, however, not so much for singling out artists for criticism as for the manner in which he makes his attack here and elsewhere.

Tufte is easier on himself than on others. He introduces with some fanfare six half-page maps of cancer incidence in the United States that he had helped to redesign for this publication. (One would do.) Even if these maps are unusually revealing, which is debatable, they happen to be based on suspect data sources, and like other maps of this type they equate visual importance with geographic area rather than with the number of people living in the county, as he himself notes. But what was important to him in this context was the amount of data shown (21,000 numbers needed to represent the outlines of more than 3000 counties). Given such an achievement, the possibility of misleading readers, which is of overwhelming importance elsewhere, is made to seem incidental. Schmid, in his systematic fashion, devotes a chapter to the problems in using such maps, including an assessment of various ways to cope with the difficulties implicit in Tufte's approach.

Tufte's book also is marred by his insistence on pursuing sensible general propositions to unnecessarily dogmatic or exaggerated prescriptions. These appear in several places, including the discussion of his theory and of some recent innovations.

Tufte's attempt at theorizing, unfortunately, constitutes the least convincing part of the book. Essentially it is a formalization of a well-recognized principle that applies to writing, architecture, engineering, and other disciplines: eliminate the nonessential. Tufte's measure of success in getting rid of unnecessary components and of subduing the impact of grids and borders is expressed in the ratio

$$\frac{\text{amount of ink used to show the data}}{\text{total ink required to print the graphic}}$$

He comes up with some numbers in the examples he uses, but it is not clear how the amount of ink is measured. Nor is it clear that the quantitative expression is any more helpful than the general principle. What should be retained and what should be left out is determined better by the eye and the mind than by counting ink spots. The argument is not advanced by jargon such as "data-ink maximization" and "chartjunk" (applied to unnecessary embellishments).

Tufte's discussion of theory includes a discussion of density. In general, he believes that the more information shown on a graphic, the better, a contention that is consistent with his interest in increasing the relative amount of "data ink." He gets carried away, however, by a chart of the Jupiter mission because it shows "453,600 instrument samples of eight bits each." Are we to infer that a million instrument samples would make the chart twice as good? It is impossible here to go into the questions raised by his discussion of density, which begins plausibly enough but gets out of hand, is imprecise, and fails to take into account related perspectives. For example, one can make the case that only the most relevant and important information should be shown—and that the real challenge to analysts and statisticians is to be selective.

The lengths to which Tufte pushes his views results in excessive austerity in typography and color. Color is virtually ruled out, because Tufte thinks it is generally confusing. His book contains only a half-dozen color graphics, half of them to show how color can be missed. A more extended discussion of how to use color properly and effectively would be preferable. Tufte's strictures again fail to take into account differing purposes of graphics. On television or in computer-assisted instruction—which are certain to be of increasing, if not dominant, use—graphics will surely be displayed in color. So will graphics in popular magazines and in textbooks. It is unrealistic to think that color will be abandoned in the competition for view-

ers and readers. Outside the professional audience the issue will not be color versus black-and-white, but rather how to use color effectively.

For the most part, Schmid is content with the task of explaining, taking the reader step by step through the field of graphics. His text is clear and complete enough to be useful to anyone who wants to understand the problems of graphic design—and ways to cope with them.

One of Schmid's themes is that graphics can be used for some rather ordinary purposes and still live up to the highest standards of truthfulness, accuracy, clarity, and aesthetics. The test of good graphics is whether the audience gets the message clearly, accurately, and memorably. Thus, Schmid's concern with research extends to empirical studies in cartography, psychology, and related fields aimed at assessing readers' responses to different graphical approaches. So far the results have not been as helpful as he had hoped, but he is optimistic about the payoff from further experimentation.

In his concluding chapter Schmid turns to the efforts that have been made to cope with the important problem of representing statistical error in graphics presentations. His approach to this subject is thorough and informative. His examples range from simple modifications of conventional graphics (such as using black and gray bars to differentiate between data that are statistically significant at the 95 percent confidence level and those that are not) to more ambitious innovations, some similar to some of those shown by Tufte.

The essential problem in presenting statistical information is deciding what to express in words, what to express in tables, and what to show in graphs—and how to integrate these three modes of communication to convey a message most effectively. Tufte turns to the matter of integration in his concluding chapter. He deplores the tendency to treat charts and tables as if they were entirely independent of the text and suggests how words and pictures can work together. His discussion is sensible. But unfortunately, in applying his precepts to his own book, he strains too much for integration, running text and charts together in ways that are not effective and failing to provide well-conceived headings for charts that must stand alone. Overall, the layout of the book reflects considerable ingenuity, but it creates enough problems to increase one's respect for some of the conventions of bookmaking. The design of complicated books is an exceedingly difficult task. Tufte as author, co-designer, and publisher of his book was able to lavish attention on design details and quality of production. If he fell short of achieving his goals, he must be credited with a dedicated effort to produce a handsome and unconventional book.

