Letters

Birth Order and Achievement

Anyone can see that there are certain differences in the environments of first-, last-, and middle-born children, and that these will have a lasting, though probably small, effect. Therefore, some of Altus's conclusions about the relation of birth order to achievement ("Birth order and its sequelae, 7 Jan., p. 44) are quite possibly qualitatively correct. But I believe that most of the evidence he cites is inadmissible.

As Altus says, ". . . if inclusion in *Who's Who* were a strictly chance affair, one would expect, of course, a 50–50 distribution of the older and the younger from two-child families. Altus and apparently others quoted by him erroneously conclude from this that if in a select group (persons listed in *Who's Who*, Merit Scholars, professors, and so forth) the fraction of first-borns among those from two-child families is significantly different from 0.5 (and among those from three-child families significantly different from 0.33, and so on), then there is evidence that the characteristic of selection of the group is linked to birth order. This is not true. Such evidence merely enables us to reject the hypothesis of a "strictly chance affair"; but there are factors other than birth order which can more reasonably account for the observations.

An example of such a factor is age. There is no reason to believe that the distribution of first-, last-, and middle-borns in a particular age group is the same as it is in the total population. This distribution depends on the history of the growth of population, and normally our population growth is such that long-term stability cannot be assumed. For example, the entering college freshmen in 1964 were born around 1946. Their older siblings were born in the years just preceding 1946 and their younger siblings in the years just following 1946. The latter years produced a considerably larger number of children than the former, and it would not be surprising to learn that the group of *all* 18-year-olds in 1964 contained an unusually high fraction of first-borns. Whether this was true, and if so to what extent, depends on a number of factors; the point is that it is possible. . . .

During the period 1943–49, the annual excess of first-borns over second-borns varied from 12 percent to 58 percent (see Table 1-J, *Vital Statistics of the United States, 1961*, vol. 1, *Natality*). In other words, the fraction of first-borns among 1964 Merit Scholars from two-child families should be compared not with 0.5 but with the fraction of first-borns among all those from two-child families who were 18, say, in 1964. It would be much more difficult to say what to do with the similar data for *Who's Who* biographees, but the problem is definitely there, since being in *Who's Who* is a characteristic that is definitely linked to age and therefore, in a changing population, possibly spuriously to birth order. . . .

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Altus's data on students entering the University of California at Santa Barbara in 1960–63 show a substantial excess of first-born over later-born among those from two-child families, and 50 percent first-born among those from three-child families. Some of this excess could be caused by changes from year to year in the percentage of first births in the population. A majority of the students entering college in 1960-63 were born between 1941 and 1947; Table 1 shows that there was a substantial variation in the proportion of all births that were first births in this period, in which wartime conditions caused substantial fluctuation in the birth rate. The precise proportion of first-born persons in the population from families of a particular size cannot be determined from these or other readily obtainable data, but the data do indicate that there can be substantial fluctuations both over and under the a priori probabilities for cohorts born in different years.

Table 1. Birth orders of white children born in the United States, 1941–47 (in percent). (Figures adjusted for underregistration of births.)

Year	Birth order			
	First	Second	Third	Fourth and higher
1947	42.8	27.5	13.6	16.1
1946	39.3	28.3	14.3	18.1
1945	34.8	27.8	15.8	21.6
1944	35.2	28.0	15.7	21.1
1943	38.1	28.0	14.3	19.6
1942	42.8	25.8	12.8	18.6
1941	40.3	25.6	13.2	20.9

From *Vital Statistics of the United States 1961*, vol. 1, *Natality* (Government Printing Office, Washington, D.C.), Table 1-F.

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The American Council on Education has collected information from the 1965 entering freshman classes at a national sample of 61 institutions, including junior colleges, colleges, and universities. Our data clearly support Altus's suggestion that the more highly selective institutions may matriculate a higher percentage of first-borns than do the less selective ones. We have arrayed the 39 4-year colleges in our sample according to "selectivity" (defined as the proportion of entering freshmen who had reached the finals in the National Merit Scholarship competition), and have examined those colleges whose normalized standard score on this variable was nearly 1½ standard deviations above or below the mean score. The percentage of first-borns among the highly selective colleges is 53 percent, and in the least selective colleges 48.8 percent; the figures for the selective colleges range from 57.7 percent to 49.9 percent, a difference of less than 8 percent, whereas the range in the least selective institutions is from 56.6 to 42.2 percent, a difference of 14.4 percent.

