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Varieties of Intellectual Talent[1]

ABSTRACT Precocity, prodigiousness, brightness, intelligence, talent, creativity, eminence, renown, greatness, and genius may be aspects or consequences of characteristics often lumped together under the multi-dimensional term "giftedness." Certain of these concepts can be traced from Galton through Spearman, Binet, and Terman to outstanding recent contributors. We consider identification of intellectually talented youth and, to some extent, their educational facilitation. Although the "abilities" view of talent is emphasized, more qualitative approaches such as those of Bloom, Ericsson, Gardner, Simonton, and Sternberg receive attention. Life outcomes of mathematically and/or verbally precocious youth identified across the nation by talent searches emanating since 1971 from Johns Hopkins University and elsewhere may help clarify relationships between intellectual precocity, creativity, and achievement.

INTRODUCTION

Each of us is the fantastically improbable result of an unbroken ancestral line going back over eons, apparently to a one-celled animal. Unimaginably complex evolutionary forces have shaped us as *homo sapiens* and individually. It is becoming clear that our genes result in many predispositions that interact with various influences during the gestation period and after birth (e.g., Plomin & McClearn, 1993; Rowe, 1995; Scarr, 1996; Plomin, 1997).

Because of the almost infinitely possible number of combinations of genes, augmented by mutations, each of us is unique. Not in the long history of hominids, stretching back perhaps four million years, has anyone exactly like you ever existed. Every person's individuality is at least a little different from anyone else's. This uniqueness may have led a number of gifted-child specialists to assume that, via a combination of nature and nurture, every person is in some way "gifted." That might be stretching the meaning of the term too much for it to be useful. Perhaps, however, nearly every individual's uniqueness is valuable biodiversity as conditions in the world change. For example, during wars some civilian ne'er-do-wells find their niches as drill sergeants and tough fighters. Also, leaders in one culture may be followers in another.

ORIGINS OF GIFTEDNESS

What, anyway, are the denotations of the words "gifted" and "giftedness" (Nevo, 1994)? I turned to the Oxford English Dictionary for guidance. There, "gifted," in the sense of being talented, is traced back to 1644: "It is one thing to say a gifted man may preach, but another thing to say a ruling elder . . . by virtue of his office may do it." In 1677: "Such of the women as were gifted at knitting and sewing . . ." In 1794: "No patriot weeps, when gifted villains die." In 1875: "The most gifted minds, when they are ill-educated, become the worst."

"Giftedness" was traced to Paracelsus, the Swiss physician and alchemist who died in 1541. The quaint word "giftishness" dates back to 1654. It seems likely that the concept itself may be about as old as mankind. Individual differences at the high and low ends of various physiological, cognitive, affective, and conative continua must have been apparent to keen observers and conceptualizers millennia before Francis Galton, James McKeen Cattell (1890), and Joseph M. Rice (1897a, 1897b) experimented with formal comparative tests during the last half of the nineteenth century.

With his *Hereditary Genius*, Galton (1869) helped launch a number of movements. The *Zeitgeist* was right, especially because Galton's cousin, Charles Darwin, had shaken the foundations of theocratic society. Gregor Mendel's creation in 1866 of the science of genetics, a crucial missing link in Darwin's and Galton's arguments, did not become known to scientists until it was rediscovered at the turn of the twentieth century. Arguably, Galton's ideas started the gifted-child movement, the heredity versus environment argument, and eugenics. Truly, he opened Pandora's box, as the raging controversy about Herrnstein and Murray's *The Bell Curve* volume (1994) indicates.

Binet Leads to Terman

The French psychologist Alfred Binet (Binet & Simon, 1905) may have been the grandfather of the gifted-child movement in the United States, even though he was interested mainly in slow-learning school children. His and Simon's 1905, 1908, and 1911 work on the construction of the first effective intelligence test was seized upon by Goddard (1910a, 1910b, 1911) to test thousands of mentally retarded and normal children even before the concept of "mental quotient" was proposed by a German, Wilhelm Stern, in 1912 (Stern, 1914). It also soon led psychologist Lewis M. Terman at Stanford University to produce the famed Stanford-Binet Intelligence Scale (Terman, 1916). That individually administered test enabled Terman to start his *Genetic Studies of Genius* in 1921 (see Bayley & Oden, 1955; Cronbach, 1996; Holahan & Sears, 1995; Oden, 1968). Recently, the research has been renamed "The Terman Life Cycle Study" (Friedman, Tucker, Schwartz, Tomlinson-Keasey, Martin, Wingard, & Criqui, 1995).

Over the years, identification of intellectually talented persons via IQ and mental age probably also owes much to the British psychologist Charles Spearman (1904). For a long time, Jensen (e.g., Jensen & Weng, 1994) and others (e.g., Gordon, in press) have striven to validate and extend Spearman's construct, "general intelligence," which is usually referred to as *g*. Intelligence testing originated in France, England, and Germany but quickly found its home chiefly in the U.S.A. For a balanced modern view that integrates psychometrics with cognitive psychology, see Hunt (1995).

Terman was fascinated by students with high IQs. I was, too, until much experience with such persons moderated my enthusiasm. When other qualities — interests, motivations, curiosities, sense of self, for example — are optimal, a Richard Feynman, John von Neumann, Donald Campbell, Lee Cronbach, or Howard Gardner may emerge. Often, though, those essential other qualities are below necessary thresholds, so a paradigm shifter does not result. I'll say more about this later.

Certainly, intelligence is by no means entirely at the mercy of genes, even though environmental influences are likely to be overestimated (see Scarr, 1992, 1996; Rowe, 1994). Neither is a high IQ *per se* a guarantee of anything, especially not the achievements of an Einstein, Gauss, Mozart, or Kant. "For fifty cents and a high IQ, you can buy a fifty-cent cup of coffee." Those students who try to "major in IQ" are likely to discover that the demands of their studies eventually stop the free ride their high mental ages have given them over the years. For example, one of my protégés whose IQ at age seven was over 200 flunked out of a highly selective university. He wouldn't study or attend classes regularly. Another super-IQ seven-year-old is, after graduating from college, playing the cocktail-music circuit. This person might make it big there, but not because of one-in-a-million IQ.

As children, the 1528 "Termites," all of them Californians, had an average IQ of about 151. All were at 135 or more. Most had IQs of at least 140 on Terman's 1916 scale. They were in the upper part of the top one percent of the general population. One unfortunate consequence of Terman's work, I believe, was to encourage use of the word "genius" to label all persons with IQ 140 or more. Although many of his subjects did achieve well as students and adults, few of their contributions were world-shaking. At least two became presidents of the American Psychological Association, however, and one of those also of the American Educational Research Association. Some others led routine lives, seeming to have far more mental ability than mental energy. Causes of such "underachievement" are still poorly understood, although there is some evidence that family variables and education were involved (Holahan & Sears, 1995).

Terman was interested chiefly in the high-IQ child in his or her "native habitat." His stated aim was to study them as they grew older, not to facilitate their development. He could not, however, refrain from serving as informal adviser and mentor to a number of them. Somehow, from his longitudinal observational study arose the gifted-child movement. Terman's efforts at Stanford University in California were augmented greatly, but largely independently, by the concurrent pioneering work of Leta Hollingworth at Teachers College of Columbia University in New York City (L. S. Hollingworth, 1926, 1942; H. L. Hollingworth, 1943).

IQ AS THE CRITERION FOR GIFTEDNESS

In the early days, a child's selection into programs for gifted children was often almost entirely on the basis of an IQ above a certain qualifying point: 140, 132, and 130 were common minima. The top one to three percent of an age group qualified; they in turn were labeled "gifted." Provisions for them varied greatly: special schools or classes, pull-out programs a few hours weekly to discuss whatever the special teacher desired, attempts to strengthen "creativity" and problem-solving ability, etc. (e.g., VanTassel-Baska, 1994a, 1994b).

