The Manpower Quality Decline

AN ECOLOGICAL PERSPECTIVE

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Foreword

This article was begun as an attempt to resolve the conflicting and controversial reports issued from various sources on a perceived drop in the quality of military manpower in the middle and late 1970s. Review of the massive literature on this controversy led the authors to conclude that, for technical reasons, it would be impossible to resolve the question satisfactorily if the analysis were limited to data based solely on available military quality indices. Because a decline in the quality of military manpower might simply reflect a decline in civilian youth, and because there is increasing concern about such a decline, the authors enlarged the scope of their review to encompass various indices of the quality of civilian youth. If the civilian quality decline were real, the military decline was also real. Further, a civilian quality decline would have important implications for future military accessions.

In studying the purported civilian decline, the authors examined the various hypotheses that have been advanced to account for the drop in Scholastic Aptitute Test (SAT) scores and in other criteria of civilian quality. Most of the literature on the SAT score decline and related problems has been written from the psychoeducational perspective.

AUTHORS' NOTE: *The views expressed are those of the authors and are not to be construed as representing those of the Navy Personnel Research and Development Center, nor of the Department of the Navy.*

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Little attention has been paid to a very substantial body of evidence suggesting that changes in the physical/chemical environment may be causing the quality decline. Since few readers will be familiar with this literature, the authors have presented it (actually, a small sampling of it) in some detail. Finally, the various approaches that might be used to correct or cope with the military quality decline were discussed and recommendations made for research on the approaches regarded as most promising.

The Decline

The Quantity Decline

There is much concern about the size and quality of the manpower pool from which the U.S. military forces must be drawn in the next two decades. The reduced size of the future pool is not a subject of controversy, since the men and women who will be 17 to 21 years old in 1995 have already been born and are now in school or approaching school age. Recent Census Bureau data indicate that the size of the primary military manpower supply pool (males 17-21) will decline significantly through 1993, and the supply of 18-year-old males will remain 20 to 25% below 1975 levels up to 1998.[1] The implications of this shortfall are quite serious. According to various estimates, by the early 1990s the Department of Defense (DoD), which currently enlists about 26% of the qualified members of the available pool of 18-year-old males, will have to enlist almost 33% of qualified males unless present requirements are lowered.[2] Competition from the private sector, already a major problem, will become even fiercer as the pool diminishes.

The options suggested for at least partially offsetting the manpower shortage include recruiting more women, older men, and personnel with broken service, as well as increased civilianization, harder recruiting, reducing demand through technological innovations, improving training, and lowering mental and/or physical standards.[3] Each option entails various disadvantages, ranging from increased costs to reduced flexibility in sea-shore rotation. Some of these options are discussed in greater detail in the section "Managerial or Legislative Interventions."

While the sharp decline in the size of the future pool can hardly be questioned, there has been a good deal of controversy regarding a

similarly sharp decline in the *quality* of recent military accessions and—at least conceivably—the future military manpower pool. Since the United States is experiencing a severe quantitative decline, it can ill afford a qualitative deficit.

Personnel Quality: Dimensions and Definitions

It is often assumed that while people do differ in ability and performance, such differences are relatively small and, for most practical purposes, can be disregarded. This assumption, common and convenient though it may be, is grossly inaccurate.

When industrial supervisors are asked to estimate the production figures for their most and least productive workers, they usually estimate a difference in performance of around 30%. However, when actual production figures are compared, differences in the range of 200 or 300% are usually found for simple jobs (for example, typing, key-punching, sewing) and differences of several thousand percent for more difficult jobs (such as computer programming and equipment repair).[4]

The performance differences among individuals are even more pronounced in competitive situations. For example, it seems safe to assume that all professional baseball and basketball players represent the tip of the distribution of ability in their sport. Each professional athlete may represent the top one-hundredth of one percent, the best one in 10,000 of the general population, in terms of ability. One might expect to find a sharply limited ranged in ability or performance in such a select group. Yet, in any season, batting averages for baseball players may range from well below .200 to .350 or higher, while the average for basketball players may range from 10 to 30 or more points per game, even when position on the team is taken into account. Thus, there are performance differences of several hundred percent even at the tip of the curve of ability.

Obviously, the range in human talent and performance is immense and can be ignored or overlooked only at great risk. In war, occasions may arise when it is necessary for the very best people to perform to their full capacity, if the nation is to avoid defeat. Disaster could result if the people at the very tip of the distribution—the truly superior individuals—fail to enter the service or leave the service prematurely. The obvious recourse of making use of the next best people in the hope that the mission will still be successful may prove disappointing. As

Toomepuu emphasizes, available combat, training test, and field experiment data indicate that the major determinant of the effectiveness of weapons on the battlefield and the dominant factor in the outcome of battles and wars is the performance of soldiers.[5] There is no substitute for quality.

While personnel quality has been discussed widely in recent years, it has been given no official definition.[6] For the purposes of this article, "quality" may be regarded as having three major components:

(1) *intellectual capacity*—the ability to learn rapidly and to solve problems, as measured primarily by aptitude tests;
(2) *academic achievement*—the possession of skills and knowledge ordinarily gained from school attendance, as measured by tests of reading, math, basic science information, and the like; and
(3) *discipline/motivation*—the desire to do well in training and on the job, and to contribute positively to prescribed goals.

The third component listed above is called discipline and motivation for lack of a better term. Schools refer to this aspect of quality as citizenship or deportment. "Character" might also be used. High rates of attrition and misconduct are generally taken to indicate low levels of discipline and motivation.

The Quality Decline—Military

There is much disagreement about the quality of the personnel accepted by the services in the past few years, especially since the advent of the All-Volunteer Force (AVF). Many critics have expressed alarm at what they consider severe deterioration of U.S. military preparedness and cite evidence, both anecdotal and statistical, in support of their criticisms. There is no shortage of studies to cite. An example is the report by Gunderson and Hoiberg, which indicates that the overall effectiveness of Navy recruits, as measured by unfavorable discharges and negative recommendations for reenlistment, dropped markedly during the eight-year period from 1966 to 1975.[7] The general decline in performance began at about the advent of Project 100,000, which involved the admission of large numbers of low mental level (Category IV) personnel into the armed forces.[8]

Low levels of literacy among recent military entrants have particularly attracted a great deal of attention and concern.[9] Recent studies

have tied illiteracy to high discharge rates, difficulties in training, poor job performance, and lack of potential for advancement.[10]

Major General John K. Singlaub, in discussing the lack of educational skills displayed by incoming recruits, claimed that in his talks with commanders and NCOs, he found that many soldiers were nearly illiterate.[11] Training manuals have had to be reduced from the eighth reading grade level (RGL) to the fifth RGL. The Beard Report cites a similar trend, noting that training manuals were revised from the eleventh RGL to the eighth RGL.[12] The Beard Report goes on to claim that 20 to 30% of recruits are unable to read at even the fifth RGL, a figure that tends to support a more drastic view of recruit illiteracy. Results of several additional studies, involving thousands of recruits, seem to confirm the fact that about 30% of recent Army accessions are unable to read beyond the seventh grade level. Anderson cites these studies in contending that "all indications point to the fact that the reading ability of our manpower pool is decreasing."[13]

Although Singlaub, Beard, and Anderson have been concerned primarily with Army recruits, there are also literacy problems among Navy recruits. Mattison, Northrup, and Jenkins found that 20% of recruits entering the U.S. Navy Recruit Training Command, San Diego, read at or below the seventh RGL; and 10%, at or below the fifth RGL.[14] Mattison et al. suggested that the ability to read at the eighth RGL be regarded as an index of minimum competence.

Duffy and Nugent report that 18.1% of a sample of approximately 31,000 recruits entering the Navy in fiscal year 1975 had an RGL below the eighth grade.[15] The average RGL for the sample of Navy recruits was 9.9; 65% had reading skills at or above the tenth-grade level. The figures for 1980 indicate an average RGL of approximately 9.6, with about 20% of recruits reading at or below the eighth-grade level. In a recent speech, Admiral J. D. Watkins, Vice Chief of Naval Operations, noted that the average reading level of incoming recruits was four years below that required to read Navy training manuals.[16] (Kern contends that lowering the RGL of training manuals will not necessarily increase comprehension among poor readers.[17]) Whatever the exact figures are, these reports imply that the quality of incoming recruits is undergoing a severe change for the worse.

Some who have investigated the quality of recent service acquisitions, however, concluded that there has been no deterioration. Cooper, for example, claimed that the quality of recruits entering the service in

recent years had actually improved, as measured by such indicators as mental level and educational attainment.[18] He asserted:

> Quality, broadly defined, has not changed substantially since the removal of the draft. The services have continued to attract approximately the same or somewhat larger numbers of the group they value most highly, Category I-III high school graduates.

Cooper noted that in the three-year period following the end of the draft (1973-1976), the services cut their Category IV accessions by two-thirds while simultaneously increasing Category IIIs from 43 to 58% of the total. Although he also noted the decline in the percentage of Category I recruits entering the service during the same period, Cooper claimed that, in general, the trend indicated an improvement in overall recruit quality.

As Cooper himself acknowledged, however, there are problems with these data. Although the services apparently reduced the intake of Category IVs during the three-year period he studied, they also accepted an increased number of Category I-III non-high school graduates. Category III nongraduates are regarded as being less productive and have a higher attrition rate than Category IV high school graduates.[19] Research from all the services covering several decades indicates that high school graduation is a better predictor of military performance than is mental group level.[20]

Cooper is not alone in his favorable review of recruit quality. A report prepared for the DoD by the Public Sector Research Group reveals a reversal of the downward trend in recruit quality on an index that mainly reflects academic achievement.[21] The index is based on high school grades, high school education programs, mathematics courses taken and passed in high school, and science courses covering electricity and/or electronics taken and successfully passed in high school. Computed on a scale of 1 to 10, the 1978 national quality index of 6.38 compares favorably with the 1976 index of 6.36.

In a recent DoD report on the AVF, the present active duty armed forces were described as superior to those of the past in terms of test scores, educational levels, and percentage of high school graduates.[22]

In view of developments of the past few years, however, the use of measures of high school education as an index of quality no longer can be considered defensible. As of 1979, all but four states were planning to require students to pass minimum competency examinations for high

school graduation. Such requirements were first adopted, by two states, as recently as 1975.[23] It has become clear that the granting of a high school diploma has become a pro forma gesture and no longer indicates that the graduate can read or calculate at the twelfth grade level. Neither the diploma nor good grades can be relied on as implying competence and motivation. A 1978 study of nearly 200,000 entering college students showed a great deal of grade inflation.[24] Professor Alexander Astin of UCLA, quoted by Walsh, remarked: "When these grades are considered in the light of declining scores on college admission tests, it seems clear that these schools' grading standards have been steadily declining since the late 1960s."[25]

According to a recent national study, the RGL of the average high school graduate dropped from 10.9 in 1960 to 9.5 in 1972.[26] New York City is expected to require, in the near future, high school graduates who supposedly can do twelfth-grade work to demonstrate that they can read at the ninth RGL by passing a standardized test. As of June 1980, California seniors must meet local standards in reading, writing, and arithmetic before they can get a diploma.[27]

Fletcher, Duffy, and Curran found, in a sample of 19,000 Navy recruits, that years of education, ranging from the eighth to the sixteenth grade, correlated only .13 with reading ability.[28] Duffy and Nugent reported that although 82% of a sample of 31,000 recruits entering the Recruit Training Command, San Diego in fiscal year 1975 were high school graduates, only 65% had reading skills at or above the tenth-grade level.[29]

High school graduation has been considered an index of attitude and motivation, as well as a reasonable academic measure. Obviously, the average high school graduate must still be considered more competent and more favorably motivated than the nongraduate. High school graduation today, however, means less than it did five or ten years ago. It is therefore not possible to measure changes in quality as a function of percentage of high school graduates.

Like high school graduation, aptitude test scores have repeatedly been found to be valid predictors of military performance and attrition.[30] As in the case of high school graduate status, however, mental category based on aptitude testing in the past few years has been found to be so seriously inflated that comparison of personnel from one time to another can be quite misleading.