For all 61 institutions, the proportions of first-born and only children in the freshman classes in 1965 are: junior colleges, 50.3 percent; 4-year colleges, 51.4 percent; and universities, 52.5 percent. Our data, like those summarized by Altus, suggest a relationship between birth order and cer-

tain outcomes. Unfortunately, as Altus notes, even thorough documentation of the phenomenon does not suggest "the reasons behind the relations."

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. . . That first-borns, or at least eldest sons, should exceed later-born children in achievement in intellectual activities is paradoxical in view of the fact, reported by Berelson and Steiner (*Human Behavior: An Inventory of Scientific Findings*, Harcourt, Brace, and World, New York, 1964), that eldest children are less intelligent than their siblings. These authors cite a study by Thurstone and Jenkins (*Order of Birth, Parent-Age, and Intelligence*, Univ. of Chicago Press, 1931) of "several hundred children each compared only to his or her own siblings," in which it was established that "within families, there is a consistent increase in average intelligence from first-born to last-born." Some of the findings reported by Altus could be accounted for by the fact that "larger families are more prevalent among groups with lower I.Q.'s in general"—that is, that across the population at large later-born children have lower I.Q.'s. But within a particular family, intelligence increases with birth order. In fact, there seems to be no upper limit on this tendency. A chart in Berelson and Steiner shows an almost uninterrupted increase in I.Q. from the first-born to the last-born in families of eight or more children.

As a first-born child, I find it difficult to accept the conclusion these findings suggest when coupled with Altus's—namely, that we first-borns become more outstanding in intellectual accomplishments than our sibling rivals in spite of the handicap of lower intellectual capacity! . . .

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. . . I fail to find justification for Altus's conclusion that "relatively few of the total available first-borns" are affected by the relation of birth order to achievement or that "birth order is effectively linked to aptitude *only at the top level*" (emphasis his). This conclusion seems to me to be based on confusion between measurements of *populations* and measurements of *scores* of those who are in a selected group.

Among the observations cited by Altus in support of his conclusion are that: (i) the *percentage* of first-borns is much higher among National Merit *finalists* (the top 0.5 percent of the general population) than it is in the entire population; and (ii) the *scores* of *all* students who took the first round of National Merit tests do not "appear to be related to birth order." It is premature to conclude from these facts that any effect of birth order on ability is present only at the top level. It may simply be easier to *see* the effect at the top level, by comparing sizes of populations there.

Observations i and ii are consistent with the assumption that every first-born is benefited in some unknown way by a "first-born effect." For convenience, I will phrase a naive model of such an effect in terms of I.Q. scores. Suppose we postulate a first-born effect which shifts the entire intelligence distribution of first-borns upward by ¼ standard deviation (about 4 I.Q. points) relative to the rest of the population. Then the normal curve of error produces consequences which are strikingly similar to observations i and ii: (i) The percentage of first-borns with I.Q. of 140 or more is almost twice as high as the percentage of others with I.Q. of 140 or more, because this I.Q. is only 2¼ standard deviations from the mean for first-borns, but is 2½ standard deviations above the mean for the others; but (ii) in any *selected* group (selected by some criterion related to intelligence), the *mean score* of the first-borns differs very little from the mean score of the others, because the selection process has already produced some uniformity in the group. For example, among all those whose I.Q. is 110 or better, the mean I.Q. of the first-borns exceeds the mean I.Q. of the others by only 1 point. The students who take the National Merit tests are in this sort of selected group. Altus did not indicate whether some such *small* difference between first-borns and others might have been present in this group.

In order to see whether a first-born effect exists in the entire population, it would be helpful to take a closer look at the scores of all National Merit contestants, and to count the relative numbers of first-borns in this and other groups. If an effect is present in the entire population, it would show

up just as clearly at the low end of the distribution as at the high end, so it should be interesting to count the number of first-borns among the mentally retarded; the paucity of first-borns in that group should match the abundance of first-borns in the high-ability groups.