Until recent years, however, academic aspects of such programs were not usually commensurate with the speed with which high-IQ youth can learn subject matter. Many, perhaps most, programs strove not to interfere with the level and rhythm of the regular classes or make less-gifted students uncomfortable.

A major defect of this IQ-grouping dates from the concept of general intelligence (*g*) proposed by Charles Spearman in 1904, a year before Binet's first test appeared. While *g* is probably the most extensively validated psychological construct, the IQ is not an ideal measure to use in grouping school children for instruction in specific subjects, say, English versus mathematics. This is primarily because IQ is an aggregate of many cognitive abilities.

For example, a child with an IQ of 150 may have verbal ability corresponding to 130 and mathematical ability corresponding to 170, which average 150. In regular classes, the demands of the subject may be so slight that the high-IQ student appears to be equally able in English and mathematics, A+ in each. Put that same child into a fast-paced, high-level math class, however, where other 150-IQers have math aptitude at level 170, and he or she probably won't be able to keep up. In such a special *English* class, the student could do well without great effort.

An illustration may make this clearer. A participant in the Study of Mathematically Precocious Youth (SMPY) at Johns Hopkins University had an IQ considerably exceeding 200. This person was tutored in mathematics intermittently, from ages 7 to 14. Then the student took the College Board Advanced Placement Program examination in two semesters of college calculus and scored 4, where 5 is the highest possible. This individual also took English and Music AP exams, without special preparation, and scored 4s.

Another extremely bright student, who was a far faster and more retentive learner of mathematics than the above, took, without much help, the two-semester Advanced Placement Program Calculus college exam at age 12 and scored 5. The point is clear: equal IQ does not necessarily mean equal learning ability in a particular subject area (Lohman, 1993). The 5-scorer went on to become a math professor in a great university. The 4-scorer is making a career in music. Despite the 200+ IQ, there was never any likelihood that the latter could become an outstanding mathematician or physicist.

BEYOND THE IQ CRITERION

Many other objections to using a measure of *g* as the sole basis for choosing gifted children have been made. There are several available individually administered psychometric instruments meant to circumvent some of the problems. Among the oldest (Wechsler, 1939) are the several Wechsler batteries, originally called the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), the Wechsler Intelligence Scale for Children (WISC), and the Wechsler Adult Intelligence Scale (WAIS). Each of these yields a verbal IQ, based on five subtests; a performance IQ, based on another five subtests; and a full-scale IQ, which is closely related to the average of the verbal and performance IQs (Stanley, 1953). Many investigators have tried to extract additional information from the subtests, but with limited success. Due to the modest reliability of subtest scores, and because they intercorrelate substantially, interpretation of subtest-score profiles is fraught with error. Only quite large differences are meaningful. Also, in academic contexts the value of the performance IQ may still be unclear.

For group-administered "aptitude" tests one could start with J. P. Guilford's Structure of Intellect, conceptualizing 120 or more at least slightly different abilities. It has not, however, fared well among psychometricians (e.g., Horn & Knapp, 1973; Clarizio & Mehrens, 1985). Therefore, I shall discuss instead a more modest test battery.

The Differential Aptitude Test (DAT)[2] can be useful in finding youth scoring high, such as at the 95th percentile or above on one or more of its eight tests: Abstract Reasoning, Clerical Speed and Accuracy, Language Usage, Mechanical Reasoning, Numerical Ability, Space Relations, Spelling, and Verbal Reasoning. These high scorers can then be retested with a more difficult test of the same ability in order to spread them out from excellent to superb.

For example, all the examinees at the 95th percentile or more on the DAT Mechanical Reasoning Test could be given a difficult level of the Bennett Mechanical Comprehension Test. Then supplemental instructional opportunities that take into account this special ability might be devised (Woodcock, 1995). The studies of Cronbach and Snow (see Snow & Swanson, 1992) on the weak interaction of aptitudes with instructional treatments should, however, make us somewhat cautious about the educational possibilities of this approach. Some work (e.g., Stanley & Benbow, 1986, and Sternberg, Ferrari, & Clinkenbeard, 1996) may be cause for optimism.

The DAT tests are not all equally loaded on *g*, and their relevance for standard school curricula varies. Overall, the scores probably relate fairly closely to IQ (McNemar, 1964). For high scorers there is, nevertheless, probably some differential validity that may be useful diagnostically and pedagogically (e.g., Detterman & Daniel, 1989; Deary & Pagliari, 1991; Detterman, 1991; Gustafsson & Balke, 1993; Achter, Benbow, & Lubinski, in press; Achter, Lubinski, & Benbow, 1996). At the end of the first fast-paced mathematics sequence that the Study of Mathematically Precocious Youth (SMPY) conducted for math-talented boys and girls, upper 1 percent in ability, the 16 finishers were tested with the DAT. Most of them had completed the seventh grade. Individually, on norms for spring of the eighth grade they ranged from a low of 25th percentile on Clerical Speed and Accuracy to five who scored perfectly on Numerical Ability (Stanley, 1976, p. 158).

In my opinion, the DAT and similar "aptitude"-test batteries may be a fairer and more effective way to locate intellectual talent than an intelligence test is. Especially, further "testing the limits" of the high scorers on DAT subtests provides valuable additional information.

In-school achievement-test batteries such as the Iowa Test of Basic Skills yield information about school skills at or near the grade level of the examinee. These are usually too easy to identify highly gifted boys and girls; they need above-grade-level testing (Stanley, 1954, 1990).

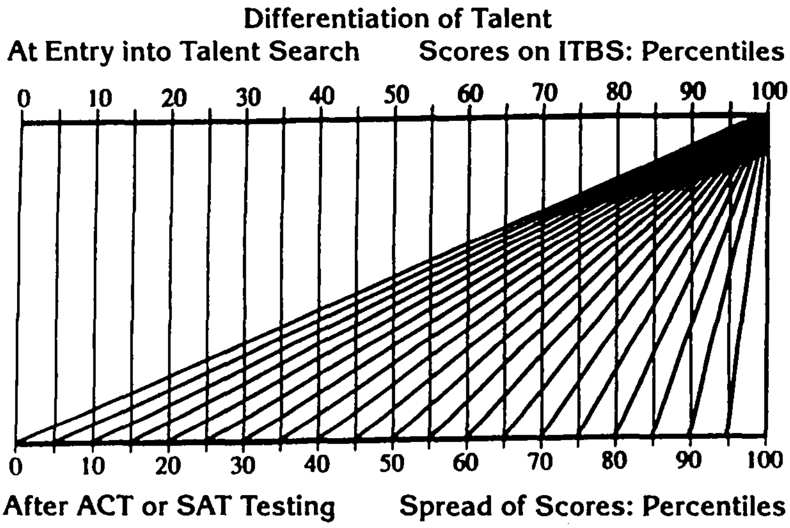
Of course, many gifted-child specialists such as Colangelo, Assouline, Cole, Cutrona, and Maxey (1996), Feldhusen (e.g., Feldhusen & Jarwan, 1993), Gallagher (1993), Passow (1993), Renzulli (1986), Robinson (1993), Tannenbaum (1993), Torrance (1977), Treffinger (1986), VanTassel-Baska (1993), Benbow and Stanley (1996), Winner (1996), and Lubinski (1996) have extended research, development, and service for intellectually talented youth far beyond dependence on the IQ *per se*. One such approach, "SMPY," pioneered at Johns Hopkins University, is more academic than most others.