The Armed Services Vocational Aptitude Battery (ASVAB), which became fully operational in January 1976 as a replacement for the

various individual service basic test batteries, has been found to be subject to severe errors in norming. Several investigations of this problem by the Center for Naval Analyses and the Army Research Institute have established beyond doubt that the ASVAB was misnormed and that this misnorming led to gross overestimates of personnel quality.[31] New norms, based on large-scale experimental testing of applicants in June and July of 1979, have now been implemented. Under the then current norms, 74.3% of the over 100,000 applicants tested in 1979 had been classified in Mental Categories I, II, or III. Under the corrected norms, however, which tie the scores back to a mobilization population tested in World War II, only 54.9% of the applicants would have fallen into the I, II, or III categories. Thus, since almost 20% of the population classified as Category IIIs or higher were actually Category IVs or Vs, the actual number of IVs and Vs was almost double the original estimate. As compared to World War II personnel, almost half of the Army's recruits in the late 1970s fell below the thirtieth percentile in mental ability.[32] Fiscal year 1980 test scores show further declines. The overall percentage of Category IVs entering the services rose to 33 in 1980 from 30 in 1979, and the percentage of Category IVs in the Army rose to 52.[33]

The overevaluation of high school graduation and mental levels probably accounts for much of the recent controversy regarding the quality decline within the armed services. There are now reports that recruits mistakenly enlisted during the last four years due to test misnorming have performed at a level significantly below that of other recruits.[34] The level of the controversy has escalated during recent months, as reflected by articles deploring a decline in military personnel quality which have appeared in recent issues of such magazines as *Fortune, Time, Newsweek,* and *Science.*[35] The *Science* article noted, among other things, that "a tank repairman's chances of correctly diagnosing a repair problem were between 15 and 33 percent, and chances of fixing the problem, once correctly identified, were between 33 and 58 percent."

Discipline/Motivation

Increasing concern has also been expressed regarding an apparent erosion in the level of individual discipline and motivation. King reported a 35% increase in the rate of nonjudicial punishment in the

armed forces over the Vietnam-era levels.[36] Courtsmartial and other-than-honorable discharges were at near-record rates at various times in the 1970s.

The results of a recent worldwide survey of nonmedical drug and alcohol use among 15,000 military personnel indicate that substance abuse is a widespread problem in the services.[37] For example, 19% of the total E1-E5 population and 26% of Navy recruits reported having been on drugs while working within the preceding 12 months, half the drug users being "high" 40 or more days. Of the total population, 27%, and of Naval respondents, 35% reported work impairment due to alcohol within the preceding 12 months. Seven percent of all military personnel and 10% of E1-E5s were "alcohol dependent"; alcohol dependency was defined as having experienced tremors, morning drinking, impaired control, or blackouts during the preceding 12-month period. The Army recently stepped up its campaign against drug users in response to West German concern about American troops spreading drugs in German communities.[38]

The high attrition rates of the 1970s also caused much concern. In the Navy, the percentage of recruits who left before completing three years service rose from 28 in FY 1971 to 38 in FY 1977. Attrition for the DoD as a whole during the same time period rose from 26 to 35%.[39] A recent GAO report examined the costs associated with rising attrition by analyzing data on personnel who entered th armed forces during fiscal years 1974 through 1977 and were lost to the service before completing their enlistment.[40] It was concluded that these personnel losses cost $5.2 billion. This is $806 million more than the expected costs if attrition rates had remained the same as during the draft era (1971-1973). Although recent data indicate that the attrition rates in the services may have peaked during the seventies, the figures are still unacceptably high.[41]

As Foch and King point out, attrition trends are difficult to interpret because of policy changes regarding discharges from the military.[42] Nevertheless, there is a pervasive concern, very evident in the media, that the morale, motivation, and general demeanor of the military forces raise doubts about their combat readiness.

The Demand for Quality Personnel

Regardless of whether or not there has been a recent decline in quality, there is little doubt that the armed forces of the future will

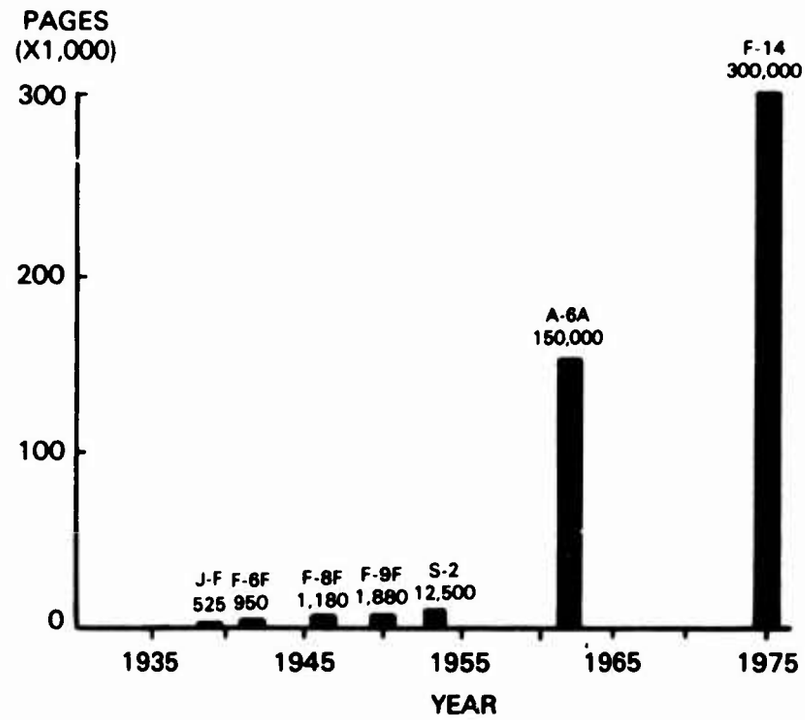


Figure 1: Increase in number of pages in aircraft technical manuals from 1937 to 1978.

SOURCE: W. E. Mueller, *Technological Forcontrol for Total Force Planning*, ONR Technical Report TM-67862, No. 347059 (Washington, DC: George Washington University, December 1979).

require personnel who are at least as sophisticated and trainable as the personnel of today. Weapons systems, vehicles, communications systems, and virtually all other military equipment are becoming more complicated and demanding, and there is reason to believe that the performance gap between high- and low-ability personnel may increase along with this rise in occupational difficulty.[43] The Beard report claims that 7 out of 10 Army jobs require technical training.[44] In the Navy, 75% of the billets require skilled or highly skilled personnel. Cook, Kane, and McQuie estimated that the Navy would require almost twice as large a percentage of highly skilled personnel in 1980 as was required in 1945 (42% versus 23%) and that the role of semiskilled personnel would be sharply curtailed.[45] A striking example of the increasing requirements for high-quality, literate personnel may be seen in Figure 1, which shows a tremendous increase in the number of pages of technical manuals needed for the upkeep of various naval aircraft. The F-6F of World War II required 950 pages; the F-14 of 1975 requires 300,000.

The Beard report observes:

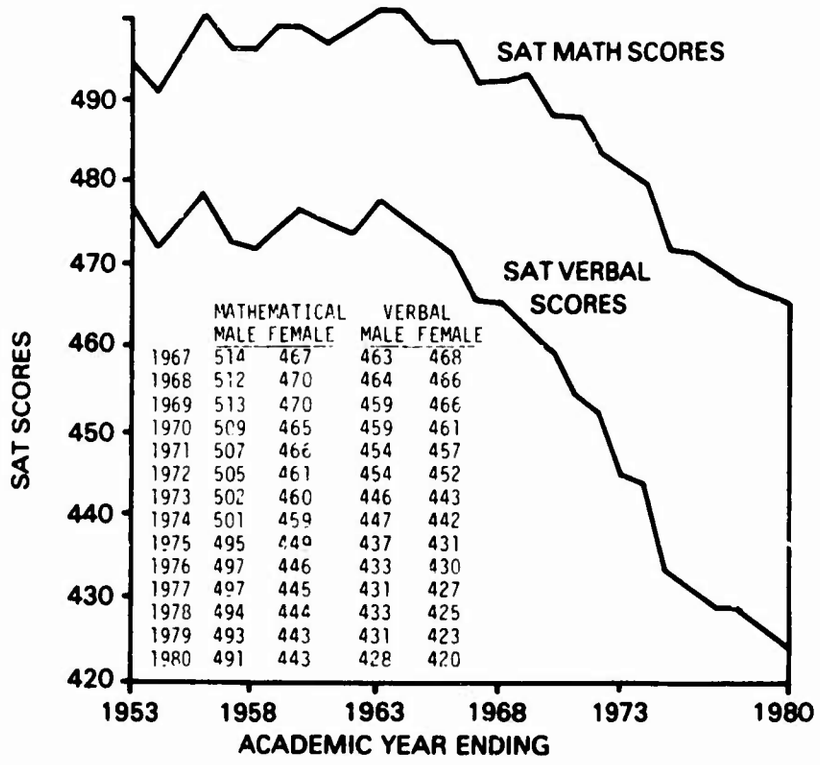
> There is deep concern and anxiety on the part of commanders and NCOs that the gulf between weapons technology and individual potential is growing wider at an alarming rate. There is little confidence in skill qualification tests (SQT) or HSG statistics that indicate high quality trends.

In short, we seem to be reaching a point at which the technological superiority enjoyed by our armed forces in the past may be vitiated by an inability on the part of military personnel to implement new scientific advances. As of early 1980, the Navy was short almost 20,000 personnel for its middle-grade skilled jobs necessary to operate its ships.[46] Ship and aircraft squadrons are down to 85.3% of the skilled personnel required for combat readiness.[47] This leads to concern over the possibility that some of the ships currently in operation may have to be inactivated owing to manpower shortages.[48]

The other services are also experiencing a severe shortage of technical personnel. Before 1978, the Air Force had an excess of pilots. As of FY 1980, however, the Air Force had a shortage of 2500 pilots, 1000 engineers, and 500 navigators.[49] The Marine Corps, which is having difficulty obtaining individuals with critically needed skills (such as engine maintenance and electronics), missed its FY 1979 quota for recruits with technical skills by 6000. Fialka, reporting findings based on a study of the Army Skill Qualification Tests, stated that, of samples of 1574 artilley crewmen, 385 nuclear weapons maintenance specialists, and 371 tank turret and artillery repairmen tested, only 14%, 10%, and 2%, respectively, passed.[50] Bonner reports that the deficits in Skill Qualification Test performance appear to result from a failure to retain the material rather than to deficient training practices.[51] These trends are particularly disturbing since operator skill may be of equal or greater importance than quality of weapons in determining the outcome of battles.[52]

The Quality Decline in Civilian Youth

As noted previously, one cannot be certain that there has been a decline in the quality of military accessions, since changes have occurred over time in the standards for mental test levels, high school graduation,



	MATHEMATICAL		VERBAL	
	MALE	FEMALE	MALE	FEMALE
1967	514	467	463	468
1968	512	470	464	466
1969	513	470	459	466
1970	509	465	459	461
1971	507	466	454	457
1972	505	461	454	452
1973	502	460	446	443
1974	501	459	447	442
1975	495	449	437	431
1976	497	446	433	430
1977	497	445	431	427
1978	494	444	433	425
1979	493	443	431	423
1980	491	443	428	420

Figure 2: SAT scores from 1953 to 1980, showing decline since 1963.
SOURCE: *Scientific, Engineering, Technical Manpower Comments* 17 (1980): 25.

and premature discharge. In the civilian sector, however, from which military forces are obtained, there are many indices of quality, most of which show a long, consistent, and significant decline. Reports of such declines cover a broad spectrum. They describe not only drops in aptitude test scores and school achievement measures, but also increases in juvenile crime and delinquency, and near-epidemic rises in hyperactivity and learning disabilities.

The SAT Score Decline

The most visible, best-documented, and most thoroughly explored decline has been in the mean scores on the Scholastic Aptitude Test (SAT) taken by college-bound high school seniors throughout the United States. For 17 years, both the verbal and mathematical scores on the SAT have plunged downward (Figure 2). Much concern and endless

speculation as to cause have been expressed, but the downward curve has hardly wavered.

In 1963, the average SAT verbal score was 478 and the average mathematics score was 502. By 1980, the verbal score had declined 54 points to 424; and the math score, 36 points to 466. The scores are now lower than ever before in the 51-year history of the test.[53] The number of students scoring over 650 has declined even more drastically than the overall averages.[54] A blue ribbon panel headed by former Secretary of Labor Willard Wirtz was commissioned to conduct a massive investigation of a variety of hypothesized causes for this decrease.[55] The panel concluded that it was probably due to a combination of factors, including excessive television watching by youth and excessively permissive education. No clear-cut answer was found; the decline continues.

