

Born to Rebel: Birth Order, Family Dynamics, and Creative Lives by Frank J. Sulloway. New York: Pantheon, 1996. xviii + 653 pp. \$30 (c). ISBN 0-679-44232-4.

Few books are so worth reading as this one. Few if any readers will not learn from it about a variety of matters. Anomalists intrigued by the Mars Effect, for example, may be particularly interested in the demonstration that reported seasonal birth-effects were an artefact of improper analysis (414ff); or that "Individuals who are most familiar with empirical evidence tend to give it the greatest weight" (534n22); or in further examples of resistance to innovation to add to Barber's (1961) seminal list: thus William Hamilton's (1963) "theory of kin selection has inspired a staggering amount of empirical research" but was "not immediately appreciated... [and] judged insufficient for a doctoral degree at the University of London" (p. 59).

Though the book's title is accurate enough, still it may mislead, for one learns from this book more than the title suggests: this work is a model for what social science can accomplish, given enough data and sufficiently careful, skeptical, statistically savvy interpretation. The prime focus indeed is on the profound influence that birth order among siblings exerts; but Sulloway considers many other influences as well, *in quantitative fashion*: "birth order... sums up several important considerations... It is a proxy for differences in age, size, power, and privilege within the family system" (p. 21). It is indicative of the importance of birth order that its influence is often considerably greater than that of sex difference (p. 75); "the influence of birth order [even] *on traits related to gender* is two-thirds as large as the influence of sex [itself]!" (p. 77; emphasis added); "family niches often override biology" in "gender-related traits... just as they often transcend cultural stereotypes" (p. 149).

Apparent exceptions to initial generalizations from the data are mined for further understanding: thus later-borns may be raised in such a manner — like Austrian Archduke Ferdinand I (p. 270) — as to be *functionally* first-borns: "biological laterborns... raised as firstborns... (29 such instances in my sample)... are statistically indistinguishable from other firstborns... significantly less likely to support liberal innovations than... functional laterborns... [who] were 4.4 times more likely to support liberal scientific breakthroughs" (465n81).

Sulloway has a magisterial command of the literature and of research techniques. His data and his approach to it inspire confidence. He drives points home through graphic use of anecdotal material; yet the use of anecdotes cannot be faulted since they are just illustrations of what the massive statistical data-set reveals. Thus the memorable anecdote about the astronomer Tycho Brahe, functionally a first-born, so unwilling to go against convention that he would not excuse himself from the table to empty his bladder and died as a result: "A man who was incapable of setting aside table manners for a call of na-

ture was hardly suited to challenging, as Copernicus did, the foundations of cosmology" (p. 27); is validated by the data-analysis that shows "individual laterborns, such as Darwin and Wallace, were 9.7 times more likely than individual firstborns, such as Lyell and Agassiz, to advocate evolutionary ideas" (p. 34).

Part One of *Born to Rebel* asks, "Why do some scientists, but not others, readily accept radical ideas?" (p. xiii). Far more than evidence, we all know, is needed to change someone's mind: "Most people, including scientists, resist radical innovations" (p. xiii). Well, Part Two of the book notes that siblings raised together typically differ from one another as much as if they had been members of different families. Why? Because siblings compete for parental attention and care. First-borns usually find it a successful strategy to conform, to be as much like their parents as parents typically like. Later-borns can hardly displace the first-born from that niche of parental favor, so they seek some *different* niche through which they can still attain a share of parental devotion: "The longer siblings live with one another, the more different they become" (p. 83)! Part Three considers the role of social influences, particularly class; and finds that social class apparently has no influence on whether one is or is not a radical in social or in scientific matters. Part Four is a synthesis and summary discussion. There are nearly 85 pages of notes — amid which there is much worth reading; 70 pages of appendices with detail about coding, statistics, and some of the specific data-sets; 75 pages of bibliography.

