Career Decisions of Very Able Students

Trends show declining interest in careers in science and engineering on the part of talented students.

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The career decisions of able students determine, in part, the future distribution of talent among various fields. Thus, it is important to study trends in these decisions and to attempt to understand the factors which influence the trends.

The purpose of this article (*1*) is to present a series of indices based on the career choices and prospective major fields of National Merit semifinalists—a group representing the approximately 1 percent of high school seniors who rank highest in scholastic aptitude. Changes from year to year in the career aspirations and study plans of this group should reflect trends in the fortunes of the various vocational areas in the competition for the nation's supply of exceptional talent. Also presented are data concerning changes in the career plans of very able students during the college years.

Career Decisions of Semifinalists

Procedure. Each year since 1956 the National Merit Scholarship Corporation has conducted a nationwide talent search to discover the most able high school seniors. As the first step in this search the National Merit Scholarship Qualifying Test is given, near the end of the junior year, in high schools in the United States which enroll some 90 percent of all students; then, the highest 2 percent, approximately, by state are selected as semifinalists. The number of students tested each year (*2*) and the number selected as semifinalists are shown in Table 1. The proportion selected has become smaller as the number tested has increased, but this increased selectivity is balanced to some extent by the tendency for more students of lower ability to take the test, so the ability range of the semifinalist group has remained relatively constant.

Near the beginning of their senior year in high school the semifinalists complete an information blank on which they indicate their anticipated career choice and their probable college major. Since 1961, the instructions have been: "Be as specific as you can; e.g., list mechanical engineering (not engineering), teaching high school physics (rather than teaching), etc. If you are not sure what field you wish to enter, you may write undecided." Before 1961 the instructions were the same except for the last sentence, which read, "It is to your advantage to give some choice rather than write undecided." This change produced an increase in the number of students who state that they are undecided, although even before 1961 there was a steady increase in the proportion of undecided students (see Tables 2 through 5). The undecided students were not included in the totals when percentages of students in the various career and major-field categories were calculated.

The major-field and career choices were coded into categories (shown in Tables 2 through 5), the same coding procedure being used for all years (*3*). Data for career choice are available for all years since 1957, and data for major field, for all years since 1958. The percentage of "decided" students in the better-represented career choices and major fields were plotted on a logarithmic scale to show trends over time.

Results. The career choices of semifinalists are shown in Tables 2 and 3, and their choices of college major are shown in Tables 4 and 5. Charts of the percentages of semifinalists choosing various careers are shown in Figs. 1 and 2. Similar charts for major field are shown in Figs. 3 and 4. These charts are drawn on a logarithmic scale, so that equal percentage changes are indicated by equal vertical distances (for example, a change from 2 to 3 percent and a change from 4 to 6 percent would appear the same on the charts, since both represent an increase of 50 percent). To the left of Fig. 4 a scale is given for evaluating percentage change in these charts. To use this scale one should trace it on transparent paper. When the zero point on the scale is placed over any given point on the chart for a particular career or major field, the percentage increase or decrease of all other points from this initial point can be read directly.

As may be seen from Figs. 1 and 2, careers which have generally increased in popularity with Merit semifinalists are (for boys) teaching, architecture, law, and medicine, and (for girls) law and government service. Careers which have shown downward trends for both sexes are business and engineering. Writing has also become less popular with girls.

Figures 3 and 4 show that, for Merit semifinalists of both sexes, biology, history, and mathematics have become increasingly popular major fields, whereas business, physics, engineering and journalism have become less popular. In addition, art, chemistry, home economics, education, medical technology, and nursing have shown declining popularity with girls, and geology has shown a particularly sharp decline for boys.

The persistent decline in engineering is particularly significant because of the relatively large numbers of students who initially choose engineering as a career or major field. Separate trends were calculated for certain engineering specialties chosen as major fields by boys; these data are shown in Table 4 and are charted in Fig. 3. The steady decline through 1962 and the small recovery in 1963 is a pattern which fits all five of the engineering specialties charted. The decline in chemical engineering was particularly steep (a net loss of about 45 percent in 5 years); the decline in aeronautical engineering was the smallest of the group (about 30 percent).

Changes during College Years

Procedure. Since many semifinalists change their plans during college, their initial career choices and major fields do not necessarily represent the fields in which they will finally study and

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Table 1. Numbers of students involved in the National Merit program from 1956 through 1963.