Wharton listed 79 hypotheses that had been advanced to explain the SAT score decline.[56] Among the hypotheses initially considered especially plausible were defective test norming and the fact that in recent years college-bound SAT takers included a large percentage of lower aptitude students who had not previously applied to colleges. These hypotheses implied that the declines in scores were merely artifacts and did not indicate a decline in student ability. Neither hypothesis proved tenable. In fact, several analyses found that the test had gotten easier and that the ability decline was actually almost 50% greater than indicated by the test scores.[57]

A great deal of national publicity was accorded the hypothesis that the decline in SAT scores and in other indices of quality might result from changes in the age spacing of children within families.[58] This is an inadequate hypothesis, for, as computations by Grotevant, Scarr-Salapatek, and Weinberg have shown, the age spacing variable accounts for only 1 to 4.5% of the differences among individuals in intelligence.[59] Several recent empirical tests of the Zajonc-Markus hypothesis have failed to support it.[60]

The score decline is not limited to the SAT. The American College Testing (ACT) program, similar to the SAT program, has also reported a consistent score decline since the mid-1960s.[61] Again, no adequate explanation has been found. Similarily, Armbruster and Braken, using data from the California testing program, showed that IQ scores for sixth- and twelfth-grade students declined year by year from 1969 to 1973.[62] Over 250,000 children per grade were tested.

The School Achievement Decline

Coupled with the SAT-ACT decline has been a similar, though not quite so consistent, nationwide decline of scores in such school achievement areas as reading, mathematics, and social and physical sciences. Data on school achievement are available from the National Assessment of Educational Progress (NAEP) and from a number of statewide testing programs. Munday, in reviewing these data, cautiously took an optimistic stance; his "uneasy generalization" is that the sharp declines of the late 1960s have ended, scores have begun to level off, and, at least in the lower grades, scores have even begun to increase.[63] Copperman, who insists that the decline continues, took strong exception to Munday's views.[64] The data appear to support Copperman rather than Munday. The most recent NAEP study, which focused on mathematic skills, showed that between 1973 and 1978, mathematics achievement declined by one percentage point for 9-year-olds, two percentage points for 13-year-olds, and four percentage points for 17-year-olds.[65] The 1979 Report of the College Entrance Examination Board (CEEB) shows that scores obtained on the Test of Standard Written English have dropped each year since the test was introduced in 1975.[66]

Armbruster and Braken, whose book, *Our Children's Crippled Future,* has attracted a great deal of attention, are also less optimistic than Munday.[67] They document widespread declines in academic skills, and place the blame largely on the goals and methods of modern education. A recent study of educational achievement in the United States and the Soviet Union indicates that the level of science and mathematics taught to Russian students is so much higher than the level taught to American students that comparisons between Russian and American students are meaningless.[68]

The low level of reading ability in incoming military personnel, which has already been discussed, may reflect a diminished literacy level in the civilian sector. The efforts or intentions of all but four states to require high school seniors to pass minimum competency tests, also previously discussed, are largely due to public concern about deficiencies in reading. In her survey of minimum competency requirements in reading, Chall found that "the vast majority [of states] are or will be establishing requirements for high school graduation based on competency examinations."[69] The examinations are not likely to be demanding. The two states that had already specified passing levels

established the ninth-grade level as the minimum to be required of twelfth-grade students. The City University of New York has recently instituted minimum competency tests that officials estimate will be failed by one-fourth of its sophomores.[70]

Horror stories about illiteracy abound. A recent news story reported that the percentage of New York City public school students who read below their grade level rose from 57 in 1978 to 60 in 1979.[71] Beaton, Hilton, and Schroeder compared the reading scores of high school seniors in 1972 to those of their counterparts in 1960 and reported a significant downward shift in reading ability.[72] Curran states, "There is no question that literacy skills among young people in our country are declining."[73]

In his book, *The Literacy Hoax,* Paul Copperman, president of the Institute of Reading Development, agrees with Armbruster and Braken in attributing much of the achievement decline to excessive permissiveness in the school.[74] There is little doubt that in recent years there has been a decline in the effective authority of teachers, principals, and, for that matter, parents. Yet, it may be simplistic to assume a unidirectional cause-effect relationship. Frustrated students, unable to meet the academic demands placed upon them, may respond by rejecting all demands.

An alternate explanation suggests that the problem lies in the nature of education. Feldhusen, Hynes, and Ames claim that the problem is one of "instructional validity"—that is, the students are no longer receiving adequate instruction in the areas in which they are being tested.[75] In support of this idea, Harnischfeger and Wiley point to an emerging picture of enrollment declines in academic courses, general courses, and the traditional college preparatory curricula such as algebra, first-year foreign language, chemistry, and physics.[76] Kapfer, Kapfer, and Woodruff concur, apparently feeling that the score declines reflect a less academically specialized individual, one who may actually be better suited for citizenship, although he is less valuable in terms of "economic productivity."[77] These authors feel that broad educational programs which allow diversity to flourish and attempt to educate the "whole man" are a step in the right direction.

Regardless of the merits of this view, the factors causing the drop in test scores are not at all clear. There is evidence that the decline cannot be blamed entirely on the educational system. Math scores have continued to fall despite the rise of "back-to-basics" movements designed to halt the drop in scores. In fact, some researchers are now

blaming this movement for even further declines.[78] As Harnischfeger and Wiley point out, Stanford-Binet IQ test scores of adolescents, 10-year-olds, and preschoolers, after a steady rise since 1932, all showed an average drop of three points between 1972 and 1975.[79] On the Iowa Tests of Basic Skills, however, declines have not become noticeable until the fourth grade.

There are other contradictions in the results of various tests. For example, ACT scores have dropped in English but hold steady in the sciences. On the other hand, NAEP data show a different pattern—a slight increase in literacy from 1971 to 1975 and a decline in science skills from 1969 to 1977 for 17-year-olds.[80] The need for further study of the test score declines is obvious. Exceptions and irregularities notwithstanding, the overall trend appears to represent a real and unexplained decline in ability, a decline that has serious implications—not only for the military, but for our whole society as well.

Teachers as well as students appear to be experiencing a dramatic quality decline. The problem was brought to national attention by a cover story in the June 16, 1980 issue of *Time* titled, "Help! Teacher Can't Teach!" Several states are already requiring teacher competency examinations, similar to the now widely required student competency exams. Early results of such programs are discouraging: the exams required by the school board of Pinellas County, Florida, since 1976 revealed that half of the applicants, all of whom were college graduates, could not read at the tenth-grade level or solve eighth-grade level math problems. As with the student decline, there is no shortage of documentation as to the reality of the teacher decline, nor of speculation as to its cause.[81]

Discipline and Delinquency

Concurrent with public concern over the decline in aptitude test scores and school achievement has been concern with a marked increase in juvenile violence, crime, vandalism, and other antisocial activities. Senator Bayh's nationwide survey found that between 1970 and 1973, school homicides increased by 18.5%; rapes and attempted rapes, by 40.1%; robberies, by 36.7%; assaults on students, by 85.3%; assaults on teachers, by 77.4%; and drug and alcohol offenses, by 37.5%.[82] A survey by the Washington-based National Education Association indicates that 113,000 public school teachers were physically attacked by students

during a recent 12-month period.[83] The security force for the Los Angeles Unified School District was recently increased to 300 full-time agents, 50 night watchmen, and 50 off-duty policemen who work exclusively in night school programs; the cost for security personnel for the 1978-1979 school year alone was $7.3 million.[84] Kratcoski, Kratcoski, and Washburn estimated that losses to the public schools from vandalism had risen from $200 million in 1971 to $600 million in 1977.[85] According to Neill, juvenile arrests increased by 138% between 1960 and 1974, while adult arrests increased by 16%.[86] Increased drug use among the young has also caused concern.[87]

Viewed in the context of these statistics, the rise in disciplinary problems in the 1970s reported by all the military services must be considered as reflecting a real increase, and not merely as an artifact produced by changes in military regulations or in reporting procedures.

A year-by-year analysis of the crime rates since 1963 shows them to parallel strikingly the yearly SAT score decline for the same period. This dramatic increase in lawlessness appears to be but one of many manifestations of the pervasive rejection of the demands and expectations of authority. Halter observed that the very high rate of absenteeism in the nation's high schools coincided with similar increases in absenteeism in naval recruits.[88]

The negative attitudes of youth seem to represent a rejection, or perhaps a lack of awareness, of all values—indeed, even the value of life itself. It is not only assaults against others that have gone up; the annual suicide rate for white youths aged 15 to 19 increased by 171% between 1950 and 1975. Suicide is now the fourth-ranking cause of death among youth—after accidents, cancer, and homicide. The sharp rise in suicide rates is limited to the young. Since 1968, the suicide rate among those over 25 years of age has increased by less than 2%.[89]

Summary

The information and opinions presented in this section represent the distillation of an enormous body of often conflicting evidence and arguments. Two main points emerge from our analysis:

First, there have been many complaints from field commanders, training personnel, and others in similar positions that the quality of military entrants has declined markedly in recent years. Judging from an extensive review of the available documents, this view is probably

justified. It is difficult, however, because of changed standards in test norms, high school graduation requirements, and military discipline standards, to quantify and thus provide conclusive evidence for or against such a decline.

Second, there have been many reports of an analogous decline in the quality of premilitary-age American youth, as manifested by lower scores on intelligence and achievement tests and by rising rates of youth crime and delinquency. The evidence for the civilian youth quality decline is better documented, much less often contested, and less subject to distortion by changing standards than the military quality decline. Since military accessions are drawn from a civilian population that appears to be deteriorating in quality, it seems highly probable that the decline in the present and future military populations is real and potentially serious.

The Decline in Human Quality: An Ecological Hypothesis

In this section we propose to dispel any remaining doubt about the reality of the quality decline by demonstrating that it is an expectable and perhaps inevitable consequence of an accumulation of ecological changes that have occurred throughout the United States in the past several decades.

As noted earlier, most of the extensive literature on the decline of the SAT scores, the decline of literacy, and the rise in juvenile crime and suicide has been written from a sociological or psychoeducational perspective. Too much passive watching of television by school children; lax, permissive instruction by their teachers; excessive preoccupation with television viewing or with their second jobs on the part of parents—these are the usual kinds of explanations that have been offered for the quality decline.

They are insufficient, for several reasons. First, although these factors may be related to the decline, they could just as easily be used to explain an *improvement* in quality, if such an improvement were to be found.

One could, for example, argue that television, by presenting an enormous range of otherwise unavailable information and experience to youngsters, should stimulate and enhance their learning and perfor-

mance. One could also argue that progressive, child-centered teaching, as opposed to rote methods, should also stimulate the children's interest and motivation. (That was, in fact, the reason for introducing such methods.)

Second, one could argue plausibly that an increase in television viewing and a decline in school performance may be the effects rather than the causes of the quality decline. That is, if, for some unknown reason, youngsters were becoming progressively duller, one would expect to find increased television viewing and less reading, poor school performance, and more frustrated, antisocial behavior at home and at school as the result of the reduced ability levels in the children.

Unlike the sociological, psychological, and educational factors that may have influenced the quality decline and that could be used to explain either a decline or an increase in quality, the ecological factors we shall now discuss can reasonably be expected to have only one effect on human quality—a downward effect.[90] These factors can influence the human brain prenatally as well as during childhood and adolescence. In some cases, the ecological effects appear to be irreversible, whereas in other cases it is still possible—or at least theoretically possible—to reverse their effects. Let us consider some of these factors.

Pre- and Postnatal Medical Interventions

One ecological factor of special interest is the use of the detergent hexachlorophene on infants, starting immediately after birth. Hexachlorophene was widely used from about 1955 to 1965. Winthrop Laboratories, manufacturer of Phisohex, recommended in the 1964 *Physician's Desk Reference:* "Infants should be bathed daily or every other day with Phisohex to prevent staphylococcal skin infections, diaper rash, and cradle cap. . . . An effective shampoo. Also for washing or irrigating genital membranes."[91] The textbook *Principles and Management of Human Reproduction* stated: "It is now the practice to scrub the mother's breast area three or four times daily with a detergent containing hexachlorophene. It is customary to have the infant nurse 7-10 minutes at each breast."[92]

Contrast the above recommendations with the following 1977 quote from Winthrop Laboratories:

> It should not be used . . . on any mucuous membranes. . . . Infants . . . are particularly susceptible to hexachlorophene absorption. Infants have

> developed dermatitis, irritability, generalized clonic muscular contractions, and decerebrate (as though they had no cerebral cortex) rigidity following application of 6 percent hexachlorophene powder. Examination of brain stems of those infants revealed vacuolization like that which can be produced in newborn experimental animals following repeated topical (skin) application of 3 percent hexachlorophene. Moreover, a study of histologic sections of premature infants who died of unrelated causes has shown a positive correlation between hexachlorophene baths and lesions in white matter of brains. . . . Phisohex should not be used routinely for bathing infants.

