Cohort Differences in Vocabulary Knowledge in the United States

Duane F. Alwin*

Department of Sociology and
Institute for Social Research
University of Michigan
Ann Arbor MI 48106-1248

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Abstract

Conflicting sets of empirical results exist on the question of changing levels of cognitive abilities in the U.S. population in the post-World War II era. Evidence concerning changes in the cognitive skills assessed by IQ tests suggests there have been improvements in abilities over time, whereas results from the College Entrance Examination Board's Scholastic Aptitude Test (SAT) suggest rather dramatic declines in performance levels of college-bound high school students over the decades of the 1960's and 1970's, with recent upturns in the early 1980's. This paper addresses the question of changing cognitive skills in the U.S. population via an examination of cohort differences in vocabulary knowledge in the U.S., assessed in six national NORC-GSS surveys. Consistent with the well-publicized SAT-score decline, cohort differences in vocabulary scores (adjusted for inter-cohort differences in the extent of schooling) are observed, with recent cohorts showing less vocabulary knowledge. The apparent recovery in the 1980's of average SAT scores is not duplicated in the vocabulary score trends reported here. Generally, however, intra-cohort factors are much more important in producing differences in vocabulary knowledge. Family socio-economic factors and amounts of schooling are associated with the largest differences in vocabulary knowledge. Family size is relatively less important than other family factors, but it affects vocabulary knowledge significantly. The present set of results provides no support for the hypothesis that cohort differences in family size experiences have led to declines in verbal skills in the U.S. population.

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Introduction

Increasingly, participation in modern society requires the exercise of basic verbal comprehension skills, such as those necessary for reading newspapers, telephone books, street signs, product information, government and company forms, etc. Moreover, illiterate persons are often at a substantial socio-economic disadvantage, given that reading skills and other indications of cognitive functioning (e.g. quantitative skills, capacities for abstraction and analogy) are frequently used, either implicitly or explicitly, as screening devices for entrance to desirable educational and occupational positions (Miner, 1957; Duncan, Featherman and Duncan, 1972; Sewell and Hauser, 1975).

Levels of cognitive skills in the population are also taken as important indicators of labor force competence and the quality of the educational system. Consequently, they are frequently taken to be matters of great socio-political significance. For example, over the past several decades, there has been a serious concern with declining performance on the College Entrance Examination Board's Scholastic Aptitude Test (SAT) (see Wirtz, Howe and Others, 1977). Average SAT scores declined systematically from the early 1960's through the 1970's, although in recent years this trend has apparently been reversed (Grant and Snyder, 1986).[1]

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[1]So important is the apparent national concern with the level of such skills in the population of young persons that in several of his "State of the Union" addresses President Ronald Reagan noted that SAT scores had increased dramatically since 1980, the first year of his administration--an administration that had purportedly emphasized the strengthening of basic reading, writing and arithmetic skills (see Lang, 1986). Indeed, apologists for the Reagan Administration have gone on record suggesting that recent upturns in SAT test scores were due to federal educational policies, but empirical evidence of this does not exist.

Even though the focus of much of this discussion was on the SAT, it is worth noting that the declines were witnessed in the ACT scores (American College Testing Service) (Ferguson, 1976), and a number of additional school-based cognitive measures (Harnischfeger and Wiley, 1976; Cleary and McCandless, 1976; Gardner, 1983). Also, it is important to point out that such declines were observed primarily at the secondary school level. On the other hand, scores on the National Assessment for Educational Progress (NAEP) were increasing, and among elementary age children scores on other tests were holding their own, with no significant declines (Menard, 1988:5).

There is also substantial concern with the quality of education of young persons generally, and there is considerable speculation regarding the failure of schools to produce basic levels of reading competency in the students that attend them. For example, in the early 1980's the U.S. Department of Education estimated that 13 percent of the U.S. adult population was illiterate, which amounts to as many as 17 to 21 million persons (U.S. Dept. of Education, 1986). Persons under the age of 50 were significantly more likely to be classified as illiterate than those over 50. Such findings are frequently interpreted as reflecting a failure of local schools and a "nation at risk" (e.g. Gardner, 1983).