THE STUDY OF MATHEMATICALLY PRECOCIOUS YOUTH (SMPY)

It was in the context of this psychometric history that Lynn H. Fox, Daniel P. Keating, and I began SMPY in 1971 (Stanley, in press). We looked for the top two or three percent scorers on the mathematical part of a standardized achievement-test battery administered by schools. Then we administered to these high-scoring seventh-graders the mathematical part of the College Board Scholastic Aptitude Test, abbreviated SAT-M (Keating & Stanley, 1972; Stanley, 1973; Stanley, Keating, & Fox, 1974). Of course, SAT-M is meant chiefly for high school seniors applying to fairly selective colleges. Thus, one might assume that it would be far too difficult for any seventh-graders. In the early days of SMPY, two irate mothers called me to say that I must be insane or sadistic to expect twelve-year-olds to take the SAT-M. Even their older siblings were terrified of it, the mothers protested.

SMPY was lucky or prescient, however, because about 18 percent of the boys and 8 percent of the girls tested scored as well on SAT-M, 500, as the average college-bound male high school senior. Some scored far higher than that. The above-level testing model (see Figure 1) works.

FIGURE 1. Retesting highly selected students with a much more difficult test spreads them out all along the score range.



(Constructed by Professor Camilla P. Benbow, Iowa State University)

A seven-year-old scored 670, two eight-year-olds 760, and a nine-year-old 800, the highest possible. A partial analogy is with the coelacanth, a primitive fish long thought extinct that was discovered in considerable numbers a few years ago. No one knew the coelacanth still existed, just as only a fool would expect such SAT-M scores from any kids still in the primary grades. Actually, in those early days even SMPY did not have the temerity to test below the sixth or seventh grade. Fortunately, a few school principals and guidance counselors did. They did not know that the task they imposed was almost surely impossible, so they did it, anyway. SMPY learned much from them and others (e.g., Charlton, Marolf, Stanley, & Ng, 1994).

And what has happened to the now-oldest nine of those extremely young super-scorers? (See Table 1.) At present, all of them are educationally accelerated, high-achieving doctoral students in the nation's top graduate schools or already recipients of Ph.D. degrees. SAT-M, used for above-grade-level testing, proved powerfully predictive for them and many other mathematically precocious boys and girls.

TABLE 1. Nine Record SAT-M Scorers at Young Ages, All of Them Male, and Where They Are Now (or Were) Graduate Students.

SAT-M Score	Age	Graduate School	Completed PhD at Age	Major
540	7	Harvard	21	Math
580[1]	7	U Pennsylvania		Math
670*	7	Harvard		Physics
760*	8	Princeton	20	Math
800*[2]	10	MIT[3]		Math & Physics
800	11	Harvard		Economics
800*	12	Harvard		Computer Science
800	12	Stanford[4]		Electrical Engineering
800	12	MIT[5]	25	Physics

* Of Asian parentage.
1 Achieved SAT-M of 800 at age 9.
2 Scored 800 on SAT-M twice at age 10.
3 Harvard *summa cum laude* in three years. As a freshman, he began with graduate-level math courses.
4 Harvard *summa cum laude* in three years.
5 Harvard *summa cum laude*. So was his brother, who scored 770 on SAT-M at age 11 and stayed at Harvard to work toward a Ph.D. in physics.

Although SMPY remained interested in extremely high scorers at an early age and in 1980 created a still-flourishing "700-800 on SAT-M Before Age 13 Group," its main concern was about those boys and girls who before age 13 were in the top 1 percent of their age group in mathematical *reasoning* ability. This meant a score of at least 500 on SAT-M. SMPY's annual talent search began with 450 students in 1972 and has progressed currently to at least 200,000 young takers of both parts of the SAT or the American College Test (ACT) all over the United States, though no longer under SMPY's auspices.

Of course, interesting as extreme precocity may be, it certainly is not the final goal. For example, earning a Ph.D. or an M.D. degree at an early age starts one along a professional path with more years available in which to achieve. It doesn't guarantee successful progression thereafter.

Even scoring in the top 10 of the prestigious Westinghouse Science (high school) Talent Search does not predict *eminence* well. Of the five Nobel Laureates up to 1990 from the 40 finalists annually in that competition, 1942-1990, only one had ranked in the carefully selected top ten. He had not been No. 1. Of the two Fields Medalists (mathematics), one was from the top ten. He was not No. 1, either (Phares, 1990).

The current data bases for studying life success of the intellectually precocious are large and varied, however. We can look forward to extensive research on this topic by Camilla P. Benbow and David Lubinski at Iowa State University and by others.

Preliminary evidence from two of SMPY's academic "prodigies" found in 1968 and 1971, respectively, is encouraging. Joseph Louis Bates completed his B.A. and M.S. Engineering degree requirements in 1973 at age 17. Now he is a leader in computer science (Peterson, 1993). Colin F. Camerer completed his B.A. degree the month he became 17 years old, his M.B.A. degree at age 19, and his Ph.D. degree at age 22, having skipped Grades 7, 9, 10, 12, and 13. At age 32 he became a full professor at the University of Chicago. By age 34, his research had won him a chaired professorship in economics at the California Institute of Technology (*Smithsonian*, 1995).

There are many other examples of outstanding early performance by SMPY's boys and girls who before age 13 scored in the top 1 in 10,000 on mathematical reasoning. As might be expected from any group of human beings, however, a few have not yet appeared to live up to their initial "promise." Perhaps they march to a different drummer and will have happy, satisfying lives nevertheless. Fortunately, none of whom we are aware yet appears to have dropped out of the system, as the much-publicized William James Sidis (Montour, 1977; Wallace, 1986) did long ago. A few may become high academic achievers but social misfits such as Norbert Wiener (1953; Montour, 1977; Wallace, 1986). Others may accommodate wide-ranging interests well, as Merrill Kenneth Wolf (A.B., Yale University, at age 14) did in medicine and musical performance (Keating, 1976, p. 346; Montour, 1978).

BEYOND SMPY

During the 1970s SMPY experimented in many ways. It developed models for providing mathematically talented boys and girls the special, accelerative, supplemental academic opportunities they sorely needed to avoid boredom, frustration, stultification, and turning away from school pursuits (Stanley, 1977; Stanley & Benbow, 1986). These led especially to the extensive academic summer programs offered by many centers and colleges across the nation. The largest of these are conducted by four private universities: the Center for Talented Youth (CTY) at Johns Hopkins, the Talent Identification Program (TIP) at Duke University, the Center for Talent Development (CTD) at Northwestern University, and the Rocky Mountain Talent Search (RMTS) at the University of Denver.

There are also many other somewhat related programs, such as those at Iowa State University, the University of Iowa, California State University at Sacramento, Arizona State University, the University of Washington, the University of Wisconsin, the University of North Texas, the University of Minnesota, and Carnegie Mellon University, as well as in several foreign countries.

Since the late 1970s about a dozen state residential high schools for talented youth have been created, starting with the North Carolina School of Science and Mathematics. Also, a few colleges have set up special programs that enable underage students to become full-time college students and yet maintain or enhance some of the social and emotional advantages of high school. Simon's Rock Early Entrance College of Bard College was created in 1964 to admit students a year or two younger than usual, most without having completed high school. Some others are the one-year Clarkson School of Clarkson University; the two-year Texas Academy of Mathematics and Science (TAMS) at the University of North Texas (Stanley, 1991); the radical-acceleration Early Entrance Program (EEP) at the University of Washington (Robinson, 1983); the Program for the Exceptionally Gifted (PEG) for girls at Mary Baldwin College in Virginia; the two-year Texas Academy of Leadership in the Humanities at Lamar University; and the one- or two-year Advanced Academy of the State University of West Georgia. See Table 2. For further background about such programs, see Brody and Stanley (1991) and Southern, Jones, and Stanley (1993).