The 1976 edition of the *Review of Medical Pharmacology* says:

> Repeated bathing of newborns may permit sufficient absorption of hexachlorophene to result in toxic effects to the nervous system; especially a spongiform degeneration of the white matter in the brain.

The preceding quotations were taken from Clark's review of the literature regarding the effects of prenatal exposure to various drugs and chemicals.[93] Clark's primary concern was the possibility of an ecologically caused increase in the number of homosexuals, a problem we have not addressed. In addition to hexachlorophene, Clark's review mentions a number of other related ecological problems that can be expected to have an adverse effect on the child's intellectual and social development, as well as on the child's later sexual orientation. He mentions the effects of the birth control pill on the mother's hormone system, tests for pregnancy using synthetic hormones, the use of phenobarbital and other sedatives, as well as the widespread use of synthetic progesterone, testosterone, and estrogen. A single exposure to such substances can trigger a permanent change in the child's brain and endocrine system.[94] From the late 1940s to the early 1970s, as many as three million pregnant women received prescriptions for synthetic estrogens.[95]

Clark also points to the widespread use of barbiturates in America, observing that these drugs are involved in nearly 5000 deaths each year. He states that Americans get about one billion doses of barbiturates annually, and quotes several experts on the adverse effects such drugs may have on the brain and nervous system of the developing fetus.

The possibility that ecological factors may have been at least partly responsible for the dramatic decline in SAT scores has not been ignored, but neither has it been given much attention. The *Report of the Advisory Panel on the Scholastic Aptitude Test Score Decline* included

27 appendices, only one of which was devoted to the possibility of a "medical basis" for the declining SAT scores.[96] Arnold, the author of this appendix, believed that it was unlikely that medical problems were an important causal factor. He was properly cautious in stating his position, however: "When we conclude that no ecological factor could account for the SAT score decline, there is a certain sense of viewing the problem through a glass darkly."

Although Arnold considered a number of conditions affecting pregnancy and infancy, he dismissed them rather lightly. He mentions the practice of restricting weight gain during pregnancy as "prevalent during 1950-1970 and this may have contributed to problems." In contrast, the Society for the Protection of the Unborn Through Nutrition (SPUN), a Chicago-based public interest group, contends that the weight gain restrictions placed on pregnant women by their obstetricians are a serious medical problem, and offers much documentation of the adverse effects of this practice.[97] SPUN also claims that the widespread use of diuretics and sodium-restricted diets in pregnancy is injurious to the fetal brain.

Arnold also mentions in passing that nearly nine percent of deliveries were electively induced.[98] Recent research shows that inducing delivery severely reduces the oxygen supply to the infant's brain and may produce permanent impairment.[99] An editorial in *Lancet* stated: "Induction on the grounds of social convenience is a pernicious practice which has no place in modern obstetric care. The mother's holiday, the calls of the obstetrician's private practice, must not influence, for the sake of even a few days, an event which for the child may affect the outcome of its entire life."[100] One witness testified as follows before the Obstetric and Gynecological Advisory Committee of the FDA regarding induced labor:

> "Hyperactivity" and "learning disabilities" have become household words and we're told that millions suffer from these conditions, in addition to millions with other forms of central nervous system damage. The remediation of learning disabilities has become a growth industry. I'm convinced that the practice of elective inductions and chemical stimulation of labor have made their own terrible contribution to that growth.[101]

Support for this claim was provided by Broman and Brackbill, who investigated the long-term effects on infants of several drugs commonly used during pregnancy.[102] They found that exposure to oxytocin, used

to induce labor, was associated with lower achievement test scores in later life. According to evidence cited by Norwood, induced infants are twice as likely to be delivered by forceps, have four times the chance of spending time in a special care unit, and have twice the number of breathing and sucking problems.[103]

In late 1978, the FDA ordered that drugs used for inducing labor be labeled to show that they were to be used only in cases of medical necessity, and not as a convenience. However, many physicians and mothers are still not content to allow a baby to arrive on its own schedule. Caesarean deliveries have quadrupled in the last 15 years. Infants delivered by caesarean are more likely to be impaired—even if the caesarean was not required.[104]

The important point here is that nearly the entire population of individuals born in the United States during the past several decades has been exposed to a series of biological insults during the most sensitive period of life. In fact, Broman and Brackbill found that so few children had been born in nonmedicated deliveries that they were unable to find a sufficient number for proper comparison with children born of medicated births. As a consequence, it appears that the adverse effects of such measures have been seriously underestimated.[105]

Further, there is mounting evidence that women who take synthetic estrogen birth control pills may have children with impaired IQs when they do give birth.[106] Jofen, cited by Seaman and Seaman, states flatly: "Among women who have taken the pill, we will find a larger number of low IQ children than among women who have not taken the pill."[107]

Nuclear Fallout

Sternglass and Bell have put forth a hypothesis that was not considered in the earlier studies on the SAT decline.[108] In their paper entitled "Fallout and the Decline of Scholastic Aptitude Scores," Sternglass and Bell provide very convincing and disquieting evidence linking the SAT score decline to the cumulative effects of nuclear fallout. They refer to research showing that the embryo and fetus are some 10 to 100 times more sensitive to radiation than are middle-aged adults. Their careful year-by-year analysis of the relationship between SAT score declines and various events in nuclear testing provides a convincing case, which can best be appreciated by reading their article.

The Sternglass and Bell hypothesis gains further credence from the fact that the states that received the greatest fallout were, by and large,

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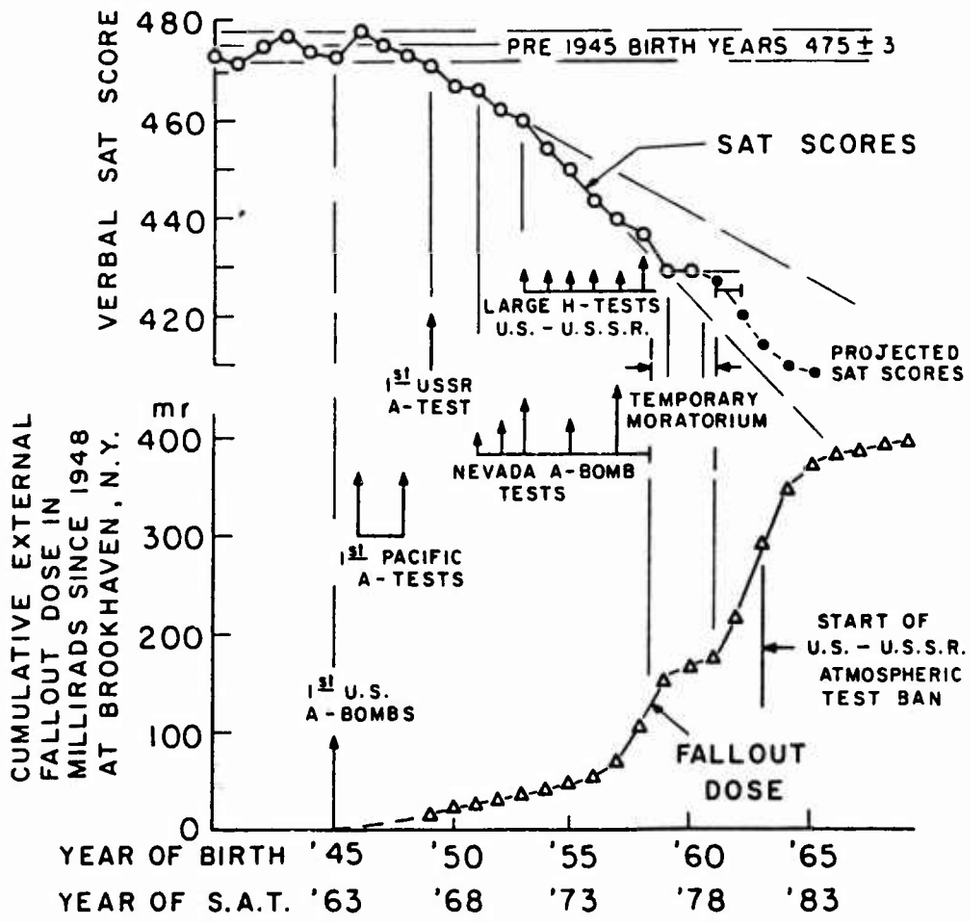

Trend of mean verbal SAT scores in the United States by year of aptitude test compared with the cumulative external gamma radiation dose from fallout as measured in New York state 18 years earlier when the test-takers were born.

Source: Sternglass, E. J., & Bell, S. Fallout and the decline of scholastic aptitude scores. Paper presented at the 1979 Annual Meeting of the American Psychological Association, New York, September 1979.

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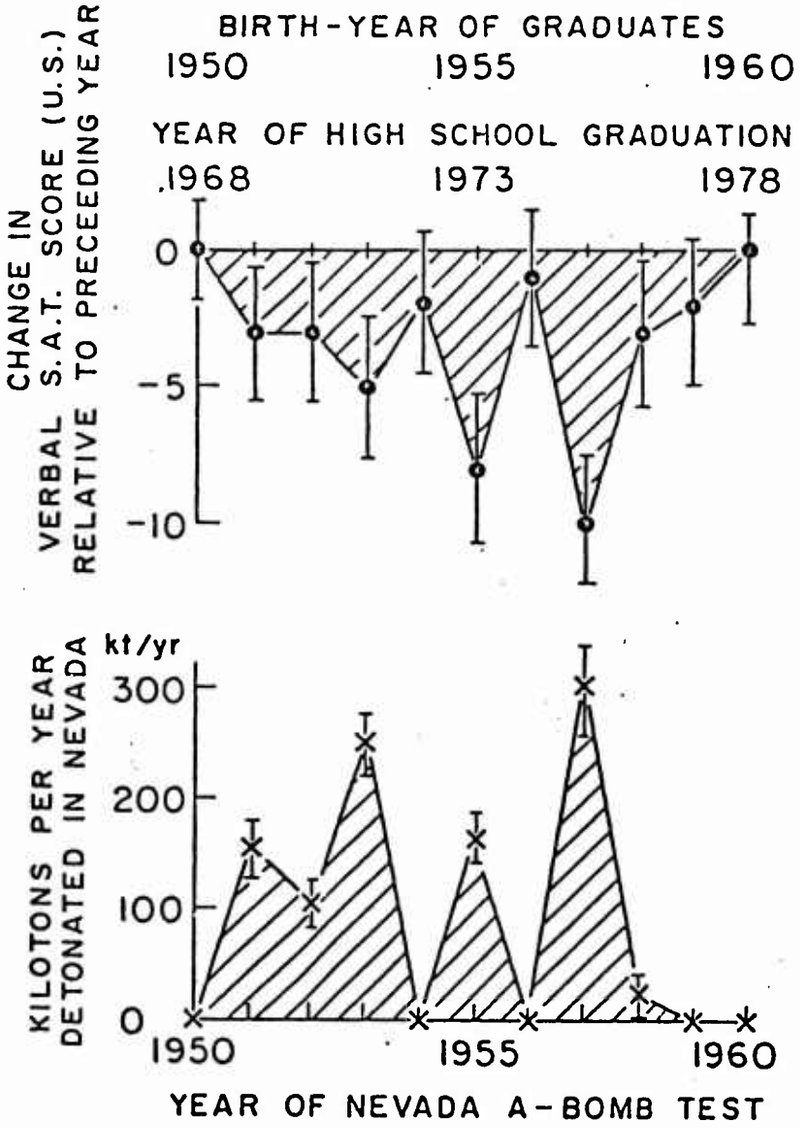

Annual declines in the mean verbal SAT scores by year of high school graduation compared with the annual kilotons of small atomic bombs detonated in Nevada 18 years earlier.

Source: Sternglass, E. J., and Bell, S. Fallout and the decline of scholastic aptitude scores. Paper presented at the 1979 Annual Meeting of the American Psychological Association, New York, September 1979.

those showing the greatest score decline. The sharpest score decline occurred in the far West, closest to the Nevada, Pacific, and Siberian test sites. Sternglass and Bell noted that, while SAT scores in the Midwest declined only eight SAT points for those born during the period 1956-1958 (bracketing the year of most intensive Nevada testing), "the western region from Alaska and Hawaii to Wyoming and Colorado declined 19 points, consistent with the hypothesis that the proximity to the test-sites or high rainfall downward from the point of detonation should lead to the largest decline, while the locations of low rainfall should show small declines." The state showing the largest drop in scores for children born during this two-year period was Utah, a fact that is consistent with Utah's proximity to the test site and the general northeastward motion of most of the fallout clouds produced by the Nevada tests. In Utah the score decline was 26 points; in Ohio, only 2 points.