Levels of cognitive skills in the population, particularly among the young, have far-reaching implications, both for the affected individuals and for society at large. However, there is little available data obtained from national probability samples of young people that would merit conclusions regarding trends in cognitive abilities and their causes.[2] And, as Menard

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[2]Because SAT scores are available only for those who elect to take the test, and such information is not available for probability-based samples of well-defined populations of young persons, it is not at all clear that conclusions regarding trends in cognitive skills should be based on the SAT-score trend. I return to this issue below.

(1988:4) recently put it, "although much has been written about reasons for changes in the test scores, most of the reasons offered for the changes (especially the declines from 1965 to 1980) can be dismissed on the basis of available evidence."

In order to partially remedy this weakness of available evidence pertaining to verbal score trends, this paper examines cohort patterns of vocabulary knowledge in the general U.S. adult population. For this purpose, I rely on vocabulary score data obtained on the U.S. population of persons 18 years and older in six NORC surveys carried out between 1974 and 1987. This examination is relevant to questions concerning cohort differences in levels of cognitive skills in the population, and the following presentation is developed in such a way as to provide some evidence on these issues.

However, in order to place the presentation and interpretation of these data in the proper context, before presenting my research results I briefly review the history of discussions of trends in cognitive scores, with special attention to demographic hypotheses regarding their long-term decline and subsequent recovery. This review reveals two interesting observations: (1) there are some seemingly paradoxical observations emerging from the literature on mental testing over the past 50 years, an apparent gain in IQ scores and other measures of academic achievement on the one hand, and a decline in SAT-scores on the other, and (2) recent theorizing regarding the link between trends in SAT scores and lagged rates of fertility (e.g. Zajonc, 1976) bears a striking resemblance to earlier discussions of the effects of fertility differentials on cognitive scores of the population (Cook, 1951; Duncan, 1952).

Paradoxes in the Study of Trends in Verbal Scores

One of the major puzzles of the post-World War II era of intelligence testing is the extent to which the abilities of the general population were

changing as a function of social composition. One early speculative claim regarding changes in levels of intelligence was occasioned by a 1949 report of the Royal Commission on the Population of Great Britain. This conclusion, based on the report (but not a conclusion of the report) was that "the average intelligence quotient of the British people was declining about 2 points every generation," a trend also witnessed in the United States, which "if (continued) for less than a century," Britain "will be well on the way to becoming a nation of near half-wits." (Cook [1951] quoted in Duncan [1952]).[3]

This argument was based on the following logic. Intelligence is correlated with family socio-economic position, and since there are higher fertility rates among the lower socio-economic groups, which tend to score lower on intelligence tests, this would eventually drive the average intelligence of the population down. A critical element of this argument is that socio-economic position transmits its effect via a number of variables, including family size, which are inversely correlated with intelligence test scores to a nontrivial degree (Duncan, 1952). It has consistently been shown that family size (and IQ scores and other measures of academic achievement) are inversely related (see Blake 1981, 1985; Duncan, Featherman and Duncan, 1972; Zajonc, 1976), although the strength of this association alone might make one skepti-

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[3]Duncan (1952:403) points out that Cook (1951) overstates the Commission's conclusions, which were actually that they were "not in a position to evaluate the expert evidence (they had) received to the effect that there is inherent in the differential birth rate a tendency towards lowering the average level of intelligence of the nation." In fact, according to Duncan, there were conflicting arguments regarding the veracity of the evidence for this hypothesis. Statements favoring the hypothesis were given by biometricians like Sir R. A. Fisher and psychometricians, the likes of Cyril Burt and R. B. Catell, but these arguments were countered by experts of equal esteem, who found little or no support for the various elements of the thesis (see Duncan, 1952:403).

cal regarding its potential to generate historical trends in assessed intellectual levels (see Duncan, 1952).[4]

Interestingly, contrary to these predictions, other observers of the post-World War II period report dramatic increases in intelligence test scores from the 1930's (Flynn, 1984). Indeed, one review of 50 years of intelligence testing concludes that "intelligence test scores have been improving in the U.S. at a fairly rapid rate," ... and that "the change in intelligence over the last 50 years in the U.S. can be conservatively estimated at one standard deviation" (Brody and Brody, 1976:164-65; see also Flynn, 1984:32). Although these authors admit that "the changing composition of test batteries and changes in the samples used in various studies" make these conclusions difficult to verify, "there is little doubt that there has been a fairly sizable increase in scores on standardized tests of intelligence ... probably related to changes in educational level" (Brody and Brody, 1976:165).