Most of these programs have been facilitated by SMPY to a greater or a lesser extent, but without its retaining any control. The result is a vast set of effective independent efforts to locate and help boys and girls who reason exceptionally well mathematically and/or verbally. Unfortunately, however, as far as national educational *policy* is concerned, their existence is like a well-kept secret. They work largely at the grass-roots level, via talented students and their parents. They grow by example, envy, and imitation, however, at local and state levels.

TABLE 2. A Unique Early-Entrance-to-College Program: The Advanced Academy of the State University of West Georgia.

Become a full-time college student after the tenth or eleventh grade. Major in whatever you wish.

Fully accredited State University of West Georgia, located in small-town Carrollton (zip code 30118), 50 miles west of Atlanta, has about 5600 undergraduates and 2400 full- or part-time graduate students.

Each fall the Academy admits about 30 carefully selected young men and women *from anywhere* and gives them special treatment, including helping them earn, via college courses, their high school diplomas from their own high schools. They may then continue as sophomores or juniors toward a degree at the State University of West Georgia, or transfer elsewhere.

TOTAL COST: Less than $9000 per year for out-of-staters, much less for Georgians.

Minimum SAT-I scores (recentered scale) required of applicant: 580 Verbal, 500 Math, and 1100 V + M, or ACT-Verbal 27 *and* ACT-Composite 25.

GENDER DIFFERENCES

An unexpected offshoot of SMPY's talent searches has been its interest in and concern about gender differences of able youth on aptitude and achievement tests, evaluative attitudes (values), and interests (Benbow, 1988, 1990; Stanley, Benbow, Brody, Dauber, & Lupkowski, 1992; Stanley, 1993, 1994; Stumpf & Stanley, 1996; Stumpf & Stanley, in press; Stanley, Stumpf, & Cohn, in press). Girls and young women tend to excel boys and young men somewhat in most language-usage areas. The opposite is true for most other school subjects, especially physics, computer science, European history, and political science.

The good news is that nowadays far more female high school students are scoring well on the College Board achievement tests in Physics and Mathematics II (precalculus) than in 1982. Table 3 contains details.

TABLE 3. Number of Examinees Scoring 700-800 on Certain College Board High School Achievement Tests in 1982 Versus 1994.

Year	Males (n)	Females (n)	M:F Ratio
PHYSICS			
1982	2,567	200	12.84
1994	3,318	485	6.84
Change	+29%	+142%	-47%
MATHEMATICS II (precalculus)			
1982	10,451	3,429	3.05
1994	17,179	8,585	2.00
Change	+64%	+150%	-34%
MATHEMATICS I (chiefly algebra & geometry)			
1982	6,154	2,423	2.54
1994	5,027	2,826	1.78
Change	-18%	+17%	-30%

BEYOND PSYCHOMETRICS

Thus far I have emphasized psychometric approaches for finding intellectually talented persons and for assessing what they have already learned and still need to learn. SMPY has done this because it wanted to help such individuals speed up their learning in their areas of greatest intellectual ability.

But, as Howard Gardner said to me during the discussion at a recent symposium, "Your presentation was a nice demonstration of how much one can find by playing with numbers. You have found lots of interesting things, some of them, I think, important. However, there is a danger of what I would call test 'idolatry'" (Stanley, 1993, p. 137). *Touché*, but his comment cuts both ways. There is, indeed, more to life than just numbers, words, or even values. Approaches that are too quantitative may miss the mark, as also may those that are too qualitative and unrestrained by need for precision. A nice balance of objectivity and subjectivity seems desirable. Human beings cannot live by impression, verbalizing, anecdotes, metaphor, or analogy alone, nor merely by counting, measuring, and statisticizing.

Part, however, of the gifted-child specialists' flight from the IQ to various kinds of subjective nominations by which to choose presumably gifted children may be motivated by considerations of political correctness. An appreciable number of members of those groups that tend to score low on objective tests can — indeed, *must* — be labeled "gifted" in other ways. Partly to get socially approved proportional representation by gender, race, socioeconomic level, and ethnicity, the searchers devise alternative ways of qualifying. Some searches involve nominations by teachers, principals, guidance counselors, parents, fellow students, and even the youth being evaluated for inclusion in a program. Elaborate check lists of characteristics and qualities presumably indicating "giftedness" of some sort abound. Perhaps more cogently, portfolios of student work, writing samples, and other performance criteria such as auditions are used.

A major strength of the psychometric approach to labeling a child as being gifted is its relative freedom from subjectivity and bias. Some would say that its weaknesses are inadequate coverage of emotional, social, and motivational factors and special talents. Yet, even today, reliable and valid assessment of such factors is difficult. Often, assertions and anecdotes replace experimental rigor.

This raises an important point: the degree of subjectivity and unreliable measurement one can tolerate in a program for gifted children depends largely on the *product* goals of that program. For example, false positives become a serious problem if (as SMPY does) one tries to find students so mathematically able that at ages 12-14 they can learn at least an entire school year of introductory algebra well in just three intensive weeks during summer programs.

On the other hand, if the program is mainly *process*-oriented, various kinds of "enrichment" can be offered to a wide range of talent. Where there are no rigorous outcome standards to be met or failed, selection can be about as subjective and socially and politically correct as the talent searchers desire. Usually, they need not be concerned about subject-matter acceleration as a substitute for in-grade academic work the bright youth is finding unchallenging. For instance, in process-oriented programs the math-talented student may be given mathematical enrichment that makes him or her even more overqualified for the regular mathematics class. A major goal of SMPY and its many offshoots is to prevent this retardation in subject-matter placement by covering a school year of mathematics quickly but thoroughly and then permitting the student to move into the next school level of mathematics.

Four of the main tenets of SMPY-type instructional programs are the following:

1. Curricular flexibility
2. Use of SMPY's model for "diagnostic testing followed by prescribed instruction" (Stanley, 1978; Benbow, 1986)
3. Close tutor-tutee mentoring between dyadic partners well matched for aptitudes, interests, and values
4. Effective articulation of the student's special educational experiences with his or her subject-matter placement in school (Southern, Jones, & Stanley, 1993).

SMPY started with mathematics because of its hierarchic nature, but these principles are applicable also to most other school subjects. In 1982 SMPY pioneered their use with the first year of high school biology and chemistry. Each subject was learned well in three intensive weeks by bright, well-motivated young students. Many of them went on quickly to master the Advanced Placement Program introductory college year of the subject in their high schools (Stanley & Stanley, 1986; Lynch, 1992).

ADULT PARADIGM SHIFTERS

Gardner (1983), Sternberg (1985), and others have insisted repeatedly that there are qualitatively different kinds of "intelligence" and ways to use them. Gardner prefers seven intelligences, Sternberg three. Both of these approaches excite much interest. They have heuristic value and suggest ways to improve classroom instruction, exemplified by Sternberg, Ferrari, and Clinkenbeard (1996). They have gone far beyond the many efforts to use Bloom's (1956) famed six-level taxonomy of educational objectives for instructional purposes. Operationalizing such concepts is difficult, however. Reliably and validly assessing the Gardner and Sternberg "intelligences" differentially in individuals is likely to require much time and effort, without assured results (Brody, 1992).

Gardner (1993a, 1993b) has extended his ideas about different kinds of intelligence into the area of adult "genius." He studied the development of seven persons acknowledged to have influenced their fields greatly, each an example of one of his seven "intelligences": T.S. Eliot (linguistic), Albert Einstein (logical and mathematical), Sigmund Freud (intrapersonal), Mahatma Gandhi (interpersonal), Martha Graham (bodily and kinesthetic), Pablo Picasso (spatial), and Igor Stravinsky (musical). What common threads tie together these diverse masters who were active between 1885 and 1935? Gardner tried, in penetratingly literary and intuitive fashion, to discern them. He noted several similarities, including need for regular, intimate contact with a confidant and the "Faustian bargain struck by each creator, who sacrificed normal relationships in the personal sphere" (p. 386).