Maternal Smoking

Smoking among women is another form of ecological pollution that has grown enormously in the years since World War II and that appears likely to have an adverse effect on the intellectual competence of children.[109] According to a 1979 report from the U.S. Surgeon General, more women than men aged 17 to 24 now smoke. Cigarette smoking among women became common during World War II, about 25-30 years after it became common among men.[110] In 1950, deaths among women from lung cancer occurred at the rate of 4.0 per 100,000. By 1970, the figure was 9.5 per 100,000; by 1977, it had risen over 300% to 14.9 per 100,000. By 1983, the projected number is about 23 deaths per 100,000, thus equaling the number of deaths due to breast cancer. The Surgeon General's report also noted that babies born to women who smoke during pregnancy were, on the average, six ounces lighter than babies born to comparable nonsmokers, and the more the women smoked, the greater the reduction in birth weight. Women who smoke double their risk of having a low birth-weight baby.[111] Small birth size and prematurity are known concomitants of impaired intellectual level. Another recent study indicates that the negative effect of smoking continues even if women quit before pregnancy. Naeye, in his study of 50,000 pregnancies, reported abnormally large areas of dead tissue in the placenta of both smoking mothers and women who had been smokers in the past.[112] Such damage to the placenta interferes with the

nutrition of the fetus. In his comparison of 2,476 hyperactive children with 12,511 normal children, Nichols found maternal smoking during pregnancy to be the most important of the 42 factors he studied.[113]

Infant Feeding

The changes that have taken place in infant feeding practices during the past several decades may also have contributed to the quality decline. Prior to 1951, 32% of U.S. mothers breast-fed their infants for three months or longer. By 1961, the percentage had dropped to 12; and by 1971, to 7.[114] A number of recent studies comparing the effects on teenagers of having been breast- or bottle-fed have reported that bottle feeding has resulted in a variety of deficits in such measures as IQ, school achievement, and social adaptability.[115] Apart from the numerous advantages of mother's milk over infant formulas in bringing about good mental and physical development of the infant, formula-fed infants run the risk of potentially disastrous errors in the manufacture of the formula.

Lead and Other Toxic Metals

Of all the ecological pollutants that adversely affect intelligence and behavior, lead is perhaps the most widely recognized. There are literally thousands of books and articles in the scientific literature on the adverse effects of lead. It has long been recognized that high blood lead levels in children lead to hyperactivity, aggressiveness, and mental retardation. Only recently, however, has it been recognized that much lower levels of lead in the body may also have adverse cognitive and behavioral effects. Clinical lead toxicity is usually thought of as being found only in persons with unusual exposure to high levels of lead, such as smelter workers or children who eat flakes of heavily leaded paint from inner city slum dwellings. There are, however, many other sources of environmental lead, including some that are almost impossible to avoid, such as lead from soldered tin cans or automobile exhaust. Automobile exhaust lead is especially dangerous, because the particle size is very small and the route of intake—lung tissue—is highly sensitive to even small amounts of lead.[116] Psychological impairment due to lead appears to be much more prevalent than has heretofore been thought. The lead burden of the human body is increasing at a rapid rate due to industrialization.

Ericson, Shirahata, and Patterson found that the bones of ancient Peruvian Indians contained less than 1/500th as much lead as is contained in the bones of persons who have died recently.[117]

One method of determining the levels of lead and other metals in the body is through hair mineral analysis, a sensitive laboratory process in which a small sample of hair is tested. In a study of subclinical lead toxicity, Moore and Fleischman determined that degradation in hand/eye coordination on a pursuit rotor task could clearly be seen at a mere 10 parts per million of lead in the hair. These authors noted that this was "probably less than the average lead burden in the U.S., and implies far more widespread toxicity than had been previously supposed."[118]

In their study of subclinical lead level as related to cognitive and sensory motor impairment in Black preschoolers, Perino and Ernhart reported that the lead levels found in their sample of 80 Black preschool children were "below the criteria set for lead poisoning, but . . . the relationship was significant, and as lead level increased, general cognitive, verbal, and perceptual abilities decreased."[119] Of special interest is the repeated finding that delinquent and disruptive behavior is associated with high lead levels. Needleman, Gunnoe, Leviton, Reed, Peresie, Maher, and Barrett conducted a study in which both psychological test performance and classroom behavior were evaluated in children with elevated lead levels. They reported that the performance of high-lead-level children was significantly worse than that of the low-lead-level children on all of the following factors on a teachers' behavioral rating scale: distractability (inattentiveness), lack of persistence, dependability, hyperactivity, impulsiveness, frustration level, daydreaming, inability to follow simple instructions, and overall functioning.[120]

In their widely cited paper, "Lead, Behavior, and Criminality," Bryce-Smith and Waldron observed that the world consumption of lead was about four million tons per year and that it had increased in the previous decade by about 3½% per year.[121] A recent paper by Settle and Patterson showed that canned tuna contains levels of lead that exceed the level in fresh tuna by a factor of 10,000.[122] They used sophisticated laboratory techniques to show that previous estimates of lead levels in foods were too low by a factor of 1000 (that is 100,000%), due to widespread lead contamination in the laboratories in which lead levels had been previously measured. Settle and Patterson warn that lead poisoning is a serious and grossly underestimated threat. Japan has

refused shiploads of canned milk from the United States, widely used in infant formulas, because of excessive lead levels.

Although lead is the metal that has received the most attention, other metals can also be neurotoxic and are being increasingly implicated as causes of physical and behavioral disorders. It has been reported that mercury, cadmium, copper, and, to some extent, aluminum have provoked "mental" problems. The increased use of copper plumbing throughout the United States since World War II is of special interest, since it has been found that excess copper causes a variety of problems, including depression, irritability, and hyperactivity. It has also been reported that copper acts synergistically with artificial food additives, so that individuals with high copper levels may become hyperactive at even low levels of these additives.[123] Pfeiffer reported his experience with metal toxicity aboard a Navy ship in World War II. The source was cadmium plating in an ice cream machine.[124]

Pihl and Parkes, analyzing hair samples from 31 learning-disabled and 22 normal students, reported that they could classify the two groups with 98% accuracy by using only the hair mineral content to predict learning disability.[125] Cadmium was the mineral most closely associated with learning disability. Pihl has subsequently reported that violent criminals have higher levels of both lead and cadmium than do their nonviolent counterparts.[126] Large amounts of cadmium have been found in sewage sludge, thus casting doubt on the widespread practice of using such sludge for fertilizer.[127] Gordus, Maher, and Bird reported a number of significant relationships between hair mineral levels and grades at the Naval Academy.[128] Additional studies of the relationship between mineral levels, as measured by hair analysis, and mental functioning have appeared recently.[129]

Food Additives, Sugar, "Junk Food"

Food additives are another ecological factor that has gained a great deal of attention in recent years as a possible cause of hyperactivity and learning disabilities. Artificial food color usage has increased tenfold since 1940. The additive-hyperactivity relationship was first reported by Feingold in 1973, and has since been the subject of a great deal of investigation and controversy.[130] Some investigators have reported studies confirming Feingold's work, while others reported little, if any, behavioral disruptions in children given artificial food colorings and

flavors. As of early 1981, the controversy seemed to be resolving strongly in Feingold's favor. The experimental studies that reported little effect had used only about 27 mg of artificial additives per day (the average daily intake of additives in the United States) to test for additive effects. However, Swanson and Kinsbourne perceived that the earlier experimenters had asked the wrong question: "Does taking the amount of additives ingested by the *average child* cause hyperactivity?" Instead, Swanson and Kinsbourne asked: "Does taking the amount of additives typically ingested by the *hyperactive child* cause hyperactivity?" They determined that many hyperactive children typically ate 100 to 150 mg per day of additives, not a mere 27 mg. On 100 or 150 mg, very noticable effects were seen.[131] Studies on both children and laboratory animals have confirmed adverse effects of additives on learning as well as on activity level.[132] In a study by Goldenring et al., Yale University researchers found a 168% increase in activity nd a 128% increase in maze learning errors in rat pups given food colorings, as compared to controls.[133]

Many specialists in the nutrition-behavior area regard sugar as the arch villain in producing an increase in juvenile crime and disruption and in causing degradation of learning skills. Sugar consumption has risen rapidly during recent years, the current per capita consumption being about 130 pounds per year, which averages about six ounces per day. As with other additives, however, some individuals consume many times that amount. Schauss, in his study of the dietary habits of delinquents, found some who ingested sugar at the rate of 400 pounds per year.[134]

Although a vast amount of literature exists on the adverse psychological effects of excessive sugar,[135] most of the evidence is anecdotal or circumstantial. Few controlled studies have been done, because, among other reasons, it is hard to control diets (especially of those who crave sweets), and foods that contain sugar also contain fats and additives. Kershner and Hawke conducted a study in which the dietary intake of hyperactive and learning disabled students was carefully controlled.[136] They obtained parent ratings on 13 factors, such as hyperactivity, aggression, and attention span, for 20 students before and after a 6.5-month trial of a high-protein, low-carbohydrate, sugar-free diet. The children improved significantly on all 13 factors rated.[137]

Lonsdale and Shamberger have shown that the diet of many American teenagers, which includes a high percentage of vitamin- and mineral-deficient, sugar-laden "junk foods," can, in some cases, lead to

symptoms of beriberi (thiamine deficiency). Among the symptoms they noted in their subjects were personality changes such as increased irritability and aggressiveness:

> Access to easily assimilable sweet beverages could represent a modern danger which is insufficiently emphasized in American society and may well be responsible for personality traits and symptomatology that are regularly overlooked and considered to be "the personality of a growing child or adolescent."[138]

Liggio studied a group of children in Italy whose diets completely lacked animal protein, consisting, instead, primarily of bread, potatoes, and pasta. As a result, the children were restless, impulsive, inattentive, and had poor memories. In cases where the child was provided with the recommended 100 grams of meat daily, his behavior improved considerably.[139] Langseth and Dowd have also reported amelioration of disturbed behavior in children upon dietary improvement.[140]

Another interesting report of the effect of improved diet upon behavior, this one involving naval personnel confined in the Naval Correctional Center in Seattle, was provided by Baker and discussed by Schauss[141]:

> On 1 November 1978, white flour was removed from the confinees' diet and was replaced with whole wheat bread. On 3 February 1979, granulated sugar was removed from the confinees' diet. This consisted of removal of all pastries, cakes, ice cream, soft drinks, and Kool-Aid from the confinees' diet. (The confinees are allowed a teaspoon of sugar in their coffee (or tea) and drink milk or water.) Since this time, the medical log shows that a definite decrease in the number of confinees at sick call and on medication has occurred and that disciplinary reports from the period this year are down 12 percent from the same time-frame of last year.

In several conversations between the present authors and Captain R. C. Miller and CWO Gene M. Baker of the Naval Correctional Facility, it was learned that the behavioral improvements reported have been maintained and that the attitude of tension, frustration, and anxiety that ordinarily pervades correctional facilities is greatly reduced at the Seattle facility. Visitors to the facility often comment on the positive demeanor of the confinees. The corrective diet found useful at the Seattle facility is essentially that developed by two officials in the civilian criminal justice system who, after a number of years of futile attempts to

cope with criminal activity through such demonstrably ineffective methods as counseling, became interested in the relationship between nutrition and crime. Barbara Reed, Chief Probation Officer of Cuyahoga Falls, Ohio, and Alexander Schauss, a criminologist formerly with the Washington State Criminal Justice System, have reported levels of success in using their dietary management methods on criminal offenders that far exceed the level achieved by traditional approaches.[142]

The link between sugar intake and behavior disorders has been questioned by many authors, partly because a direct relationship between blood sugar levels and behavior has not been clearly demonstrated.[143] A better understanding of this problem is beginning to emerge. Hudspeth, for example, recently found that high insulin levels, rather than fluctuations in blood sugar levels, bear a relationship to EEG abnormalities, neurological symptoms, and agitation.[144]

Time and space limitations preclude a thorough discussion of this topic. Our main point here is that there is a mounting body of evidence indicating that poor nutrition contributes significantly to the quality decline. It should be noted that both sugar and white flour contain very little nourishment other than calories. The process of refining wheat to make white flour from the whole wheat removes 87% of the fiber, 98% of vitamin B_6, 84% of the magnesium, and 81% of the manganese. The brain, which *must* have these nutrients in order to function properly, evolved over a period of hundreds of thousands of years, during which vitamins and minerals were not removed from foods through a "refining" process. It is thus not surprising that some individuals who consume highly refined foods such as white sugar and white flour, to the exclusion of needed nutrients, may suffer problems in learning and behavior. Variations as great as 2000% among normal people in vitamin requirements are not unusual.[145]

In his analysis of the possibility that medical (meaning biological) factors might be at the root of the SAT score decline, Arnold pointed out that one reason for believing that such factors were not important was the finding that the scores declined gradually, over a period of 16 years.[146] Arnold argued that any unknown medical factor would be more likely to produce a rather sudden, marked, discontinuous drop in scores, rather than the gradual year-by-year decline that has been observed. This is not a compelling argument. As Vayda points out in his article on the causes of hyperactivity, "Although a single chemical may not provoke a reaction, . . . the combination of the myriads of compounds that find their way into our food and water supplies may

produce a combined effect."[147] There are, in fact, many kinds of interactions that would be expected to cause a series of minor physiological insults to multiply their effects upon the individual. For example, a nutritional deficit, brought about by the excessive consumption of sugar and white flour as opposed to more nutritious substances, might be expected to weaken the body over an extended period of time so as to make it more vulnerable to other kinds of injuries, such as those brought on by smoking or exposure to radiation or toxic substances such as lead or pesticides.[148] The striking, almost mirror-image correlation, starting about 1963, between the curves showing the decline in SAT scores and the upsurge in violent crime strongly suggests the existence of one or more common causal factors.