However, Flynn (1984:39) also raises the possibility that there might have been biases in the calibration of test scores in such comparisons, reflecting observed increments based on obsolete standards. Thus, one plausible interpretation of such "gains" is that over time comparisons based on obsolete test norms reflect artificial gains in IQ, especially when environmental influences, such as levels of education, are not controlled in the comparisons.

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[4]A typical observed correlation between family size and IQ is somewhere in the range -.25 to -.30 (see Duncan, 1968; Duncan, et al, 1972). Family size is inversely related to family socio-economic position in this same range. One obvious implication of this is that family socio-economic position must be adequately controlled in the assessment of the effects of family size. I return to this issue in the subsequent analysis and discussion.

The SAT-Score Decline

The state of knowledge regarding changes in the levels of intelligence in the general population suggests one of two possibilities: either there have been improvements or gains in levels of cognitive abilities measured by these tests, or there has been no change (and no evidence suggesting a decline in verbal competence among young persons), but a shifting obsolescence in the norms for calibrating the tests. Regardless of which of these is the correct conclusion, both are seemingly incompatible with the well-publicized declines in verbal and quantitative scores of the Scholastic Aptitude Test (SAT). These declines, shown in Figure 1, began in the early 1960's and continued for nearly two decades, at least through the late 1970's. The verbal score decline is more exaggerated than the quantitative score, a decline of about 45 points, which is nearly one-half of one standard deviation.[5]

Insert Figure 1 Here

The significance and regularity of these declines were judged to be so great that in 1975 the College Entrance Examination Board (which sponsors the SAT) and the Educational Testing Service (which develops and administers the SAT) commissioned an advisory panel to study the trends that had been witnessed in SAT verbal and quantitative scores over the preceding decade (see Wirtz, Howe and Others, 1977). The report, On Further Examination, summarizes an impressive amount of analysis of the College Board SAT data (see Wirtz, Howe and Others, 1977).[6] There is little question that SAT scores declined significantly during this period and that it was experienced broadly throughout the population taking the test.

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[5]The standard deviation of the SAT score is arbitrarily set equal to 100.

[6]This report, although based on the work of 21 social scientists, is here cited as authored by Willard Wirtz and Harold Howe II, the *chairman* and *vice-*

As Flynn (1984:36) indicates, the combination of these two sets of observations--the estimated gains in IQ scores and the observed declines in SAT scores--are virtually inexplicable. Given the generally high correlation between verbal test scores and general measures of intelligence (Flynn, 1984:36; see also Miner, 1957:29), and given the above set of trends, the SAT results seem very unlikely. Or conversely, if we assume there is some reality to the SAT-score decline, then either the IQ gains noted above are not real, due primarily to the methodological problem associated with norming alluded to earlier, and/or the factors responsible for SAT declines are purely non-intellective, that is, due to motivational, personality and environmental factors orthogonal to the IQ component of the SAT (Flynn, 1984). And given the reality of an IQ gain and the positive association between IQ and the SAT (they share some 64% of their variance), the decline in such non-intellective factors would have to be unrealistically dramatic and systematic to explain the rather regular decline in SAT scores over the period in question.

Explaining the SAT Score Decline

These issues cannot be completely resolved here, although I am persuaded that the methodological difficulties of standardization in the IQ literature may have created the spurious impression of true IQ gains, when in fact none exist. The SAT-score decline, by contrast, seems to be more real, although certainly not free of the possibility of sample bias.[7] Indeed, the College

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chairman of the advisory panel. This report also included several appendices, which are here referred to by author.