Gardner's *Creating Minds* is a "must" for all persons interested in genius, talent, and creativity. It is exceedingly readable and challenging. Be warned, however, about Gardner's strong preference for literary and artistic sources and, therefore, his not covering many scientific works that, to others interested in studies such as those of Roe (1952) and Zuckerman (1977), might seem relevant.

This brings up the whole matter of adult genius and eminence, which often are not the same. Cox (1926) studied both in the large second volume of Terman's *Genetic Studies of Genius*, but almost wholly from the standpoint of the childhood versus the adult IQ of each of 300 great historical figures. For estimating the childhood IQ she had to be too dependent on the available data. This may have exaggerated the difference between childhood and adult IQ in a number of cases.

Several psychologists, especially Simonton (1994) in an admirably comprehensive recent book, have made prolonged studies of genius and eminence. Even then, they remain rather elusive. Given extensive information about their childhoods, could anyone have predicted the later accomplishments of Gregor Mendel, Albert Einstein, Charles Darwin, Isaac Newton, or even Texas Senator Phil Gramm, who reportedly failed three grades in school and yet became a full professor of economics at a good university by age 31? In all of these, opportunism and a favorable *Zeitgeist* appear to have played a part, but there must have been much more.

One of my favorite sets of informal studies of great men is the novelist C. P. Snow's (1966) anecdotal book, *Variety of Men*. Snow was trained as a physicist but made his mark chiefly as the author of the eleven-volume academic *Strangers and Brothers* novel-sequence. Perhaps he is best known for his theory about two contrasting cultures, the humanistic versus the scientific. This book features what Snow calls "a set of personal impressions" about nine men, all but one of whom (Stalin) he had known personally to some extent: the physicist Rutherford, the pure-mathematician Hardy, the writer H. G. Wells, the physicist Einstein, the statesmen Lloyd George and Winston Churchill, the poet Robert Frost, the diplomat Dag Hammarskjold, and the dictator Stalin. Only Einstein overlaps Gardner's seven.

Biographers of greatness face a problem akin to that of the editors of *Who's Who in America*, i.e., how large a net to cast. That directory of newsworthy persons includes two types, those whose substantial achievements merit inclusion, and those who have somehow acquired a title such as "Congressman" that, for a while, makes them of reference interest. This *Who's Who* screens names for each subsequent volume, however. Those whose luster has tarnished are likely to be dropped.

In that tradition, the Goertzels (Goertzel & Goertzel, 1962; Goertzel, Goertzel, & Goertzel, 1978) included a wide variety of famous persons. They developed case studies of their leadership, personality, and other characteristics. Gardner does not cite the Goertzels' work, perhaps because it does not deal in depth with the level of person he studied. Of course, Gardner's (1993a) book devoted to only seven surpassingly eminent persons provides the opportunity for far more penetrating analyses than if three hundred were covered. It suffers, however, from the problems of $N = 1$ studies; e.g., Picasso may not be representative of Cezanne, nor Gandhi of other "interpersonal" leaders.

Then there is the field of psychohistory (e.g., Strozier & Offer, 1985), pioneered partly by the psychoanalyst Erik Erikson with his studies of Martin Luther, Gandhi, Thomas Jefferson, Einstein, and many others. Erikson began as an artist and then was drawn into analysis with Anna Freud, Sigmund's daughter. Gardner gives much attention to his work.

Attempting to understand extreme precocity and adult genius, such as that of the boy who scored 670 on SAT-M at age 7 or the startling accomplishments of largely untutored Gregor Mendel, many persons have concocted theories. A recent one might, if it holds up under scrutiny, help explain some unexpected idiosyncrasies and super-traits. It is the concept of "emergenesis" (Lykken, 1982; Lykken, McGue, Tellegen, & Bouchard, 1992): "Traits that are influenced by a configuration — rather than by a simple sum — of polymorphic genes may not be seen to be genetic unless one studies monozygotic twins . . . because such 'emergenic' traits will tend not to run in families. Personal idiosyncrasies that have been found to be surprisingly concordant among monozygotic twins separated in infancy and reared apart may be emergenic traits. More speculatively, important human traits like leadership, genius in its many manifestations, being an effective therapist or parent, as well as certain psychopathological syndromes may also be emergenic" (Lykken et al., 1992, p. 1565).

OTHER THEORIES

Sternberg's (1985) well-known three-part ("triarchic") theory of analytic, practical, and creative intelligence seems less concerned with genius and eminence than does Gardner's conceptualization. There are levels of talent even among Nobel Laureates (e.g., Roe, 1952; Zuckerman, 1977). I am reminded of the comment that C. P. Snow (1971) made about two famous physicists, both of them Nobel Laureates. "Einstein was a man of overwhelming genius, [Max] Born one of great talent," analogous to the Mozart versus Salieri contrast in the fictionalized play and film *Amadeus*.

Actually, many theories of intelligence are not about giftedness or genius *per se*. They aim to encompass most persons (Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg, & Urbina, 1996; Gottfredson, 1996, in press). The word "intelligence" has different connotations for psychometricians than for the lay public, which values intelligent behavior more than test-derived IQ itself. Even sociologists of science may, for scientific or political reasons, make little or no use of test-measured intelligence when discussing great achievements. For example, Zuckerman (1977) did not invoke IQ or g when studying factors related to Nobel Laureates in the United States. Her theory of cumulative educational advantage parallels Gardner's child-master relationship: apprenticeships, mentorships, internships, early identification with the great, successively more sophisticated levels of development.

This is somewhat akin to Ericsson's insistence that the main factor in the development of concert-level performance on the piano or the violin or star status in a sport such as tennis is unremitting, focused practice of component skills under expert tutelage (Ericsson, Krampe, & Heizmann, 1993; Ericsson, Krampe, & Tesch-Romer, 1993). For example, to become an outstanding solo music performer, it may be almost essential to begin at about age four and practice ten thousand hours. To start at age eight and practice just eight thousand hours may relegate the person to achieving only a place in a symphony orchestra. In his emphasis on the acquisition of expertise, Ericsson says, "I have nothing in principle against accepting the role of basic talent factors, but, from my reading of the literature, there is no conclusive evidence that they are related to the acquisition of expert performance" (Ericsson, Krampe, & Heizmann, p. 235). He and his associates do qualify this, however: "We believe that motivation is a necessary *prerequisite* for effective practice, because when the goal to improve is given up, individuals cease deliberate practice. At the same time, we recognize that remarkably little is known about the development and maintenance of the motivation to practice over the long preparational period" (pp. 230-231).

As one might suspect, this negation of the talent concept is distinctly a minority viewpoint. None of the other twenty-four participants in the Ciba Foundation symposium where Ericsson presented his paper agreed with him (see Bock & Ackrill, 1993, pp. 232-249). Their barrage of criticism did not seem to shake his confidence. Probably, development of expertise deserves far more attention than it usually receives from gifted-child specialists, perhaps partly in the context of mastery learning and overlearning in order to improve retention (see Bloom, 1985). For a modern theory of giftedness, see Sternberg and Zhang (1995)[3].

FURTHER DISCUSSION

Thus, it is obvious that there are many different ways to define "giftedness." The noun suggests a single continuum ranging from extremely ungifted to extremely gifted, but of course there are many dimensions of giftedness and talent. For children there are natural and facilitated precocity, genetic and environmental predispositioning ("aptitude"), "noncognitive" characteristics such as dogged determination ("motivation"), basic temperament, and many other cognitive, affective, and cognitive influences. These are facilitated or inhibited by environmental influences such as parents, the *Zeitgeist*, sheer luck, serendipity, and, more generally, all those intra- and inter-individual main effects and interactions that depend partly on how fortunate the individual was in where, when, and to whom he or she was born.