Year	No. of high schools	No. of students tested	No. of semi-finalists
1956	10,338	58,158	5,078
1957	12,503	166,592	7,496
1958	13,752	255,942	7,620
1959	14,454	478,991	10,334
1960	14,549	550,000	10,181
1961	15,095	586,813	10,542
1962	15,461	576,435	10,444
1963	16,024	596,241	11,128

work. Thus it is important to look at their changes in career choice and major field during their college years. Data concerning such changes were provided by a random sample of 6661 of the 1957 semifinalists and recipients of the "Letter of Commendation" (a group with slightly lower test scores than the semifinalists) (*4*). These students, using a check list of coded options, indicated their career choice and major field at the time they entered college in 1957 and again at about the time of graduation from college in 1961. Those who had dropped out of college indicated their last major field. The percentage of students giving each career choice and major field on these two occasions and the percentage net gain or loss for each field were calculated; data for undecided students were excluded. The statistical significance of these changes was evaluated by a test of significance between correlated proportions, for which the number of students in each category who did not indicate a change of choice was tallied.

Results. Table 7 shows changes in career choices during the college years. Because of the large N, relatively small differences were statistically significant, and significant ($p < .01$) net changes occurred in every career choice. However, some of the changes are so small as to be of relatively little practical significance. For both sexes, the career of college teacher showed the largest net increase. Other fields which showed major gains were business and the professions (except for medicine and the ministry) among boys, and home-making and office work among girls. The careers of scientific researcher and engineer showed net losses of more than 50 percent for both sexes.

Table 8 shows changes in major field during the college years. Significant net changes occurred in all major fields except biology and speech. Talented male students appear to have shifted their interest from the physical sciences and engineering to the humanities and social sciences. Exceptions to this general trend are the losses in the fields of education and music and the gain in mathematics. The same general trend appears to be true for females, but for them it is much less clear-cut.

Discussion

Definite changes have occurred in the vocational and study plans of very able students in recent years, both in terms of the choices made each year by high school seniors and in terms of changes in study and career plans on the part of students in college. Can these changes be attributed to such factors as job opportunities, pay scales, scientific advances, and recruitment campaigns, or are they the result of more subtle social forces? Can the trends be manipulated by national programs or are they relatively independent of such influence?

It is tempting to attribute year-to-year changes in particular fields to specific events (for example, the spurt of interest in biology since 1961 may be due to excitement over recent discoveries concerning the DNA molecule), but such conclusions based on a single coincidence are hazardous. However, speculation about the causes of general trends involving several fields may be more justifiable.

One generalization, to which there are several striking exceptions but which nevertheless describes the overall trend, is that the interest of able students in physical sciences and engineering has been decreasing during the period covered by this study and that interest in the social sciences and humanities has been correspondingly increasing (*5*). This trend holds true for the career decisions of high school seniors as well as for the changes in career plans of college students. During recent years there has been an unprecedented national campaign to interest talented students in scientific and technical careers. Bright students have been urged to choose careers in science in the interest of national security and national prestige, and they have been lured by multi-billion-dollar science

Table 2. Percentage of male National Merit semifinalists choosing various careers in the years 1957 through 1963. (Blank cells indicate that a field was not coded in that year and was included in "other.")