In the foregoing paragraphs, we have enumerated a number of ecological factors that have increased individually and collectively in the past several decades and that have demonstrable adverse effects upon human learning and behavior. Our examples were merely illustrative; our list of factors is by no means exhaustive. Space limitations preclude discussion of the effects of microwave and fluorescent light radiation,[149] sugar substitutes,[150] and many other marvels of modern technology. There are literally dozens of books, none of which have reached best-sellerdom, on this topic,[151] as well as many journal articles[152] that the reader may wish to consult for further information.

What of the future? In the case of some of the ecological factors we have mentioned, there has been an increase in public awareness of the danger, and some attempts have been made to correct the problems. Decreased use of lead in gasoline and paint, curtailment of the use of drugs during pregnancy and delivery, and legislation aimed at getting "junk food" out of the schools and residential institutions represent attempts to correct the problem. There are, however, other areas in which little or no progress is being made. For example, The Environmental Protection Agency recently estimated that 90% of the 57 million tons of toxic wastes produced annually in the United States is disposed of by environmentally unsound methods.[153]

Minor Physical Anomalies

Although it is widely known that many of the adverse ecological factors we have mentioned may cause cancer and birth defects, it is not widely known that they also contribute to the problems of learning and

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"The striking, almost mirror-image correlation, starting about 1963, between the curves showing the decline in SAT scores and the upsurge in violent crime strongly suggests the existence of one or more common causal factors."

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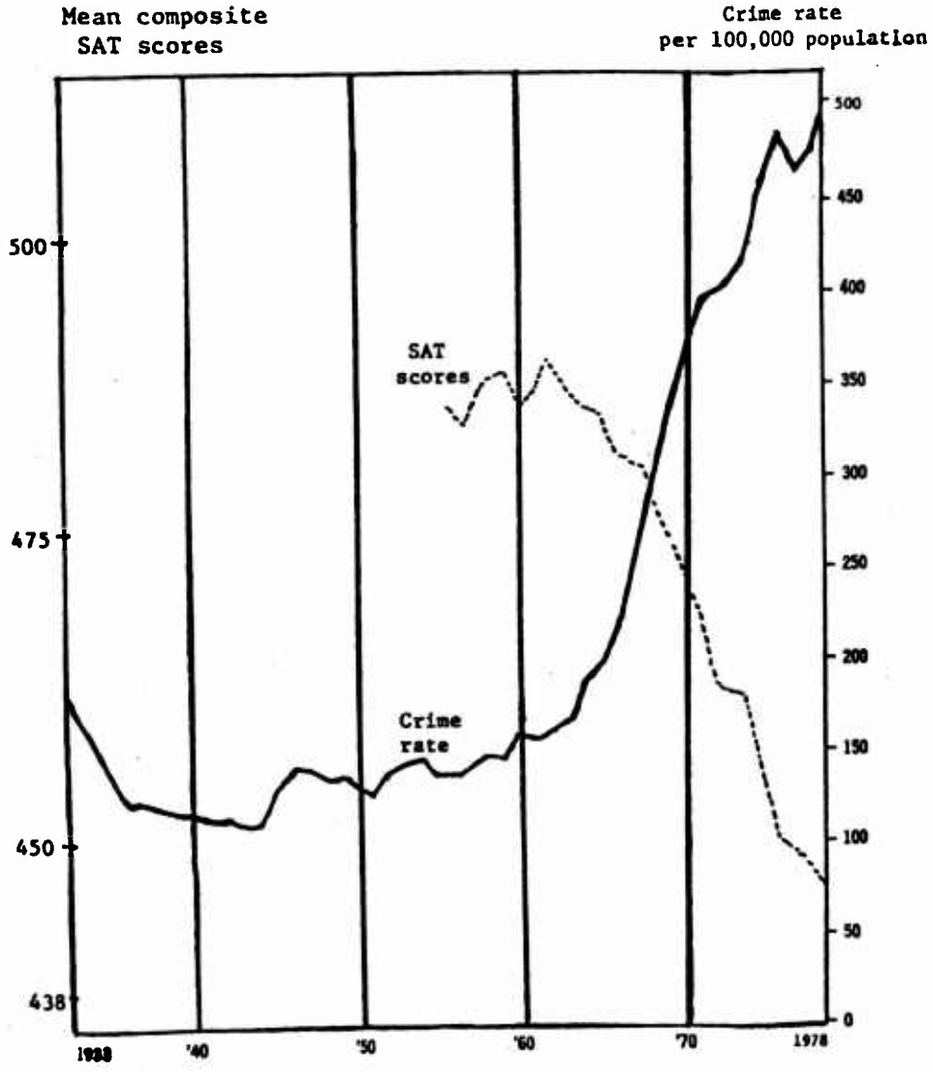


Declining SAT scores vs. rising rate of violent crime.

behavior with which we have been concerned.[154] Many studies have, in fact, closely linked the occurrence of minor congenital physical birth defects, often referred to as minor physical anomalies or MPAs, with various learning and behavior disorders, such as delinquency, distractability, and hyperactivity.[155] The number of such MPAs appears to be an index of the number, severity, and timing of adverse exposures during the child's prenatal life.

In a study by O'Donnell, O'Neill, and Staley, a group of 117 normal preschool children served as subjects. Each was rated on a checklist of MPAs, which includes such rarely noticed deviations from the norm as one ear being slightly higher than the other, unusual patterns in the creases in the palms of the hand, the index finger being longer than the ring finger, and others. The study showed that the number of MPAs was highly related to the degree of distractability of the 62 boys in the study.[156] The O'Donnell study, which is one of many with similar findings, adds further support to our contention that the learning and behavior problems we are observing in youth are more likely to be a consequence of events in the biological environment than in the psychosocial environment. Although one might try to attribute the youngsters' distractability to excessive permissiveness at home or in the school, it is hard to explain away the correlation with MPAs in that manner. Von Hilsheimer and Kurko concluded their study of MPAs in over 1000 children by saying: "It seems unarguable that learning disabilities are rooted in profound biochemical processes and are not mere social phenomena. The attention of our profession must be directed to the biological roots of learning disabilities."[157]

To summarize this section of our report: The quality decline is—in our opinion—real, serious, and, unless vigorous corrective actions are undertaken, likely to get worse.

Further, the *quantity* decline may turn out to be even more serious than expected. The manpower quantity decline, like the quality decline, may be partly a consequence of the inadvertent poisoning of the population through various forms of pollution. Norwood has provided an interesting, if disturbing, discussion of the problem, starting with the discovery some years ago that none of the males working in a northern California pesticide factory had fathered any children since starting work there.[158] The pesticide produced in the factory, DBCP, contains dioxin, an incredibly dangerous substance shown to produce tumors in mice in concentrations as low as five parts per trillion. (Dioxin also appears in hexachlorophene, mentioned earlier.) To visualize one part

per trillion, consider the volume of a small-to-medium ice cube as compared to the volume of 15-1/2 Pentagons!

Studies in the United States, Europe, and Japan have shown a decline in sperm density over the past 30 years,[159] and pesticides have been implicated in the decline. DBCP, however, is but one of many widespread chemicals found to be spermicidal and/or teratrogenic. A recent study of sperm density found 23% of American men to be functionally sterile, as compared to 0.5% in a similar study in 1938.[160] Diethylstilbestrol (DES), one of the many drugs that have been found to reduce fertility in women and produce defects in children born to users or former users, has been implicated, along with insecticides and other pollutants, as a cause of male impotency. Airola mentions an Italian resort town whose residents reported a dismaying epidemic of male impotence. Investigation showed that the major supplier of chickens to the town had been overly enthusiastic in implanting DES pellets in the necks of his chickens, as a means of increasing their weight.[161]

Prospects for Remediation

The initial purpose of this article was to examine the evidence for a decline in the quality of the manpower pool. We believe the evidence indicates that the decline is real. A good deal of that evidence, as well as some of the hypothesized causes of the decline, has been presented in the foregoing pages.

While a discussion of the possibilities for improving the picture is not an essential part of the original objective of this report, we would be remiss if we did not include at least a brief discussion of some of the approaches that may be available for halting or reversing the decline, or for offsetting its effects upon military preparedness.

Managerial or Legislative Interventions

As indicated previously, there are a number of ways to reduce the effects of the quantity decline, including reinstituting the draft, pay raises, increased use of women, lateral entry, lowering entrance standards, and civilianization. Many of these programs would—or could—improve the quality problem as well, by providing a larger pool of individuals from which the more capable could be chosen.

The lowering of physical standards may provide an especially attractive option. Binkin estimated that if the military simply extended maximum and minimum weight limits by 10%, the supply of eligible recruits would be increased by 5%.[162] The overweight individual, in particular, seems to represent a resource whose value has been underestimated. Robertson has shown that overweight individuals, male and female, tend to be superior in upper body strength, an important consideration in the performance of many Navy duties.[163] (For a more extensive discussion of the effects on the manpower supply of lowering physical/medical standards, see Siegel.[164])

An obvious way to help offset the quantity and quality declines would be to reinstitute the draft. So much has been written on that topic that there is little to add, except for one point that seems to have been overlooked. The severe shortage of high-aptitude personnel in the enlisted ranks makes service life particularly unattractive to high-aptitude young people who might otherwise want to enlist. Today a potential recruit who ordinarily seeks a buddy with whom to go to a play or a museum or with whom to play chess knows he will find scant companionship in the service. He will be disappointed, derided, or worse. He, his friends, and younger brothers are staying out in droves. For this and other reasons, steps must be taken to increase the number of Category I and II personnel in the service. Such steps might include reinstituting the draft, quality bonuses for recruiters, providing post-service educational benefits, and fewer free and low-cost college scholarships in the civilian sector.

Psychoeducational Interventions

Apart from attempting to wring quality personnel from a somewhat unpromising pool by whatever managerial or legislative means available, the military services may wish to consider various forms of remediation for those individuals with impaired capabilities in learning or performance.

There are two major approaches to remediation: psychoeducational and biological. In both the civilian and military sectors, the psychoeducational methods are the most widely applied. Specialized instruction is used to raise the level of achievement in reading and other academic skills, while various forms of counseling and social skills training are used to try to bring about improvement in such areas as discipline, attitude, and motivation.

Remedial education can be helpful, but it is costly and seldom brings the trainee up to full functioning. Aiken, after a number of years of experience with remedial reading training in the Navy, concluded that after receiving about four to five weeks of intensive reading instruction, the typical reading-impaired naval recruit will increase his skill by about two RGLs, with about half of that gain remaining after six months.[165] The General Accounting Office recently concluded that "brief, one-time efforts, as presently structured, do not substantially reduce illiteracy."[166] Sticht, after studying the results of literacy training in the Army, Navy, and Air Force, concluded that the graduates will be of marginal value—they fail to achieve the reading levels needed for even the least demanding jobs.[167] Armbruster and Braken provide data showing that the sharp decline in U.S. student achievement since 1960 occurred despite a *doubling* of constant dollars expended per pupil during the same period.[168]

While the degree of success of remedial training for academic deficiencies is easily measured, the effectiveness of the psychoeducational approach to disciplinary and behavior problems is quite difficult to determine, except in the extreme cases of overt delinquency and criminality. Many studies of recidivism following psychoeducational treatment for delinquency and criminality have been conducted. Few of these studies have produced encouraging results.