Chapter 8, which ends Part Two of the book, is a fine summary of the data on receptivity to scientific innovation. An 8-variable model correctly classifies two-thirds of Sulloway's sample of more than 3000 scientists in respect to receptivity to innovation. The 8 variables consist of three *main* ones — birth order, parent-offspring conflict, sibship size — together with another five that exert an influence through interaction effects (gender, age gaps, age at parental loss, social class, temperament). Then Sulloway looks at the exceptions, and is able to account for them in various ways, finding roles for social attitude, parental social attitude, parental birth order, age, personal influences, national styles, weight of evidence; but finding *no* effect of social class (p. 213).

While the book's main theses are straightforward, the discussions do justice to the complexity of actual instances. A major distinction is between conservative and radical innovations or revolutions: first-borns "lead fashionable reforms, populist revolutions, and orthodox science" (p. 351), innovations that do not threaten a *status quo*, for example Spiritualism, eugenics, refutations of spontaneous generation; whereas they oppose such radical changes as Darwinian evolution, Freudian psychoanalysis, continental drift. The latter are typically supported by later-borns who are in "politics... radical revolutionaries, fostering protest long before it is stylish to do so. As social reformers they support the most unpopular causes, such as abolition, socialism, anarchism, and atheism. In science... those innovations that are heterodox within the epistemological and social context of the day. They do not wait for a crisis to support

radical change. Instead, they work hard to precipitate crises on their complacent elder siblings, who generally see little reason to abandon the status quo... As a general rule, the more heterodox the innovation, the more siblings are likely to disagree over its merits" (p. 351).

In fact, Sulloway finds that the data distinguish between four (rather than two, radical and conservative) categories (p. 39-41): *radical ideological revolutions* like the Copernican; *technical revolutions* like the Newtonian; *controversial innovations* like phrenology or antisepsis; and *conservative theories* like eugenics. The book carefully analyzes how these types of innovation were greeted by the various participants *at different times*, for naturally the opposition to even the most radical departure dissipates after (if!) it turns out to have been substantively justified.

Another significant distinction is between "genetic" and "hereditary." "Properly understood, evolutionary accounts of human behavior are far from deterministic. A Darwinian approach calls attention to the constant interaction between nature and nurture... within a *developmental* framework... Darwinian evolution highlights *the uniqueness of the individual.*"

"One would think a 50 percent overlap in genes [as siblings have] would cause substantial resemblances... but this is not the case. Sexual reproduction... rearranges the sequence of genes through... 'recombination' ...many genetic influences are unique to the individual and cannot be passed on through inheritance" (p. 87-89).

"We are all very different from one another, even from our siblings — a circumstance that confounds most sociological claims about group differences. Our minds, in particular, embody an astonishing diversity of abilities that facilitate intelligent behavior. There are no simple 'types' of intelligence, just as no single specimen of Darwin's finches can be said to represent the 'type' of the species" (356:1).

"IQ is only weakly related to achievement among people who are smart enough to become scientists... a scientist who has an IQ of 130 is just as likely to win a Nobel Prize as a scientist whose IQ is 180 (357n). "As Darwin himself once pointed out about science, the smartest people do not tend to make the most important discoveries" (p. 360). "Nearly 90 percent of my sample either accepted or rejected both... [evolution and phrenology]... [But] Darwin... rejected... [phrenology] on *scientific* grounds" (p. 248, p. 251).

Interaction effects are crucial; for example, "Being female makes some women more agreeable, empathetic, and liberal. Because of family niches, being female has the opposite effect on other women. In particular, firstborns of both sexes tend to be 'alpha males'" (p. 170). "Shyness makes firstborns more open to experience — the opposite effect to that which it has on laterborns" (p. 179, p. 193).

Here is one illustration of the power and sweep of Sulloway's analysis. Darwinism was accepted or supported according to age — in keeping with the conventional wisdom that we become less open to innovation as we grow older,

both later-borns and first-borns were less likely to have accepted evolutionary theory, the older they were. But 80% of later-borns aged 25, as contrasted to only 30% of first-borns aged 25, supported Darwinism. It was only by 1875 that first-borns accepted evolutionary notions at the same level (40%) as later-borns had shown (pre-Darwin!) in 1775.

Why were "French scientists... so hostile to Darwinism compared to scientists from other nations"? "France began the demographic shift during the late eighteenth century, about 50 years earlier than other European countries... In 1859, French scientists had had only 1.1 siblings compared with 2.8 siblings among scientists in other countries". Ergo, French scientists were much more often first-borns and therefore innately unlikely to accept a radical innovation....