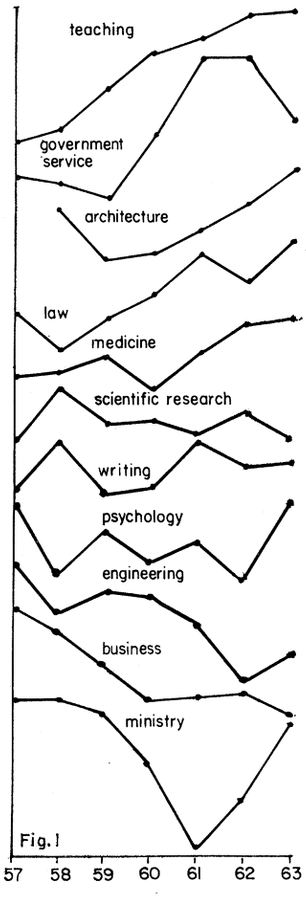
Career choice	1957	1958	1959	1960	1961	1962	1963
Architecture		1.25	0.97*	1.00	1.12	1.30	1.53*
Business	5.19	4.54*	3.85*	3.20*	3.26	3.35	3.03
Engineering	33.60	25.46*	28.52*	28.05	24.61*	18.17*	20.82*
Farming		0.14	0.14	0.14	0.12	0.22	0.17
Government service	2.13	2.07	1.80*	2.64*	3.90*	3.86	2.80*
Law	6.45	5.32*	6.24*	7.00*	8.83*	7.57*	9.36*
Medicine	9.10	9.28	10.08*	8.50*	10.30*	11.87*	12.24
Ministry	1.95	1.97	1.83	1.43*	0.92*	1.18	1.73*
Psychology	0.77	0.52*	0.65	0.56	0.62	0.51	0.75*
Scientific research	28.66	37.77*	31.21*	31.79	29.57*	32.62*	28.87*
Social work	0.16	0.08	0.23*		0.18	0.14	0.15
Teaching	7.95	8.45*	10.31*	12.32*	13.35*	14.93*	15.14
Writing	1.80	2.29*	1.78*	1.85	2.34*	2.08	2.12
Other	2.21	0.84*	2.35*	1.34*	0.76*	2.02*	1.25*
Number on which percentages are based	4930	5019	6178	6628	5637	5524	6001
Number undecided	297	188	555	480	1188	1427	1481
Total number	5527	5207	6733	7108	6825	6951	7482

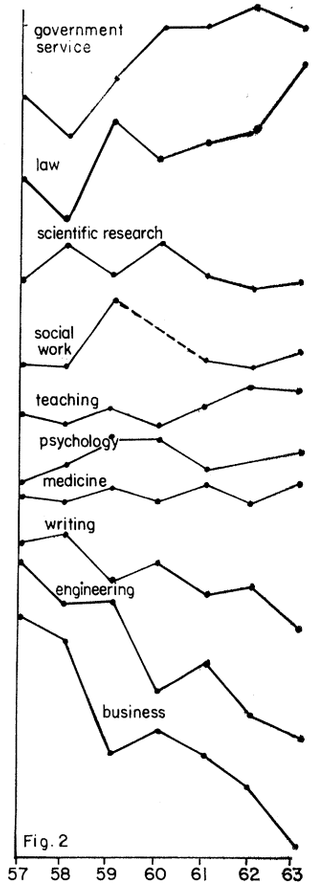
* The change from the previous year is statistically significant ($p < .01$).

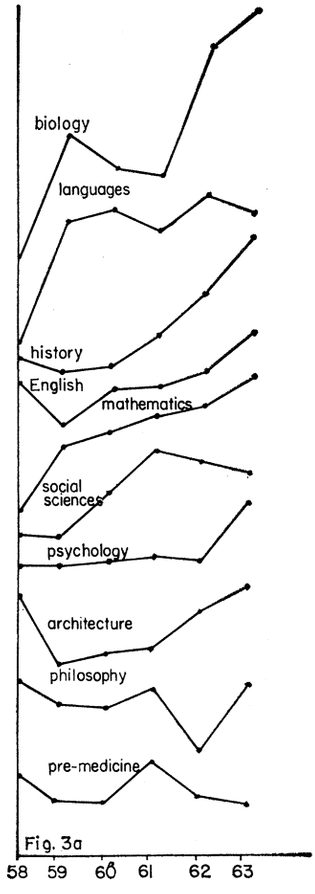
Table 3. Percentage of female National Merit semifinalists choosing various careers in the years 1957 through 1963. (Blank cells indicate that a field was not coded in that year and was included in "other.")