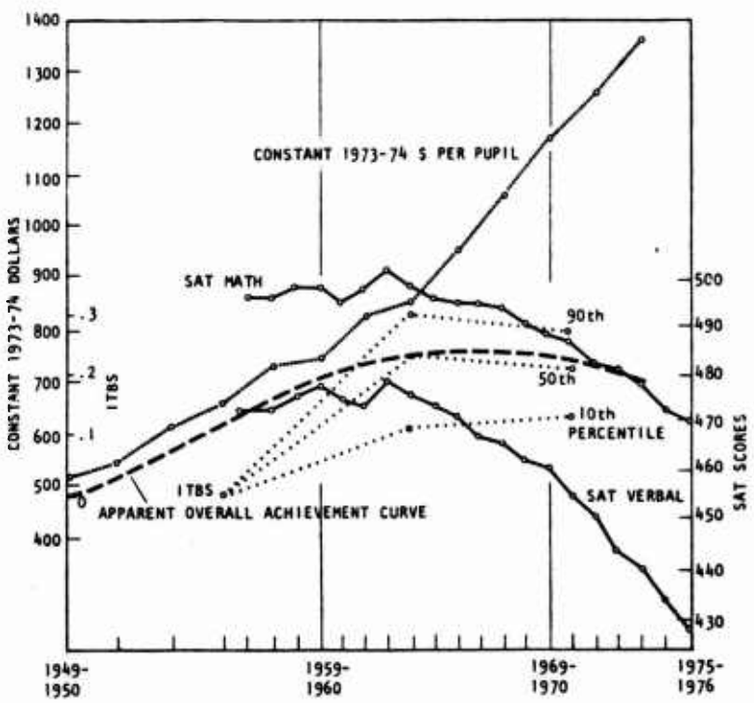
In their book *Resocialization: An American Experiment,* Kennedy and Kerber reviewed a good deal of the massive amount of literature on this topic.[169] They conclude, as have virtually all other reviewers, that criminal rehabilitation programs do not change the recidivism rate. They observe that although few corrections agencies will openly admit that their efforts do not work, the statistics nevertheless show failure. They note, however, that admissions such as this increasingly appear in print: "Despite our best efforts and intentions, we continue to be unsuccessful in the development of a scientifically valid correctional process."

Recently, McCord reported the results of a 30-year followup of two large matched groups of delinquents and nondelinquents from the Boston area.[170] McCord expressed chagrin at finding that on almost every criterion, the counseled men had done *worse* than the control group. Further, the more extensive and intensive the "therapeutic experience," the more poorly the counseled men performed. Similar negative effects were reported in an Army study in which it was found that men provided with a supposedly "preventive" counseling program

Page 54a - Insert to The Manpower Quality Decline: An Ecological Perspective, by Bernard Rimland & Gerald E. Larson.

"Armbruster and Braken provide data showing that the sharp decline in U. S. student achievement since 1960 occurred despite a doubling of constant dollars expended per pupil during the same period."

--page 54, para. 1



Relationship between educational expenditures and educational achievement, 1949-1976. The SAT math and verbal scores, as well as the Iowa Test of Basic Skills (ITBS) scores, decline as constant educational dollars rise.

Source: Armbruster, F. E., & Braken, P. Our children's crippled future: How American education has failed. New York: Quadrangle/The New York Times Book Company, 1977.

actually committed *more* offenses that those assigned to a random control group.[171]

The President's Commission on Mental Health has recently reviewed evidence of the value of various therapeutic interventions in several problem areas. Two of these areas—hyperactivity and learning disabilities—are of interest to us. Neither was found to be favorably affected by psychosocial intervention.[172]

In his experimental testing of graduates and failures from Army basic training, Andrulis reported that the failures had markedly worse scores on a battery of tests designed to identify those with learning disabilities.[173] Andrulis says the acceptance and early discharge of such trainees costs the Army $54-72 million annually. This study, as well as many others showing a close link between learning disabilities and military attrition, implies that the problem cannot be solved by simple motivational or reorientational methods.

While new and innovative methods based on psychoeducational models are, and should be, constantly proposed and evaluated, it must be recognized that whatever their merits (or lack thereof), such methods do not at present offer a great deal of hope as an effective means of offsetting the quality decline.

Biological Interventions

The fact that traditional approaches have not proved to be as effective as had been hoped has aroused interest in alternative approaches. In particular there has been growing interest in the idea that improved learning and behavior might best be achieved by improving the metabolic functioning of the brain. The human brain has often been likened to a computer. There is merit in that analogy, but there are also some critically important differences. For one, the brain consists primarily of water—about 85% by weight. Connections are made by liquids dissolved in a liquid medium, rather than through the firmly wired metallic contacts and conductors one finds in a commercially produced computer. This "soggy computer" concept of the brain has important implications for remediation. Certain methods exist, and others are under development, that have been found to improve or restore cognition in humans. These methods, known collectively as orthomolecular therapy,[174] simply entail changing the composition of the fluid by reducing the level of noxious substances and/or increasing the concentration of the nutrient substances the brain requires.

The term "metabolic dysperception" has been used to refer to the spectrum of disorders of learning and behavior attributable to brain dysfunction brought about by the presence of the wrong substances or the shortage of required substances. Many studies show that juvenile delinquency and learning disabilities are closely linked. Both may be regarded as being frequently, if not primarily, the consequences of metabolic dysperception. Some studies show that almost 90% of delinquents have disabilities in reading and other school subjects.[175] The individual who has poor control over his attention and his impulses and whose perception and judgment are impaired because of too little or too much of some substances dissolved in the brain's liquid medium, is an obvious candidate for a learning disability and/or impaired ability to interact effectively with his parents, teachers, peers, and the authorities. Wacker[176] has written extensively on the "dyslogic syndrome," emphasizing the relationship between the perceptual distortions that lead to learning disabilities and the distortions of judgment and foresight that lead to delinquent and antisocial behavior.

Even if the individual incurred his handicapping condition prenatally or in infancy, there is a reasonable probability that the efficacy of brain function can be increased by orthomolecular methods. Although it is unlikely that remediation can bring the individual damaged prenatally or in infancy to his full potential, it is nevertheless possible that worthwhile improvement can be achieved. It may be, for example, that the "damage" increases the brain's need for a certain substance to a level that would not ordinarily be reached by eating a normal diet, but that might be reached by using potent nutritional supplements.

An obvious first step in orthomolecular remediation is to reduce or stop the intake of noxious substances that cause brain impairment. It is commonly known that such substances as alcohol, marijuana, and LSD can cause such impairment. Only recently, however, has evidence begun to accumulate indicating that a wide variety of other substances such as food additives, lead, and cadmium can also have adverse effects. We have already discussed the benefits to hyperactive/learning disordered persons of discontinuing the consumption of artificial food colorings and flavorings. We have also referred to studies in which sugar and additive-laden foods were removed from the diet, with good behavioral results.[177]

The heavy metals, such as lead, cadmium, and mercury, remain in the body and can continue to be troublesome, even after the individual has ceased ingesting or inhaling them. They are especially likely to be

troublesome if the individual's diet is low in zinc, calcium, and iron. There are medical and nutritional procedures for reducing the body level of heavy metals, through the process of chelation.[178] Chelation therapy consists of administering substances orally or by injection that capture (chelate) the molecules of lead or other contaminants. Chelation therapy by injection, while not dangerous when done properly, requires extensive medical involvement. Oral chelation can be done with drugs and/or nutrients. In their study of hyperactive children whose blood lead levels were in the elevated but "nontoxic" range, David, Clark, and Hoffman reported marked behavioral improvement when chelation therapy was applied to the subgroup that had no known cause for their behavioral problems.[179] The children whose problems stemmed from non-lead-related causes did not show such improvement.

There are a number of nonprescription chelating compounds on the market. Most of these contain various nutrients, including large quantities of vitamin C, which is a good chelating agent. Stone reports a number of studies showing the value of vitamin C in protecting against poisoning by heavy metals, toxic gases, and other pollutants.[180] For example, when vitamin C was used to treat 17 subjects with chronic lead poisoning, all showed improvement within a week: "Most of the men enjoyed normal sleep, lost the irritability and nervousness . . . and no longer had tremors."

A certain, as yet indeterminable, proportion of learning- and behavior-disabled individuals can be helped by discontinuing their intake of noxious substances, or by removing deposits of noxious substances from their bodies through chelation therapy. In a great many other instances, however, it will also be necessary to increase the brain's concentration of the substances it uses during its normal functioning; that is, by improving nutrition. The rate of synthesis of at least three major neurotransmitters is affected by diet.[181]

Improving nutritional intake can be accomplished in two ways. The first is the obvious one of restoring to the individual's diet natural foods high in protein and low in refined carbohydrates, such as was done in the previously mentioned studies by Kershner, Baker, Reed, and Schauss. When an individual improves his diet by using whole wheat bread instead of white bread; by consuming milk, soup, water, and other healthful liquids instead of soft drinks, beer, and coffee; and by eating a plentiful supply of fruits and vegetables rather than candy and doughnuts, he can expect that the vitamin and mineral content of his body will, in time, be restored to a natural healthful level and that his

brain may begin to function in a more nearly normal and effective manner.

For most individuals, the use of such a diet, particularly when supplemented by a quality vitamin and mineral tablet, will provide adequate nutrition.[182] There is, however, a certain and not insubstantial proportion of the population whose learning and behavior disorders stem from the need for a much larger intake of vitamins and minerals than they can reasonably expect to obtain from even a superior diet.[183] Whether such individuals need larger than normal amounts of these nutrients because of a genetic defect, a handicapping condition incurred prenatally or during childhood, or for some other reason, their primary hope for improved functioning may lie in the intake of vitamin supplements in quantities that are perhaps many times as large as those needed by normally functioning individuals. The use of such large amounts of vitamins as a means of remediation is known as megavitamin therapy.

The topic of megavitamin therapy is a very controversial one, and this is not the place to enter into any lengthy or detailed discussion of the evidence for and against its use. Nevertheless, since it is a remedial modality in increasing use, at least a brief discussion is in order.

Megavitamin therapy has been the center of a good deal of dispute and debate during the past 30 years. The controversy peaked in the early 1970s, with the publication of a series of often vitriolic attacks and counterattacks by groups favoring or opposed to this approach. The dispute seems to be subsiding as more objective data have become available and as each side has adjusted its stance in response to criticism.

As the result of the ongoing dispute over megavitamin therapy in Canada, the Minister of Social Services of the Province of Alberta commissioned a study in 1975 on the efficacy and safety of this form of treatment. Realizing that the parties to the dispute were not likely to be wholly objective, the minister selected three faculty members of Alberta medical schools, who had not publicly taken sides on the issue, to investigate the matter. The committee's report took a middle position: it stated that megavitamin therapy was promising, although it had not been conclusively proven to be effective, and recommended that adequate support be provided for well-designed and controlled clinical trials of megavitamin therapy, as judged by a process of scientific peer review.[184]

Evidence favoring megavitamin therapy is now accumulating at a fast rate and, with little doubt, in a few years it will be a widely accepted form

of treatment for learning and behavior disorders.[185] Any serious consideration of options available for combating the quality decline should therefore include the possibility of employing, or at least investigating, the use of megavitamin therapy.

Until recently, most of the reports on the use of megavitamin therapy as a means of treating learning and behavior disorders have been anecdotal. Starting in 1978, however, a series of papers were published employing double-blind crossover designs and sophisticated laboratory tests of blood, urine, and EEGs that have proven, beyond a reasonable doubt, that high dosage levels of certain of the B vitamins (particularly B_6) confer profound benefits on many youngsters with disordered behavior.[186] Most of these studies deal with youngsters with severe problems, such as mental retardation, autism, or clinical hyperactivity. Nevertheless, the positive findings have broad implications for the value of the approach in other populations. Of particular interest is a double-blind study of high-potency vitamin and mineral supplementation on a group of retarded children.[187] Highly significant gains in IQ were seen in the group given the vitamins, with similar gains later occurring in the control group when they were also given the supplements. The effect of the supplements was striking and undeniable.