"Throughout the debates over evolution, 80-year-old laterborns were as open to this theory as were 25-year-old firstborns... being laterborn was equivalent to a 55-year dose of the openmindedness that typically resides in youth" (p. 36). Surely these findings indicate the desirability of research on birth-order influences among anomalists and in anomalistics!

The success of Sulloway's model is also demonstrated by the range of topics it illuminates:

- It may require little analysis to conclude that "the varied outcomes of Henry VIII's six marriages are directly related to the obedience that each wife showed to his authority"; but Sulloway can explain the degree of obedience: "Controlled for differences in shyness, birth order is a significant predictor of the fates of the six wives. The best marriages were to spouses of early birth rank or... to shy and cautious laterborns. Those wives who lost their heads tended to be late in birth order and outspoken in their opinions" (p. 280-1).
- "During the past five centuries, the highest proportion of firstborn revolutionaries — including such creative scientists as Johannes Kepler, William Harvey, and Isaac Newton — occurred in the immediate wake of the Protestant Reformation. To a substantial degree, this cultural trend was the legacy of sibling differences that had taken hold during the previous century" (p. 283).

An intriguing effect not explicated by Sulloway is that later-borns exceed first-borns among *supporters* of radical innovation to a greater extent than among *initiators* of those innovations (42, 464n70). Plausibly this difference reflects the role of sheer serendipity in the making of scientific discoveries.

Part Three of *Born to Rebel* considers *social* radicalism. The findings will be anathema to Marxists of all stripes: "social class is a surprisingly poor predictor of social radicalism" (p. 93) — "the correlation between social attitudes and social class is .04" (509n49); "some liberals are close-minded, whereas some conservatives are open to new ways of thinking" (p. 217). "For all practical purposes, the causes of sibling differences in social radicalism are the same as... in science... This... model is 138 times more predictive of social attitudes

than is social class" (p. 226-7). "Primogeniture, not aristocratic origins, is what causes most monarchs to be conservatives" (p. 231-2). "In spite of being raised in disparate classes, the three codiscoverers of the theory of natural selection [Matthew, Darwin, Wallace] shared similar social attitudes" (p. 241). "When historians seek to explain radical thinking, they often call upon social class. Most... who do so are already convinced of a causal relationship, so they rarely bother to test their claims. The moral urgency of Marxist thought, which bolsters such beliefs, tends to render them 'emotionally resistant to disconfirmation'... Social class is relevant to *participation* in science: peasants rarely become scientists. But the causes of intellectual radicalism are another matter entirely... Compared with laterborns, firstborns are generally better educated and hence more likely to become scientists. Firstborns are especially overrepresented among the members of *establishment* science. Such tendencies toward intellectual primogeniture create a trap for the unwary historian who, without adequate hypothesis testing, opts for a Marxist explanation of radical thought.... Marx's theory of class struggle sheds almost no light on individual differences in personality, including openness to radical ideas" (p. 253-4). Again, "many people became Protestants 'against their own economic and social best interests' ... a Marxist approach sheds surprisingly little light on religious loyalties during the Reformation" (p. 270-1).

That Sulloway's model explains so much about science by considering such social factors as birth order should give no comfort to relativist social constructivists or their ilk. At a number of places the book emphasizes the importance of *individual* characteristics that result from the *idiosyncratic combined influence* of the eight or more factors Sulloway has been able to identify as significantly predictive of human behavior. *Evidence* causes "empirical arguments to uncouple from ideological ones. This... occurs regularly during scientific controversies and reveals the insufficiency of explanations that reduce science to a social activity. Rational considerations play a substantial part in scientific deliberations, although in most cases the power of rationality changes over the course of debate" (p. 345); "social constructionists are dead wrong in their efforts to minimize the cognitive and empirical aspects of science.... Neither Latour nor any other social constructionist has ever bothered to *test* their claims... these scholars ought perhaps to recognize that, in choosing to forgo testing, their own research program... embodies a moratorium on critical inquiry. Without hypothesis testing, claims about the nature of scientific thought are likely to end up as intellectual fads. Crews (1986) offers a lucid critique of such relativist views about knowledge, as do Gross and Levitt (1994)" (535n28).