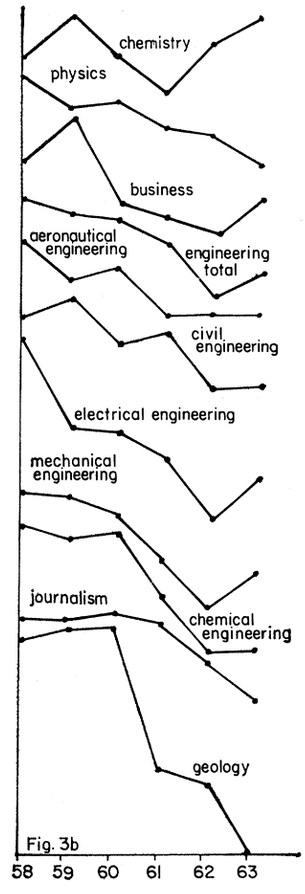
Career choice	1957	1958	1959	1960	1961	1962	1963
Architecture		0.31	0.75*	0.60	0.27*	0.34	0.67*
Business	4.62	4.08*	2.27*	2.58	2.28	1.89*	1.40*
Engineering	2.57	2.06*	2.05	1.31*	1.50	1.17*	1.05
Farming		0.04	0.03	0.00	0.07*	0.08	0.04
Government service	5.00	4.04*	5.44*	7.03*	7.02	7.81*	7.06*
Law	1.04	0.83*	1.37*	1.12	1.23	1.28	1.79*
Medicine	12.09	11.77	12.53	11.70	12.44	11.69	12.82*
Ministry	0.33	0.31	0.16*	0.19	0.17	0.08*	0.32*
Psychology	2.86	3.12	3.51	3.55	3.10	3.21	3.34
Scientific research	19.00	23.33*	19.52*	22.96*	19.64*	18.22*	18.96
Social work	2.14	2.11	2.95*		2.18	2.11	2.25
Teaching	36.71	34.92*	37.53*	34.17*	38.11*	41.45*	40.32
Writing	7.71	8.00	6.25*	6.84	5.86*	6.04	4.92*
Other	5.24	5.05	5.63	5.31	6.10*	4.64*	5.06
Number on which percentages are based	2100	2276	3216	2674	2933	2651	2847
Number undecided	169	137	385	399	784	842	799
Total number	2269	2413	3601	3073	3717	3493	3646

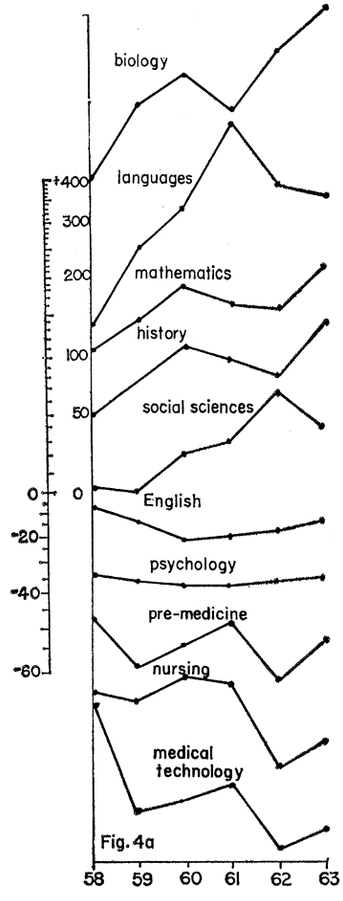
* The change from the previous year is statistically significant ($p < .01$).

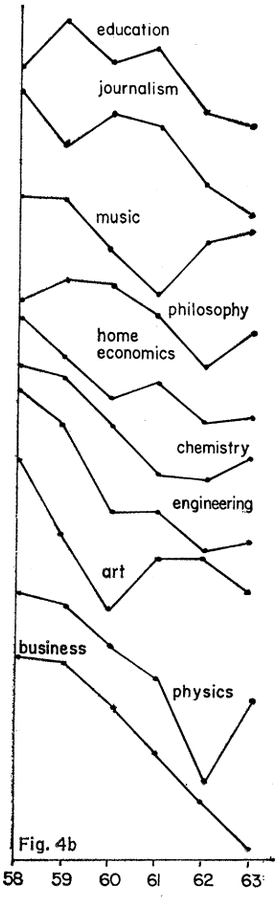












Figs. 1–4. Charts, drawn on a logarithmic scale, representing choices of careers and major fields by National Merit semifinalists. A scale for evaluating percentage change in any of the charts is given at the left of Fig. 4. When the zero point on the scale is placed over any given point on the chart for a particular career or major field, the percentage increase or decrease of all other points from this initial point can be read directly.

Fig. 1. Career choices of male semifinalists.

Fig. 2. Career choices of female semifinalists.

Fig. 3 (*a* and *b*). Major-field choices of male semifinalists.

Fig. 4 (*a* and *b*). Major-field choices of female semifinalists.

budgets, the adventure of space exploration, and plentiful fellowship support. Yet talented students have shown an ever increasing interest in fields which are singularly lacking in these advantages.