For success as adults, the picture is even more complex. Many promising children do not become highly successful adults, whereas some who seemed less able and promising achieve much. At each stage, some drop out of the race and others speed up. Studies such as those of Kerr (1992), Albert (1994), and Arnold (1995) make this clear. Most of us could tell both cheering and depressing stories about our former classmates. For example, the valedictorian of a 200-student high school graduating class could read fourth-year Latin at sight. She went on to earn, four years later, a Bachelor's degree in classics, Phi Beta Kappa. Yet in her seventies she drove a taxi in her home town, not ever having had much of a career. Family background and finances had been stacked against her too heavily. Also, after college she had made unfortunate vocational choices.

About all we can do for gifted children, however defined, is to provide them special, supplemental, accelerative educational experiences appropriate to their abilities and interests. Intellectual challenge and high expectations will usually be part of this extra package. For schools, key concepts are curricular flexibility and effective articulation of out-of-school academic learning (formal or informal) with in-school experiences. Try not to teach students what they already know or move them too slowly or too fast through what they don't yet know.

Even with the best planning, however, outcomes will be variable (e.g., Gardner, 1993b). We know a little about how to "produce" Max Borns, but almost nothing about how to produce Einsteins, Mozarts, or Gandhis. That should not deter us from doing the very best we possibly can to help all youth live up to, or beyond, their presumed potential.

As Browning wrote, in the male-chauvinistic language of his day, "Ah, but a man's reach should exceed his grasp, Or what's a heaven for?" And Keats equated aesthetic orientation with theoretical orientation (Spranger, 1928) in his "'Beauty is truth, truth beauty;' — that is all Ye know on earth, and all ye need to know." I have not quoted these familiar lines simply to end with a literary flourish. Buried deep in them lies much wisdom about the nurturing of giftedness and creativity.

REFERENCES

ACHTER, J. A., BENBOW, C. P., & LUBINSKI, D. (IN PRESS). Multipotentiality among the gifted: Is it a pervasive problem? *Gifted Child Quarterly, 41*, 2-12.

ACHTER, J. A., LUBINSKI, D., & BENBOW, C. P. (1996). Multipotentiality among intellectually gifted: "It never was there and already it's vanishing." *Journal of Counseling Psychology, 43*, 65-76.

ALBERT, R. S. (1994). The achievement of eminence: A longitudinal study of exceptionally gifted boys and their families. In R. F. Subotnik & K. D. Arnold (Eds.), *Beyond Terman: Contemporary longitudinal studies of giftedness and talent* (pp. 282-315). Norwood, NJ: Ablex.

ARNOLD, K. D. (1995). *Lines of promise: High school valedictorians over time.* San Francisco, CA: Jossey-Bass.

BAYLEY, N., AND ODEN, M. H. (1955). The maintenance of intellectual ability in gifted adults. *Journal of Gerontology, 10,* 91-107.

BENBOW, C. P. (1986). SMPY's model for teaching mathematically precocious students. In J. S. Renzulli (Ed.), *Systems and models for developing programs for the gifted and talented* (pp. 2-25). Mansfield Center, CT: Creative Learning Press.

BENBOW, C. P. (1988). Sex differences in mathematical reasoning ability in intellectually talented preadolescents: Their nature, effects, and possible causes. *Behavioral & Brain Sciences, 11,* 169-232.

BENBOW, C. P. (1990). Sex differences in mathematical reasoning ability: Further thoughts. *Behavioral & Brain Sciences, 13,* 196-198.

BENBOW, C. P., & Stanley, J. C. (1996). Inequity in equity: How "equity" can lead to inequity for high-potential students. *Psychology, Public Policy, and Law, 2,* 249-292.

BINET, A., & SIMON, TH. (1905). Methodes nouvelles pour le diagnostic du niveau intellectuel des anormaux. *Année Psychologique, 11,* 191-244.

BLOOM, B. S. (Ed.). (1956). *Taxonomy of educational objectives: The classification of educational goals.* Handbook I: Cognitive domain. New York: McKay.

BLOOM, B. S. (Ed.). (1985). *Developing talent in young people.* New York: Ballentine.

BOCK, G. R., & ACKRILL, K. (Eds.). (1993). *The origins and development of high ability.* Proceedings of a symposium held at the Ciba Foundation in London on 25 January 1993. New York: Wiley.

BRODY, L. E., & STANLEY, J. C. (1991). Young college students: Assessing factors that contribute to success. In W. T. Southern & E. D. Jones (Eds.), *The academic acceleration of gifted children* (pp. 102-132). New York: Teachers College Press.

BRODY, N. (1992). *Intelligence* (2nd ed.). San Diego, CA: Academic Press.

CARROLL, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* New York: Cambridge University Press.

CATTELL, J. M. (1890). Mental tests and measurements. *Mind, 15,* 373-380.

CHARLTON, J. C., MAROLF, D. M., STANLEY, J. C., & NG, L. (1994). Follow-up insights on rapid educational acceleration. *Roeper Review, 17,* 123-130.

CLARIZIO, H. F., & MEHRENS, W. A. (1985). Psychometric limitations of Guilford's structure-of-intellect model for identification and programming of the gifted. *Gifted Child Quarterly, 29,* 113-120.

COLANGELO, N., ASSOULINE, S. G., COLE, V., CUTRONA, C., & MAXEY, J. E. (1996). Exceptional academic performance: Perfect scores on the PLAN. *Gifted Child Quarterly. 40,* 102-110.

COX, C. M. (1926). The early mental traits of three hundred geniuses. *Genetic Studies of Genius,* Vol. II. Stanford, CA: Stanford University Press.

CRONBACH, L. J. (1996). Acceleration among German males: Correlates in midlife and after. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 179-191). Baltimore, MD: Johns Hopkins University Press.

DEARY, I. A., & PAGLIARI, C. (1991). The strength of *g* at different levels: Have Detterman and Daniel rediscovered Spearman's "Law of diminishing returns"? *Intelligence, 15,* 247-250.

DETTERMAN, D. K. (1991). Reply to Deary and Pagliari: Is *g* intelligence or stupidity? *Intelligence, 15*, 251-255.

DETTERMAN, D. K., & DANIEL, M. H. (1989). Correlations of mental tests with each other and with cognitive variables are highest for low-IQ groups. *Intelligence, 13*, 349-359.

ERICSSON, K. A., KRAMPE, R. T., & HEIZMANN, S. (1993). Can we create gifted people? In G.R. Bock & K. Ackrill (Eds.), *The origins and development of high ability* (pp. 222-249). New York: Wiley.

ERICSSON, K. A., KRAMPE, R. T., & TESCH-ROMER, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363-406.

FELDHUSEN, J. F., & JARWAN, F. A. (1993). Identification of gifted and talented youth for educational programs. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 233-251). New York: Pergamon.

FRIEDMAN, H. S., TUCKER, J. S., SCHWARTZ, J. E., TOMLINSON-KEASEY, C., MARTIN, L. R., WINGARD, D. L., & CRIQUI, M. H. (1995). Psychosocial and behavioral predictors of longevity: The aging and death of the "Termites." *American Psychologist, 50*, 69-78.

GALTON, F. (1869). *Hereditary genius*. London: Macmillan.

GALLAGHER, J. J. (1993). Current status of gifted education in the United States. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 755-770). New York: Pergamon.

GARDNER, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.

GARDNER, H. (1993a). *Creating minds: An anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. New York: Basic Books.

GARDNER, H. (1993b). The relationship between early giftedness and later achievement. In G. R. Bock & K. Ackrill (Eds.), *The origins and development of high ability* (pp. 175-186). New York: Wiley.

GODDARD, H. H. (1910a). A measuring scale for intelligence. *The Training School, 6*, 146-155.

GODDARD, H. H. (1910b). Four hundred feebleminded children classified by the Binet method. *Pedagogical Seminary, 17*, 387-397.