The Tufte and Schmid books can hardly be considered companion volumes, but neither can they be considered substitutes for one another. Anyone who peruses them both will surely gain a broader perspective on the status of and trends in graphics.

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Nectar Production

The Biology of Nectaries. BARBARA BENTLEY and THOMAS ELIAS, Eds. Columbia University Press, New York, 1983. x, 260 pp., illus. $33.50.

In this brief overview of the biology of nectaries the editors have brought together much of the new and exciting research dealing with these interesting nectar-secreting organs of the flowering plants. Detailed knowledge of how nectaries work and what their potential significance is has been unfolding during the past few decades, and the unfolding has accelerated in recent years with the dramatic advances in instrumentation. However, questions as apparently fundamental as how nectar is secreted from these glands are still unresolved. The mechanism by which nectar moves from the site of production (gland) to the area of presentation (exterior of plant) is a matter of controversy. The alternatives are transportation via vesicles that fuse to the plasmalemma and release their nectar into the wall area (granulocrine secretion) and transport of individual sugar molecules across the membrane by some carrier molecule (eccrine secretion). That it does not present a decision between these alternatives is not a weakness but a strength of this work. By objectively reviewing the possibilities the authors whet the reader's appetite for further investigation into these intriguing problems.

Some of the other questions that are posed by the various authors but left unanswered include: What is the switch mechanism that determines when nectar secretion starts and stops, as in the case when secretion ceases when "some critical amount" is reached and resumes after some of the nectar has been removed by floral visitors? What is the mechanism that allows some flowers to regulate the concentration of sugar in nectar so that the viscosity of the solution remains relatively constant during the day? Is there any taxonomic significance to the distribution of extrafloral nectaries among the families of angiosperms? Can extrafloral nectaries that are found on certain crop plants attract sufficient numbers of predators to offer an effective alternative to the use of pesticides in tropical agricultural systems?

Possibly one of the most valuable aspects of this book is the exposition in the last chapter of what questions to ask, what data to collect, how to collect your data, how to calculate the amount of sugar per flower, and what field equipment you will need if you plan to study nectar.

Overall this book should, as the editors indicate, serve the function of stimulating more research into the biology of these fascinating nectar-secreting organs. I enthusiastically recommend it to anyone interested in the ecological and coevolutionary relationships that exist among plants and animals.

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Books Received

The A to Z of Women's Health. A Concise Encyclopedia. Christine Ammer. Facts On File, New York, 1983. 482 pp. $19.95.

Academic Medicine. Present and Future. Papers from a conference, North Tarrytown, N.Y., May 1982. John Z. Bowers and Edith E. King, Eds. Rockefeller Archive Center, North Tarrytown, N.Y., 1983. x, 242 pp., illus. Paper, $15.

Actinide Recovery from Waste and Low-Grade Sources. Proceedings of a symposium, New York, Aug. 1981. James D. Navratil and Wallace W. Schulz, Eds. Harwood, New York, 1982. xiv, 386 pp., illus. $69.95. Radioactive Waste Management, vol. 6.

The Activated Sludge Process. Fundamentals of Operation. Randy Junkins, Kevin Deeny, and Thomas Eckhoff. Ann Arbor Science (Butterworths), Woburn, Mass., 1983. xvi, 136 pp., illus. $29.95.

Adaptability. The Significance of Variability from Molecule to Ecosystem. Michael Conrad. Plenum, New York, 1983. xxiv, 384 pp., illus. $42.50.

Advanced Computers. Parallel and Biochip Processors. Norman W. Lord, Paul A. Girogosian, Robert P. Ouellette, Robert J. Clerman, and Paul N. Cheremisinoff. Ann Arbor Science (Butterworths), Woburn, Mass., 1983. xii, 156 pp., illus. $29.95.

Advanced Quantity Surveying. A. Ashworth and B. C. Heath. Butterworths, Boston, 1983. x, 150 pp., illus. Paper, $19.95.

Advances in Chromatography. Vol. 21. J. Calvin Giddings, Eli Grushka, Jack Cazes, and Phyllis R. Brown, Eds. Dekker, New York, 1983. xvi, 342 pp., illus. $49.75.

Advances in Electronics and Electron Physics. Vol. 60. Peter W. Hawkes, Ed. Academic Press, New York, 1983. xii, 410 pp., illus. $60.

Advances in Enzymology and Related Areas of Molecular Biology. Vol. 54. Alton Meister, Ed. Interscience (Wiley), New York, 1983. viii, 512 pp., illus. $50.

Advances in Shock Research. Vols. 9 and 10.

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