It is hard to believe that the recruitment programs and the increasingly favorable public image of science and technology have actually discouraged the most able students from entering these fields, yet alternative explanations

Table 4. Percentage of male National Merit semifinalists choosing various college major fields in the years 1958 through 1963.

Major field	1958	1959	1960	1961	1962	1963
Architecture	1.22	0.84*	0.89	0.92	1.12*	1.26
Biology	0.86	1.63*	1.37*	1.31	2.53*	3.02*
Business	2.02	2.25	1.62*	1.50	1.36	1.62*
Chemistry	6.81	8.37*	6.74*	5.60*	7.25*	8.15*
Engineering total	29.59	27.44*	26.63	23.51*	17.76*	19.88
Aeronautical	2.75	2.27*	2.45	1.91*	1.94	1.92
Chemical	5.83	5.45	5.62	4.06*	3.06*	3.08
Civil	1.77	1.93	1.53*	1.63	1.22*	1.24
Electrical	10.36	9.07*	8.79	7.73*	5.58*	6.94*
Mechanical	3.81	3.71	3.40*	2.78*	2.15*	2.55*
English	3.22	2.58*	3.08*	3.16	3.43	4.17*
Geology	0.61	0.65	0.66	0.32*	0.30	0.20*
History	1.78	1.63	1.69	1.97*	2.43*	3.30*
Journalism	0.80	0.79	0.82	0.79	0.64*	0.53
Languages	0.65	1.20*	1.28	1.16	1.41*	1.27
Mathematics	8.40	11.40*	12.18*	13.36*	14.03*	16.04*
Philosophy, religion	1.84	1.62	1.58	1.75	1.26*	1.77*
Physics	18.80	16.38*	16.44	14.66*	14.20	12.23*
Pre-medicine	8.12	6.90*	6.79	8.58*	7.12*	6.96
Psychology	0.96	0.95	0.98	1.00	0.98	1.32*
Social sciences	7.30	7.21	9.10*	11.44*	10.74*	10.14*
Number on which percentages are based	5096	6439	6847	6179	6042	6598
Number undecided	111	294	261	646	909	884
Total number	5207	6733	7108	6825	6951	7482

* The change from the previous year is statistically significant ($p < .01$).

Table 5. Percentage of female National Merit semifinalists choosing various college major fields in the years 1958 through 1963.

Major field	1958	1959	1960	1961	1962	1963
Art	2.90	1.92*	1.32*	1.71*	1.72	1.44
Biology	2.85	4.16*	4.88*	3.98*	5.50*	6.69*
Business	1.36	1.33	1.05*	0.72*	0.66	0.51
Chemistry	9.71	9.09	7.19*	5.57*	5.43	6.02
Education	5.62	7.23*	5.83*	6.17	4.47*	4.20
Engineering	2.04	1.71	1.08*	1.08	0.89	0.93
English	13.72	12.89	11.63*	11.95	12.26	12.91
History	2.39	2.83*	3.36*	3.15	2.92	3.84*
Home economics	1.62	1.30	1.05	1.14	0.93	0.51*
Journalism	3.28	2.42*	2.85*	2.67	1.99*	1.57*
Languages	4.77	7.23*	8.78*	10.37*	9.94	9.42
Mathematics	11.37	13.22*	15.53*	14.44*	13.98	17.65*
Medical technology	1.96	1.12*	1.19	1.29	0.93*	1.02
Music	2.47	2.45	1.86*	1.47*	1.92*	2.02
Nursing	2.17	2.09	2.34	2.22	1.46*	1.67
Philosophy, religion	1.06	1.18	1.15	0.99	0.76	0.90
Physics	4.17	3.98	3.22*	2.76*	1.62*	2.50*
Pre-medicine	5.45	4.16*	4.75	5.27	3.88*	4.77*
Psychology	4.90	4.69	4.58	4.55	4.57	4.68
Social sciences	6.09	6.01	7.22*	7.61	9.71*	8.26*
Speech, drama	1.45	0.27*	0.71*	0.93	0.76	0.58
Number on which percentages are based	2347	3389	2949	2933	3018	3122
Number undecided	66	212	124	784	475	524
Total number	2413	3601	3073	3717	3493	3646

* The change from the previous year is statistically significant ($p < .01$).