GODDARD, H. H. (1911). Two thousand normal children measured by the Binet measuring scale of intelligence. *Pedagogical Seminary, 18*, 232-259.

GOERTZEL, V., & GOERTZEL, M. C. (1962). *Cradles of eminence*. Boston: Little, Brown.

GOERTZEL, M. G., GOERTZEL, V., & GOERTZEL, T. F. (1978). *Three hundred eminent personalities: A psychological analysis of the famous*. San Francisco, CA: Jossey-Bass.

GORDON, R. A. (in press). Everyday life as an intelligence test: Effects of intelligence and intelligence context. *Intelligence*.

GOTTFREDSON, L. S. (1996). What do we know about intelligence? *American Scholar, 65* (1), 15-30.

GOTTFREDSON, L. S. (in press). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence*.

GUSTAFSSON, J.-E., & BALKE, G. (1993). General and specific abilities as predictors of school achievement. *Multivariate Behavioral Research, 28*, 407-434.

HERRNSTEIN, R. J., & MURRAY, C. A. (1994). *The bell curve: Intelligence and class structure in American life*. New York: Free Press.

HOLAHAN, C. K., & SEARS, R. R. (1995). *The gifted group in later maturity*. Stanford, CA: Stanford University Press.

HOLLINGWORTH, H. L. (1943). *Leta Stetter Hollingworth: A biography*. Lincoln: University of Nebraska Press.

HOLLINGWORTH, L. S. (1926). *Gifted children: Their nature and nurture*. New York: Macmillan.

HOLLINGWORTH, L. S. (1942). *Children above 180 IQ Stanford-Binet: Origin and development*. Yonkers-on-Hudson, NY: World Book Co.

HORN, J. L., & KNAPP, J. R. (1973). On the subjective character of the empirical base of Guilford's structure-of-intellect model. *Psychological Bulletin, 80*, 33-43.

HUNT, E. (1995). The role of intelligence in modern society. *American Scientist, 83*, 356-368.

JENSEN, A. R., & Weng, L.-J. (1994). What is good *g*? *Intelligence, 18*, 231-258.

KEATING, D. P. (Ed.). (1976). *Intellectual talent: Research and development*. Baltimore, MD: Johns Hopkins University Press.

KEATING, D. P., & STANLEY, J. C. (1972). Extreme measures for the exceptionally gifted in mathematics and science. *Educational Researcher, 1*, 3-7.

KERR, B. (1992). A twenty-year follow-up of gifted women. In N. Colangelo, S. G. Assouline, & D. L. Ambroson (Eds.), Talent Development, Vol. 2. *Proceedings from the 1991 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 240-247). Unionville, NY: Trillium Press.

LOHMAN, D. F. (1993). Teaching and testing to develop fluid abilities. *Educational Researcher, 22*, 12-23.

LUBINSKI, D. (Ed.). (1996). Applied individual differences research: Its quantitative methods and its policy relevance. Special issue of *Psychology, Public Policy, and Law, 2* (2, June), pp. 187-392.

LYKKEN, D. T. (1982). Research with twins: The concept of emergenesis. *Psychophysiology, 19*, 361-373.

LYKKEN, D. T., MCGUE, M., TELLEGEN, A., & BOUCHARD, Jr., T. J. (1992). Emergenesis: Genetic traits that may not run in families. *American Psychologist, 47*, 1565-1577.

LYNCH, S. J. (1992). Fast-paced high school science for the academically talented: A six-year perspective. *Gifted Child Quarterly, 36*, 147-154.

McNEMAR, Q. (1964). Lost: Our intelligence? Why? *American Psychologist, 18*, 871-882.

MONTOUR, K. M. (1977). William James Sidis, the broken twig. *American Psychologist, 32*, 265-279.

MONTOUR, K. M. (1978). Merrill Kenneth Wolf: A Bachelor's degree at 14. In J. C. Stanley, W. C. George, & C. H. Solano (Eds.). *Educational programs and intellectual prodigies* (pp. 57-58). Baltimore, MD: Study of Mathematically Precocious Youth, Johns Hopkins University.

NEISSER, U.; BOODOO, G.; BOUCHARD, Jr., T. J.; BOYKIN, A. W.; BRODY, N.; CECI, S. J.; HALPERN, D. F.; LOEHLIN, J. C.; PERLOFF, R.; STERNBERG, R. J.; & URBINA, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*, 77-101.

NEVO, B. (1994). Definitions, ideologies, and hypotheses in gifted education. *Gifted Child Quarterly, 38*, 184-186.

ODEN, M. H. (1968). The fulfillment of promise: 40-year follow-up of the Terman gifted group. *Genetic Psychology Monographs, 77* (Ist half), 3-93.

PASSOW, A. H. (1993). National/state policies regarding education of the gifted. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 29-46). New York: Pergamon.

PETERSON, I. (1993). Wizard of Oz: Bringing drama to virtual reality. *Science News, 142*(Nos. 25 & 26, Dec. 19 & 26), 440-441.

PHARES, T. K. (1990). *Seeking — and finding — science talent: A 50-year history of the Westinghouse Science Talent Search*. Pittsburgh, PA: Westinghouse Electric Corporation.

PLOMIN, R. (1997). Genetics and intelligence. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed.) (pp. 67-74). New York: Allyn & Bacon.

PLOMIN, R. & McCLEARN, G. E. (1993). *Nature, nurture, and psychology*. Washington, DC: American Psychological Association.

RENZULLI, J. S. (Ed.). (1986). *Systems and models for developing programs for the gifted and talented*. Mansfield Center, CT: Creative Learning Center.

RICE, J. M. (1897a). The futility of the spelling grind: I. *Forum, 23*, 163-172.

RICE, J. M. (1897b). The futility of the spelling grind: II. *Forum, 23*, 409-419.

ROBINSON, H. B. (1983). A case for radical acceleration: Programs of the Johns Hopkins University and the University of Washington. In C. P. Benbow and J. C. Stanley (Eds.), *Academic precocity: Aspects of its development* (pp. 139-159). Baltimore, MD: Johns Hopkins University Press.

ROBINSON, N. M. (1993). Identifying and nurturing gifted, very young children. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 507-524). New York: Pergamon.

ROE, A. (1952). *The making of a scientist*. New York: Dodd, Mead.

ROWE, D. C. (1994). *The limits of family influence: Genes, experience, and behavior*. New York: Guilford.

ROWE, P. M. (1995). Smithsonian lecture series is a smashing success. APS (American Psychological Society) *Observer, 8*, 1 & 20-22.

SCARR, S. (1992). Developmental theories for the 1990s: Development and individual differences. *Child Development, 63*, 1-19.

SCARR, S. (1996). How people make their own environment: Implications for parents and policy makers. *Psychology, Public Policy, and Law, 2*, 204-228.

SIMONTON, D. K. (1994). *Greatness: Who makes history and why*. New York: Guilford.

SMITHSONIAN MAGAZINE (1995). The math whiz kids have fulfilled their promise — in a variety of ways. *26* (April, No. 1), 34.

SNOW, C. P. (1966). *Variety of men*. New York: Scribner's.

SNOW, C. P. (1971). Review of *The Born-Einstein letters*. *American Association for the Advancement of Science Bulletin*, *16*, 3 & 8.

SNOW, R. E., & SWANSON J. (1992). Instructional psychology: Aptitude, adaptation, and assessment. *Annual Review of Psychology*, *43*, 583-626.

SOUTHERN, W. T., JONES, E. D., & STANLEY, J. C. (1993). Acceleration and enrichment: The context and development of program options. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 387-409). New York: Pergamon.

SPEARMAN, C. (1904). "General intelligence" objectively determined and measured. *American Journal of Psychology*, *15*, 201-293.