By implication of the stunningly informative nature of this book as well as by the occasional critical comment like those immediately above and following, Sulloway challenges much traditional work in social science and in history:

- "The historian who feels uncomfortable with statistical generalizations is uncomfortable with the nature of history" (p. 365). So historians must get used to such Sullowegian conclusions as "Owing to high parental conflict, Lincecum's probability of accepting new scientific ideas was 80 percent" (p. 124); "Kepler's predicted probability of supporting radical causes is 65 percent. Compared with other firstborns, this predicted probability places him in the 97th percentile" (487n22); "Newton's probability of supporting innovation is 60 percent, which places him in the 89th percentile for all firstborns" (487n23); "Born's support for these novel theories [quantum & relativity ideas] would be more difficult to understand had he not lost a parent when he was young. Based on the multivariate model... in Chapter 10, Born's likelihood of supporting these... theories was 61 percent" (490n56).
- "Systematic within-family differences introduce a trap for unwary historians who assume that social class and other group differences are major forces of historical change. The integrity of narrative history is constantly being compromised by a failure to understand this explanatory trap" (p. 240).
- "Hypothesis testing possesses another distinct virtue. It reduces the siren-like lure of those interpretive fads that pass for progress within the humanities. This is why so many recent humanistic approaches are now labeled as being 'post' some other once-popular approach. There is no post-physics, post-biology, or post-chemistry" (p. 367).
- Social science is notoriously unable to make good predictions; but Sulloway's multivariate model can:
 - "Relative to firstborn justices, laterborn justices have been significantly more likely to vote in a liberal direction." President Eisenhower and other leading Republicans were taken aback at what Chief Justice Earl Warren wrought; but they could have known better than to appoint him, had they recognized that as the younger of two children he would harbor liberal views that had of necessity been suppressed during his time as a Republican politician (p. 294-6). "For relative birth rank and Supreme Court voting in a liberal direction, $r = .38$ " (521n43). "For the entire history of the Supreme Court, with its 108 appointments, the correlation between relative birth rank and the party of the nominating president is 0.36... Republican presidents have tended to nominate firstborns" (521n42).
 - "If you happen to be a shy individual and have radical aspirations, consider collaborating with a lastborn extravert" (p. 187);
 - "Whenever scientific commissions are staffed by eminent experts from 'establishment science', they tend to be biased for firstborns (and hence conservative conclusions). This... has important implications for science policy" (513n48); "Because commission [sic] tend to be packed with eminent individuals (and hence firstborns), their votes should per-

haps be 'weighted' to adjust for individual biases in attitudes toward innovation" (537n43).

Sulloway's unorthodox push to *understand* irrespective of disciplinary traditions has to-be-expected corollaries, like the rejection by the National Science Foundation of his proposal to study "aging and creativity in science... using multivariate methods". The reviewing panel stated: "One of the most pervasive issues discussed by the panelists was the approach the Principal Investigator was taking toward history... applying a heavy-duty statistical analysis to history is *naive, inappropriate, and even peculiar*... as if the Principal Investigator was going back to 19th-century beliefs that history is a science which could uncover laws. Panelists were opposed to such a narrow [sic] view of history" (538n31). These pygmies will not climb onto a giant shoulder.

One criterion of ground-breaking work is that it stimulate new studies. Rare will be the person who can read this book without thinking of things worth looking into; what do we know about birth-order effects in animals, for example? But there is a danger here too. Others less willing to put in as much effort as Sulloway has, in data-gathering and analysis, may seize on "birth order" and some of the other variables as thought-bites and slogans, ignoring the crucial interaction-effects and need for multivariate controls. It is profoundly to be wished that this does not happen, that Sulloway will not suffer the death of a thousand epigones but rather will presage much furtherance of understanding of history and in social science.

Henry H. Bauer

Professor of Chemistry & Science Studies

Virginia Polytechnic Inst. & State University, Blacksburg, VA 24061-0227

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