Table 6. Changes in career choices of talented students during 4 years of college. (Data for some fields are not reported because of the small numbers of cases.)

Career choice	Males			Females		
	Percentage in 1957	Percentage in 1961	Net change†	Percentage in 1957	Percentage in 1961	Net change†
Architect	0.91	1.23	35.2*			
Business executive	3.74	6.41	71.1*	1.23	0.75	−39.8*
Dentist	0.30	0.35	16.7*			
Engineer	32.72	15.47	−52.8*	2.34	.85	−64.1*
Homemaker				8.13	11.98	46.1*
Lawyer	5.96	9.33	56.2*	0.89	1.05	18.0*
Medical technician				2.51	1.85	−26.7*
Military officer	2.00	3.24	62.0*			
Minister	2.75	2.43	−11.0*			
Nurse				3.56	2.63	−26.1*
Office worker				1.56	2.52	61.5*
Physician	9.81	9.51	−3.3*	4.46	2.42	−45.7*
Proprietor	0.46	0.95	106.5*			
Scientific researcher	25.37	11.40	−55.2*	19.55	8.04	−58.9*
Social worker				2.56	2.05	−19.9*
Teacher, primary or secondary	2.28	2.87	25.4*	26.18	24.45	−6.6*
Teacher, college	4.90	16.63	238.6*	5.79	16.72	188.8*
Other	8.78	20.20	130.1*	18.72	22.82	21.9*
Number on which percentages are based	3954	3975		1795	1902	
Number undecided	520	499		392	285	
Total number	4474	4474		2187	2187	

† Net change is given as a percentage increase or decrease from the 1957 figure. *$p < .01$.

Table 7. Changes in major fields of talented students during 4 years of college. (Data for some fields are not reported because of the small number of cases.)

Major field	Males			Females		
	Percentage in 1957	Percentage in 1961	Net change†	Percentage in 1957	Percentage in 1961	Net change†
Architecture	3.81	0.88	−71.9*			
Art	0.33	.45	26.7*	2.66	2.23	−16.2*
Biology	2.32	2.30	−0.9	4.68	4.71	0.6
Business	3.11	4.35	39.9*	2.12	1.41	−33.5*
Chemistry	8.64	6.14	−28.9*	11.00	6.90	−37.3*
Education	3.00	0.59	−80.3*	7.81	5.97	−23.6*
Engineering	31.61	21.75	−31.2*	2.66	1.02	−59.8*
English	3.33	7.35	120.7*	12.86	19.23	49.5*
Geology	0.45	0.70	55.6*			
History	2.25	5.71	153.8*	4.30	7.07	64.9*
Journalism	0.45	0.56	24.4*	1.65	1.17	−29.1*
Languages	.81	2.01	148.1*	4.41	6.41	45.4*
Mathematics	5.68	8.32	46.5*	10.31	9.52	−7.7*
Medical technology				3.24	1.36	−58.0*
Music	0.88	0.77	−12.5*	2.87	2.23	−22.3*
Nursing				3.08	2.33	−24.4*
Philosophy	1.89	2.86	51.3*	1.43	1.84	28.7*
Physics	12.30	9.72	−21.0*	2.23	1.99	−10.8*
Political science	3.08	4.06	31.8*	2.66	3.74	40.6*
Pre-dentistry	0.43	0.25	−41.9*			
Pre-medicine	7.10	3.74	−47.3*	3.03	1.07	−64.7*
Psychology	1.11	2.59	133.3*	4.04	4.27	5.7*
Sociology	0.33	0.70	112.1*	2.34	1.89	−19.2*
Speech	.30	.25	−16.7	1.28	0.87	−32.0*
Number on which percentages are based	3960	4432		1882	2059	
Number undecided	497	25		254	77	
Total number	4457	4457		2136	2136	

† Net change is given as a percentage increase or decrease from the 1957 figure. *$p < .01$.

are not plentiful. It is possible that talented students manifested an increased interest in science and engineering as a result of World War II, and that this interest was at an abnormally high level during the late 1950's; thus, that what we have been observing during the period covered by this study is a cyclical correction rather than a major trend. However, the assumption on which this explanation rests—that there is some limit to the proportion of students who can be interested in a given area, and that when interest has reached this limit it will swing in the opposite direction—has little more appeal than the notion that recruitment programs decrease interest.