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. . . In none of the studies to which Altus refers was the representation of first-borns among eminent men (Fellows of the Royal Society, Rhodes Scholars, and outstanding scientists) compared with their representation among noneminent men in the same profession. As Schachter (*1*) has pointed out, the birth-order effect shown in these reports may be "simply a reflection of the fact that scholars, eminent or not, derive from a college population in which first-borns are in marked surplus. . . ."

In the few studies in which birth-order distributions of eminent and noneminent men in the same profession have been compared, the results are inconsistent. In only one (comparing eminent and less eminent architects) did first-borns tend ($P = .10$) to predominate among the more creative subjects (*2*). In one study, a different relationship was found: among eminent as compared with less eminent chemists, first-sons-but-not-oldest children and middle children were overrepresented; and only, oldest, and youngest children were underrepresented (*3*). Two studies—one of more and less creative industrial research chemists (*4*) and one of more and less eminent psychologists (*3*)—showed no relationship to being first-born. In these studies, comparisons were based on the simple proportions for more and less eminent men rather than on the discrepancy between observed and expected frequencies computed for family size distributions, so variations in family size could obscure otherwise significant tendencies or exaggerate otherwise insignificant differences. If, for example, the eminent chemists tended to come from larger families than did the noneminent chemists, the "overrepresentation" of middle children could be an artifact of the disproportionate opportunity to be a middle child. There are apparently no studies in which eminence is varied and the dependent variable is the excess of first-borns. . . .

A study of intellectually able male entrants in the Westinghouse Science Talent Search (*5*) failed to induce any simple relation between family structure and early scientific attainment as judged by ratings of the projects submitted. While there was some indication of an inhibiting influence on the younger son who is separated from his next oldest sibling by five or more years, for a considerable range of family-size, sibling-sex, sibling-separation, and ordinal-position combinations any "favorable" effects of one ordinal position appeared to be as susceptible to attenuation by other influences as any "unfavorable" effects of another ordinal position. If early scientific attainment may be considered to be on some continuum with subsequent attainment, our results are consistent with Schachter's hypothesis that the so-called relation between eminence and birth order is a methodological artifact.

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3. J. Chambers, *Psychol. Monogr.* No. 584 (1964); personal communication.
4. M. Stein, cited in I. Harris, *The Promised Seed: a Comparative Study of Eminent First and Later Sons* (Free Press, Glencoe, Ill., 1965), p. 254.
5. L. Datta, "Birth Order and Early Scientific Attainment" (1965), mimeographed.

Hooke raises the valid point that we do not have satisfactory base rates for the actual proportions of the various ordinal positions in any given age group. He also cites census data showing marked differences from year to year in the proportion of first births. If one averages the percentages of first births from the census data cited by Folger and Bayer for the years 1942–1946, one gets 38.04 as a mean. These 5 years are the birth years of all college matriculants in 1960–1963 who were 17 or 18 years of age on entrance. During this 4-year span, the percentage of first-borns matriculating at the University of California at Santa Barbara (the great majority of whom were 17 or 18) was 61.34. The difference of 23.3 percentage points, if the census data are taken as an approximation of the proportion of suitably aged first-borns in the population, would seem to buttress my

thesis. Ratios of first births may vary considerably year to year, but my data—and Schachter's (*1*)—tend to show an overrepresentation in college of the first-born which is not to be explained simply as derivative from these ratios, varying or constant.

Actually, in a state having such an enormous in-migration as California it would be difficult (if not impossible) to assign with precision any figure for the percentage of first-borns among our citizens of a given age. I did survey the seniors in two local senior high schools in October 1963, and found the percentage of first-borns to be 37.3. Most of these seniors would have been born in 1946, for which year Folger and Bayer cite a national percentage of first births of 39.3. Schachter (*1*) surveyed all students in a Minneapolis high school in 1961 and reported "no birth order effect at all." He found first-borns from families of two, four, and six children to be somewhat underrepresented; from families of three, five, and seven or more children to be slightly overrepresented. Overall, the differences canceled out, as, Schachter points out, he would expect in a school system which enrolls almost everybody who is of high school age. Schachter checked the Minnesota census data on first births for the years when his high school students would have been born. The difference between what obtained in the high school and what the census figures showed was a negligible 0.18 percent. Schachter also cites a study from West Germany which shows the birth orders to be "normally" distributed among an N of 3315. Stewart in a study (*2*) made in 1958 of 7000 children in London secondary schools found a relatively "normal"—that is, almost 50-50—distribution of older and younger from the two-child family; the number of second-born slightly exceeded the number of first-born.