Not all of the recent studies have provided positive results. For example, Arnold, Christopher, Huestig, and Smeltzer reported that megavitamins had not alleviated hyperactivity in their sample of school children.[188] The treatment, however, had been used for only two weeks—probably too short a time for a meaningful evaluation.[189]

An unpublished study on the use of megavitamin therapy on a group of learning-disabled teenage boys by Denhalter is of special interest:

> Recently, I tried a control study with 12 teenage boys. Six were on megavitamin treatment and six were not. I presented to all 12 the same reading remediation with pre- and post-testing. The results were startling. Those on megadosage vitamins improved in reading from 1.6 to 3.4 years grade level, while those who were not improved only .6 to 1.6 in reading grade level. Parent reaction was also very interesting, with most parents reporting that their children were much easier to get along with than before.[190]

Like many of the other earlier reports, Denhalter's study was done on an informal, ad hoc basis on a relatively small sample, without rigorous statistical testing of the data. Nevertheless, Denhalter's findings are

sufficiently consistent with other findings and with theory—and sufficiently provocative—to be taken seriously.

Another anecdotal, albeit well-documented, report may be of interest. Several years ago, Professor Nicholas Bond, formerly Chairman of the Personnel Research Panel of the Navy Research Advisory Committee, who had been skeptical about the usefulness of megavitamin therapy, called an interesting case to the attention of the senior author. One of his graduate students, a special education teacher, had given intensive remedial training to her son, a junior high school student with severe disabilities in reading and writing. Despite his mother's best attempts at remedial teaching, the youngster could read only slowly and with great difficulty. His writing was backward, being readable only with the aid of a mirror. Finally, in desperation, she placed the boy on megavitamin therapy. A few weeks later, the boy was able to read fairly fluently, no longer needing to follow the printed lines with his finger, and his writing became legible. The mother reported that the boy's speech teacher called her to say she was thrilled with the improvement and that she had never seen a child advance so fast. The improvement was maintained until the summer recess, when the family embarked on vacation without an adequate supply of the vitamins. The labored reading and mirror-writing soon returned, but was quickly corrected when the family returned home and reinstated the vitamins: "By the end of the week he was able to read again without using his finger." Figure 3, which presents samples of the child's homework, permits comparison of the previtamin mirror-writing with the improved writing less than a month later. While it is difficult to attribute the boy's improvement on two occasions to anything but the vitamin therapy, it is necessary nonetheless to conduct carefully controlled studies to be sure of the value of this or any other form of treatment.

How might a vitamin supplement correct dyslexia? We have some clues. Levinson, in his book *A Solution to the Riddle Dyslexia,* ascribes dyslexia to a malfunctioning vestibular system and reports successful use of antiseasickness drugs in treating dyslectics.[191] The Russian investigator Lapaev has reported successful use of vitamin B_6 in preventing seasickness in a population of "98 healthy men, ages 19 to 45" (presumably military).[192] Lapaev believes vitamin B_6 stabilizes the vestibular system. The vitamin is much cheaper and safer than the drug.

Most of the controversy surrounding the use of megavitamin therapy in treating learning disabilities has centered on the use of high dosage levels of the B vitamins. A substantial body of evidence, however, shows

Sample 1
Before Megavitamin Therapy

Sample 2
During Megavitamin Therapy

Figure 3: Samples of homework of junior high school boy before and during megavitamin therapy, showing correction of mirror writing after one month of megavitamins. Years of remedial education had not corrected the mirror writing.

that vitamin C also has beneficial effects upon mental functioning. Kubala and Katz investigated the relationship between blood levels of vitamin C and IQ, using four groups of students as subjects. They found that high blood levels of the vitamin were associated with above average IQ in all four groups. Supplementing the students' diet with citrus juice raised the IQ of the low vitamin C groups by 3.5 points, but had no effect on the group already high in vitamin C.[193]

The Czechoslovakian government has done extensive work with vitamin C. In one study of vitamin C supplementation on 12,000 coal miners, remarkable improvements were noted in a variety of mental and physical measures.[194] Of particular interest was the significant decrease in accidents, which was attributed to increased alertness. Further investigation showed that vitamin C administration improved such "psychomotor reactions" as tapping speed and reaction time.[195]

Kerxhalli, Vogel, Broverman, and Klaiber reported that megadose vitamin C supplementation produced a stronger EEG response than a placebo in their group of 18 healthy adolescent males.[196]

In an as yet unpublished study, Rimland, Montor, and Afdahl determined the relationship between body level of vitamin C (as measured by a urine dipstick test) and grades at the Naval Academy for the class of 1980.[197] The 941 plebes were divided into high and low groups on the basis of their urinary levels of vitamin C. When grades of the two groups were compared, it was found that the high C group had earned significantly higher grades in engineering, history, English, and in most other courses, for their first four semesters. In another study, Biersner, Gilman, and Thornton found that during a long submarine patrol, men with high blood levels of vitamin C had more often completed qualifying training activities than had those with low levels of C.[198] (However, age differences between the high and low C-level groups make the interpretation of this finding unclear.)

Since vitamin C is more strongly concentrated in the brain than in any organ other than the adrenal cortex,[199] it is not surprising that it should have a great deal to do with the function of the brain. Vitamin C supplementation, like supplementation with the B vitamins and the various nutrient minerals, is not only safe but can confer many additional benefits beyond the improvement in mental functioning described above. As noted earlier, Stone cites numerous studies showing that vitamin C protects against heavy metal toxicity.[200] It also protects against other organic and inorganic toxins, heat and cold stress, physical shock and trauma, various kinds of infections, and radiation.

Iron is another nutrient that has been implicated in learning disabilities.[201] In a 1971 report to the Food and Nutrition Board, "tests of attentiveness and ability to focus on, orient to, and sustain interest in a learning task revealed significant differences between children with iron deficiency anemia and those who were not anemic.[202] A recent FDA press release (30 May 1980) noted that "an expert advisory committee reported to the FDA that iron deficiency is a leading nutrition problem in the United States," and advised that selected foods be fortified with iron. According to the DHEW, certain segments of the military-age population—for example, white male youths aged 15-19 years from low-income families and black youths aged 18-19—have average iron intakes that are 17 and 25% below dietary standards, respectively.[203]

A Proposal for Research

In the foregoing sections we have merely touched on several of the orthomolecular approaches that might be used to help stop or reverse the decline in human quality. These methods are safe and inexpensive, and it seems highly advisable that a research program be undertaken to evaluate them in a formal and systematic way.

It is not proposed that innovative psychoeducational interventions be discontinued, nor is it claimed that the orthomolecular approach has been proven successful to everyone's satisfaction. It *is* asserted, however, that these biologically based methods are sufficiently promising, safe, and inexpensive to warrant their systematic evaluation, on a priority basis.

As the first step in such a research program, troublesome, reading-disabled recruits should be compared with control groups of higher-functioning recruits, by means of hair mineral analysis and laboratory tests of blood and urine, to determine the levels of toxic substances and of various nutrients. A comparison of the minor physical anomalies of the two groups would also be instructive.

Another phase in the research program could be the replication at other military correctional facilities of the Navy's Seattle Correctional Facility findings. Pre- and posttesting of all incoming and departing personnel with a battery of literacy and aptitude tests would permit an objective evaluation of the cognitive effects of a healthful, no "junk-food" diet. Measures of such behaviors as cooperativeness, combativeness, and general demeanor, as well as before-and-after tests of reading grade level, might also be collected as criteria.

A further phase of the research effort might entail trying a similar improved diet on a dozen or so companies of recruits at boot camp. Part of the sample could also be given a therapeutic vitamin-mineral supplement, to facilitate recovery from past dietary and ecological abuse. One might predict improved performance not only on achievement tests but also on other criteria of interest to the military, including disciplinary infractions.

Consideration should also be given to the evaluation of megadose vitamins, beyond the normal therapeutic range. With the possible exception of vitamins A, E, and D—which may, in rare cases, be harmful when taken in large amounts—megavitamins are quite safe.

Vitamins A and D are not used in the megavitamin treatment of learning disabilities in any case.[204] Several recent reports in the medical literature have claimed danger from megavitamin therapy and have caused unwarranted concern about safety. One widely cited study, for example, claimed that high levels of vitamin C ingestion resulted in the destruction of vitamin B_{12}.[205] This report was inaccurate, since the authors had simply used the wrong laboratory method for measuring B_{12}.[206] Another report, which was widely cited as proving that "megavitamin therapy" was dangerous, mentioned a four-year-old child who became ill after taking excessive vitamin A and who recovered quickly when he stopped taking the vitamin A.[207] As it turned out, this report had nothing to do with megavitamin therapy; the teachers of the child had reported seeing him on the playground eating candy-flavored vitamins.

Although the B vitamins and vitamin C are quite safe even in very large doses, the effectiveness of megadoses of these vitamins in improving learning should be conducted in military settings under close medical supervision. The results of these and similar studies would be of great and continuing importance, not only to the military but to the entire nation.

Interestingly enough, experiments with military personnel in the past have led to two discoveries that have provided information of immense value to mankind. In 1593, Admiral Sir Richard Hawkins of the British Navy, after 10,000 seamen under his command had died of scurvy, discovered that citrus fruits could prevent and even cure scurvy.[208] Scurvy had been "the scourge of the sea" since the dawn of maritime history. Vasco de Gama had lost 100 of his 168-man crew in his voyage of 1498. After Admiral Hawkins' death in 1622, the value of citrus fruits in combating scurvy was forgotten, at enormous cost in life and suffering, until its rediscovery by another British naval officer, James Lind, 150 years later. Although Lind's careful experiment, which demonstrated the value of oranges and lemons in combating scurvy, is a landmark in science and medicine, half a century passed before the recommendations resulting from that experiment were finally implemented.

It is well for the British Navy that it accepted Lind's recommendation, however reluctantly. Osmond asserts that discovering how to prevent scurvy was as important to military history as the development of radar.[209] Nelson's victories over the French Fleet and Britain's long domination of the seas depended on the British use of—and the French failure to use—oranges and lemons on their naval vessels.

Albert Szent-Gyorgyi, who was awarded the Nobel Prize for discovering the chemical composition of vitamin C, has observed that the tiny amount of C necessary to prevent scurvy, which is ingested by most Americans, is much smaller than the amount required for optimum health.[210] Szent-Gyorgyi himself takes eight grams of C per day[211].

The other discovery of immense value to mankind resulting from an experiment with naval personnel was Kanehiro Takaki's discovery of the benefits of improved diet upon the health of sailors in the Japanese Navy. Beriberi, a vitamin B_1 deficiency disease, was wreaking havoc in the Japanese Navy, just as scurvy had killed innumerable sailors in the preceding centuries.[212] Almost half of the sailors on some ships died or were incapacitated by beriberi. Takaki's studies in the 1880s led the Japanese to improve the white rice diet of its sailors. According to Dankenbring, "he [Takaki], as much as any man, deserved credit for the Japanese naval victory over the Russian Fleet in May, 1905."[213]

Earlier we referred to the work of Lonsdale and Shamberger[214] as indicating widespread thiamine deficiency, not yet at the beriberi level, in American teenagers as the result of their consumption of junk foods. Aggressiveness and irritability were reported as common symptoms. Supplementation with megadoses (150-300 mg/day) of vitamin B_1 reversed the symptoms, sometimes in a matter of weeks.

Alcoholism, another serious problem in both the military and civilian sectors, also seems to be aggravated by junk foods. In a study conducted at Loma Linda Medical School,[215] laboratory rats fed a "typical American teenage diet" consumed five times as much alcohol as did rats given conventional human foods. Adding coffee increased the consumption of alcohol to sixfold, but supplementing the teenage diet with vitamins produced a significant *decrease* in alcohol consumption. Vitamin supplements have also been shown to decrease the level of intoxication resulting from alcohol consumption.[216]

It is clear from the foregoing examples that dietary improvement, coupled with nutritional supplements, may provide a safe, effective, and inexpensive means of reversing the quality decline.

Conclusions and Recommendations

The evidence considered strongly supports the conclusion that there has been a serious and continuing decline in human quality in recent

years, and the military quality decline is but one manifestation of this larger problem.

The quality decline has profound implications for our society. It seems obvious that the problem and its effects on our daily lives can no longer be safely ignored. The "band-aid" psychoeducational interventions that have been tried by the educational, military, and correctional institutions have proven inadequate. Such efforts appear to us to be directed at treating the effects, rather than the basic causes, of the decline.

Serious consideration should be given to conducting the kinds of biologically based research proposed in the concluding section of this monograph. Research designed to investigate dietary interventions can be done safely, inexpensively, and with objectively measurable criteria of effectiveness. Such research would be of great potential benefit both to the military and to society as a whole.

Notes

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