Another interesting paradox is apparent in the trends for engineering and college teaching. During the period covered by this study the shortage of talent in both these fields has been widely publicized, and there have been corresponding increases in salary levels. Yet, among talented students, the trend of interest in college teaching has been as bullish as the trend of interest in engineering has been bearish.

One must conclude from these observations that the factors determining the distribution of talent are not simple, and that many important influences remain unknown. Obviously the talent supply is not always responsive to direct attempts at manipulation.

Notes

1. This study is part of the research program of the National Merit Scholarship Corporation and was supported by grants from the National Science Foundation, the Carnegie Corporation of New York, and the Ford Foundation. Mary Alice Meyer contributed skillful assistance.
2. The dates referred to throughout are for the years the students were expected to graduate from high school. The students were actually tested approximately a year earlier.
3. These data were compiled by Mrs. Ruth Stalnaker and were presented each year in the annual report of the National Merit Scholarship Corporation. The coding categories were arbitrarily established to include the major groups of fields indicated by students in the early years and were not changed after that.
4. The sample and procedures are described more fully by A. W. Astin, *Science* **141**, 334 (1963).
5. This discussion of trends should not be interpreted to mean that Merit semifinalists are not interested in science in an absolute sense. R. C. Nichols and J. A. Davis [*Personnel Guidance J.* **42**, 794 (1964)] showed that Merit semifinalists more frequently plan careers in science and engineering than average college students do.

News and Comment

Elliott Inquiry: Chairman's Loss In Alabama Primary Raises Doubt About Future of Investigation

Representative Carl Elliott's defeat in last week's Alabama primary raises the question of what is going to happen to the House Select Committee on Government Research, whose creation was personally engineered by Elliott.

As things now stand, Elliott's loss has no direct bearing on the committee's activities. The nine-man committee, which was established by a unanimous vote of the House last fall, was given until the end of this year to conduct a comprehensive investigation of government support of research and associated activities. And Elliott's term will not expire until January. But from the committee's very beginning it was tacitly understood that the subject could not be properly covered in 14 months, and that, as the expiration date drew near, the House leadership would be extremely sympathetic to a request to extend the committee's life.

Whether such a request will now be forthcoming is a matter of some uncertainty. With Elliott gone from the committee, the chairmanship would go to the next-senior Democrat, Representative John Fogarty of Rhode Island. Fogarty has been noncommittal on whether he wants to assume the responsibility, but it is clear that his first legislative love is the NIH appropriations subcommittee, which he chairs. House rules permit him to head both committees, but Fogarty puts an incredible amount of time and energy into looking after NIH's interests in the House, and it would not be unreasonable for him to feel cool toward taking on another demanding job.

The next in the committee's five-man Democratic majority is George P. Miller of California, whose affection for the select committee has never been excessive. The House Aeronautical and Space Sciences Committee, which Miller chairs, reacted to the proposed establishment of the select committee by quickly setting up its own Subcommittee on Science, Research, and Development, chaired by Representative Emilio Q. Daddario (D–Conn.).

The two committees got geared up for hearings and studies at about the same time, and ever since, it has been something of a race to see which would become the principal forum for issues involving science and government. Neither has established a clear-cut lead, but since Miller, who is 73, is seeking to crown a long and useful political career by making the space committee a power in the House, it is unlikely that he would want to bestow his abilities upon a competing committee. After Miller come Representatives Mel Price, of Illinois, and Phil M. Landrum, of Georgia. Each might be quite interested in heading a committee whose potential for prestige and power is considerable, though as yet unrealized. But it remains to be seen whether they want the job. Price is well occupied with the chairmanship of subcommittees of the Joint Committee on Atomic Energy and the Armed Services Committee, and Landrum, who was passed over for a seat on the powerful Ways and Means Committee last year, may get a chance at a vacancy there next year.

Another possibility, of course, is that the committee might be continued with an outsider as chairman. But that is unlikely, not only because it is rare for an outsider to be jumped to a chairmanship over sitting members of a committee but also because the committee, in large part, was tailored to Elliott's interests and political needs. And he, in turn, offered qualities that provided a middle ground between those who felt that government support of research had got out of hand and those who feared that an investigation could be used as a club against federal research activities.

Although verification of such matters