SPRANGER, E. (1928). *Types of men: The psychology and ethics of personality*. (Translation of *Lebensformen*, 1927). Halle (Saale): Niemeyer.

STANLEY, J. C. (1953). Why Wechsler-Bellevue full-scale IQs are more variable than averages of verbal and performance IQs. *Journal of Consulting Psychology*, *17*, 419-420.

STANLEY, J. C. (1954). Identification of superior learners in grades ten to fourteen. *Supplemental Educational Monograph* No. 81, University of Chicago Press, pp. 31-34.

STANLEY, J. C. (1973). Accelerating the educational progress of intellectually gifted youths. *Educational Psychologist*, *10*, 133-146.

STANLEY, J. C. (1976). Special fast-mathematics classes taught by college professors to fourth-through twelfth-graders. In D. P. Keating (Ed.), *Intellectual talent: Research and development* (pp. 132-159). Baltimore: Johns Hopkins University Press.

STANLEY, J. C. (1977). Rationale of the Study of Mathematically Precocious Youth (SMPY) during its first five years of promoting educational acceleration. In J. C. Stanley, W. C. George, & C. H. Solano (Eds.), *The gifted and the creative: A fifty-year perspective* (pp. 75-112). Baltimore: Johns Hopkins University Press.

STANLEY, J. C. (1978). SMPY's DT-PI Model: Diagnostic testing followed by prescriptive instruction. *Intellectually Talented Youth Bulletin*, *4* (10), 7-8.

STANLEY, J. C. (1990). Leta Hollingworth's contributions to above-level testing of the gifted. *Roeper Review*, *12*, 166-171.

STANLEY, J. C. (1991). A better model for residential high schools for talented youths. *Phi Delta Kappan*, *72*, 471-473.

STANLEY, J. C. (1993). Boys and girls who reason well mathematically. In G. R. Bock and K. Ackrill (Eds.), *The origins and development of high ability* (pp. 119-138). New York: Wiley.

STANLEY, J. C. (1994). Gender differences for able elementary school students on above-grade-level ability and achievement tests. In N. Colangelo, S. G. Assouline, & D. L. Ambroson (Eds.), Talent Development, Vol. 2. *Proceedings from the 1993 Henry B. and Jocelyn Wallace Research Symposium on Talent Development* (pp. 141-148). Dayton, Ohio: Ohio Psychology Press.

STANLEY, J. C. (1996). In the beginning: The Study of Mathematically Precocious Youth (SMPY). In C. P. Benbow & D. Lubinski (Eds.). *Intellectual talent: Psychometric and social issues* (pp. 225-235). Baltimore, MD: Johns Hopkins University Press.

STANLEY, J. C., & BENBOW, C. P. (1986). Youths who reason extremely well mathematically. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 361-387). Cambridge, England: Cambridge University Press.

STANLEY, J. C.; BENBOW, C. P.; BRODY, L. E.; DAUBER, S. L.; & LUPKOWSKI, A. E. (1992). Gender differences on eighty-six nationally standardized aptitude and achievement tests. In N. Colangelo, S. G. Assouline, & D. L. Ambroson (Eds.), Talent development, Vol. 1. *Proceedings from the Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 42-65). Unionville, NY: Trillium Press.

STANLEY, J. C., KEATING, D. P., & FOX, L. H. (1974). *Mathematical talent: Discovery, description, and development.* Baltimore: Johns Hopkins University Press.

STANLEY, J. C., & STANLEY, B. S. K. (1986). High-school biology, chemistry, or physics learned well in three weeks. *Journal of Research in Science Teaching, 23,* 237-250.

STANLEY, J. C., STUMPF, H., & COHN, S. J. (In press). Ipsative evaluative attitudes versus cognitive abilities and vocational interests of bright male versus female seventh-graders. In N. Colangelo, S. G. Assouline, and D. L. Ambroson (Eds.), Talent Development, Vol. 3. *Proceedings from the 1995 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development.* Dayton, Ohio: Ohio Psychology Press.

STERN, W. (1914). *The psychological methods of testing intelligence.* Baltimore: Warwick & York.

STERNBERG, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence.* New York: Cambridge University Press.

STERNBERG, R. J., FERRARI, & CLINKENBEARD, P. (1996). Identification, instruction, and assessment of gifted children: A construct validation of a triarchic model. *Gifted Child Quarterly, 40,* 129-137.

STERNBERG, R. J., & ZHANG, L. (1995). What do we mean by giftedness? A pentagonal implicit theory. *Gifted Child Quarterly, 39,* 88-94.

STROZIER, C. B., & OFFER, D. (1985). *The leader: Psychohistorical essays.* New York: Plenum Press.

STUMPF, H., & STANLEY, J. C. (1996). Gender-related differences on the College Board's Advanced Placement and Achievement Tests. *Journal of Educational Psychology, 88,* 353-364.

STUMPF, H., & STANLEY, J. C. (in press). Gender-related differences in enrollment in and scores on the Advanced Placement Computer Science examinations. *College Board Review.*

TANNENBAUM, A. J. (1993). History of giftedness and "gifted education" in world perspective. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 3-27). New York: Pergamon.

TERMAN, L. M. (1916). *The measurement of intelligence.* Boston: Houghton Mifflin.

TORRANCE, E. P. (1977). Creatively gifted and disadvantaged gifted. In J. C. Stanley, W. C. George, & C. H. Solano (Eds.), *The gifted and the creative* (pp. 173-196). Baltimore, MD: Johns Hopkins University Press.

TREFFINGER, D. J. (1986). Giftedness as potential for creativity productivity: Transcending the scores. *Roeper Review*, 8(3), 150-154.

VanTASSEL-BASKA, J. (1993). Theory and research on curriculum development for the gifted. In K. A. Heller, F. J. Mönks, & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 365-386). New York: Pergamon.

VanTASSEL-BASKA, J. (1994a). The National Curriculum Development Projects for High-Ability Learners: Key issues and findings. In N. Colangelo, S. G. Assouline, & D. L. Ambroson (Eds.), Talent development, Vol. 2. *Proceedings from the 1993 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 19-38). Dayton, Ohio: Ohio Psychology Press.

VanTASSEL-BASKA, J. (1994b). Needed research about the gifted and talented. In N. Colangelo, S. G. Assouline, & D. L. Ambroson (Eds.), Talent development, Vol. 2. *Proceedings from the 1993 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp.137-140). Dayton, Ohio: Ohio Psychology Press.

WALLACE, A. (1986). *The prodigy: A biography of William James Sidis, America's greatest child prodigy*. New York: Dutton.

WECHSLER, D. (1939). *The measurement of adult intelligence*. Baltimore: Williams & Wilkins.

WIENER, N. (1953). *Ex-prodigy: My childhood and youth*. Cambridge, MA: M.I.T. Press, Massachusetts Institute of Technology.

WINNER, E. (1996). *Gifted children: Myths and realities*. New York: Basic Books.

WOODCOCK, R. W. (April 1995). Conceptualizations of intelligence and their implications for education. Paper presented at annual meeting of the American Educational Research Association in San Francisco, California.

ZUCKERMAN, H. (1977). *Scientific elite: Nobel laureates in the United States*. New York: Free Press.

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Note

[1] This paper is based on an invited address by me, entitled "Varieties of Giftedness," at the annual meeting of the American Educational Research Association (AERA) in San Francisco in April of 1995. I am indebted to Robert S. Albert, Linda E. Brody, Howard Gardner, Robert A. Gordon, Edward L. McDill, Barbara S. K. Stanley, Joyce VanTassel-Baska, and anonymous reviewers for helpful comments.

[2] Published by the Psychological Corporation, San Antonio, Texas.

[3] For comprehensive factor-analysis treatment of cognitive abilities, see Carroll (1993).