It is clearly true that the percentage of first births varies from year to year and from state to state. It is also true that short of a huge normative sample it will be impossible to answer with precision Hooke's question of base rates. But the evidence in the preceding paragraph—small and parochial as it is—would seem to imply that gross deviation from theoretical expectancy does not appear to be the norm.

It is in college that marked deviation from expectancy comes: I have cited (*3*) studies which show this condition to exist, at least as far back as 1928, on through the 1930's, the 1940's, the 1950's, and, of course, the 1960's. Schachter sampled (*1*) the proportion of first- and second-born from two-child families matriculating at Columbia College for a 20-year span, 1943–1962, and found some variation in the proportions of younger and older, but in all the intervals in his table the first-born exceeded the younger. It does not seem reasonable that trends of the kind just cited running over decades are entirely derivative from the annual crop of first births.

Stewart's study of London secondary schools also shows a marked educational orientation in the first-born. Proportionally more of the first-born were found to have passed the state examination (the "11-plus") the passing of which admits to the grammar school, which is a college-preparatory secondary school. Obviously, more of the second-born go to the secondary school of lesser prestige, called the modern school, a terminal school for most who attend. In both kinds of high school, among those who persisted beyond the age of compulsory attendance twice as many were first-born as second-born. It seems that in the United States, where practically everyone goes to high school, no birth-order effects show short of college; but in England, where universal education, at state expense, is not so much a matter of course, the scholarly predilection of the first-born shows itself as soon as compulsion to attend is dropped, even in the secondary school.

As to the data on eminence, I would point first to its unanimity, regardless of the criterion employed, for nearly 100 years of investigation. Second, I would note that if a first-born in a given family becomes eminent (or, for whatever it is worth, gets into *Who's Who*, say), he continues to be eminent (or remains in *Who's Who*) usually for a decade or so. Now if there is a younger sibling in the eminent one's family, he should attain his eminence before the star of the first-born has set. I would, therefore, accept the data on eminence in the two-child family as more likely to be fairly valid than would Hooke, who thinks that a variation from 50-50 in the two-child family is not so significant an index. I do not think that eminence, like a comet, belongs to a single year; more often it sheds light for

a generation, giving time for the laggards to catch up—if they can. But like Hooke I would feel much more comfortable with an established set of expectancy ratios for our birth orders.

Datta's comment that eminent people show more first-borns simply because they come from a pool of college graduates merely pushes the need for explanation back to the question why the first-born are overrepresented in college. As for the eminent always deriving from a pool of college graduates, I am willing to accept this as true of scientists of today. Almost all eminent scientists in the United States, I suspect, have two or three college degrees, with the doctorate included. I am not so sure that having a college degree was the norm for scientists in 1850, though it may have been. I am even less sure that it is the norm of those who are eminent in fields of artistic endeavor, even today. Of the five male Americans who were Nobel prize winners in literature, only Sinclair Lewis earned a degree.

Of Oberg's strictures based on Thurstone's study, I will say this: Thurstone's study was one of dozens at that period, over a generation back, which attempted to link birth order with IQ. When Harold Jones in 1954 (*4*) summarized all the research—including Thurstone's—on this topic, his conclusion was that "no birth-order differences in intelligence occur in normal samples."

Jones was right, I should think, in so evaluating studies at his disposal when he wrote over a decade ago. But a different opinion may be in order when Robert Nichols publishes his findings (*5*) based upon 800,000 high school students who have taken the National Merit Scholarship qualifying examination. With such a huge number of cases, perhaps we may also have a partial answer to whether the various birth orders follow postulated expectancy ratios.

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