[7]Changing SAT-test norms, while a reality (see Modu and Stern, 1977), cannot be used to explain away these patterns, since any decrease in the difficulty of the SAT would simply make the true SAT declines greater than they appear. The idea that the SAT tests themselves may have changed has largely been discredited (see Harris, 1976; Harneschfeger and Wiley, 1976). No one has suggested that changes in the tests might account for the recent upturn in SAT scores, and it is not likely that changes in the tests could account for

Board/ETS advisory panel concluded that compositional differences of those taking the tests in different years were perhaps the most important set of factors accounting for the change between 1960 and 1970. The dramatic growth in college-bound seniors was largely responsible for this shift. In the space of just one decade the number of persons taking the SAT test tripled, from 564,000 juniors and seniors in 1960, to more than one and one-half million in 1970 (Wirtz, Howe and Others, 1977:15). And, the improvements in educational opportunities for socio-economic, racial and ethnic minorities gradually eroded the earlier "elite" nature of the subpopulation taking the test (Wirtz, Howe and Others, 1977:13-18).

So important was composition in shaping the SAT-score decline, that the authors of the report (Wirtz, Howe and Others, 1977:18) concluded: "the largest part of the SAT score decline between 1963 and about 1970 was identifiable with compositional changes in the mix of the SAT-taking group, ... and fairly careful calculation indicates that they account for between two-thirds and three-fourths of it." The panel was, however, less willing to attribute the changes since 1970 to such compositional factors, attributing only some one-fourth of these later changes to compositional shifts of those taking the test (1977:24).

In the decade of the 1970's the most plausible explanation of the declines, the panel concluded, lay not in compositional factors, but in what seemed to be an increasingly "across-the-board score decline, the apparent consequence of more 'pervasive' changes or influences affecting higher and lower scoring groups alike." (Wirtz and Howe, 1977:13). The more "pervasive"

SAT-score trends (see Menard, 1988:7). However, there are potentially serious problems with interpreting changes in SAT-scores as if they reflect true aggregate levels of verbal and quantitative skills of high school juniors and seniors, given the changing composition of the test-taking population.

factors explaining the remaining three-quarters of this later change apparently refer to changes in the educational and family experiences of young persons during this period (1977:25-43). Specifically, the panel's report referred to the following six sets of factors: (1) the failure of schools to properly emphasize basic skills, offering too many non-academic electives, (2) the diminished emphasis on academic excellence in schools, the family, and society generally, (3) the impact of television in promoting non-traditional modes of learning, (4) changes in the family, particularly increases in family size and the number of single-parent families, (5) unique historical factors, especially the effects of the Vietnam War in "the disruption in the life of the country during the time when those groups of test takers were getting ready for their college entrance examinations," and (6) the "diminution in young people's learning motivation" (Wirtz and Howe, 1977:46-48).[8]

Others have offered their own assessments. Jencks (1979:13) suggested that schools and parents had failed to instill proper academic values in students, concluding that students had "lost respect for the value of reason." Others have concluded that student motivation is a plausible explanation (Winter, 1977). Citing a recent study by Rock et al. (1985), Menard (1988:12) notes that "the number of hours spent on homework" changed between 1972 and 1980, and is "probably related to the test score decline." Some have even suggested, in line with the Wirtz-Howe report, that the decline in SAT-scores was due to increases in the amount of time children watched television, but little hard evidence exists for the connection (Ryor, 1977; Schramm, 1977). Moreover, trends toward increasing television viewing began much before the cohorts responsible for SAT declines, and if anything, television may increase

[8] In an appendix to the report Wharton (1976) lists nearly 90 separate hypotheses that have been advanced as explanations of the SAT-score decline. The six-category schema provided by the report summarizes these.

reading scores (Harris, 1976). Finally, some have suggested that trends in the use of marijuana and alcohol by high school students during the late 1960's and early 1970's might be responsible for test score declines (Flanagan and McGarrell, 1986; Menard, 1988). The best data indicate that these cohorts experienced a rapid increase in marijuana use during the period of sharpest decline in the SAT test-scores (e.g. O'Malley et al., 1984), but to my knowledge no evidence has been presented linking the two trends.

More recently, Rock and associates (1987; Rock et al., 1985) find that student perceptions of their educational experience declined between 1972 and 1980 and were linked to SAT-score declines during this period. School characteristics reflecting school composition and curriculum content are linked to SAT-scores, but did not change during this period. Menard (1988:6) concludes that "the literature on the SAT decline (rejects) the suggestion that the quality of schooling or teaching caused the decline," but that there is similarly no evidence that the recent increases in the SAT-score have resulted from increases in the quality of schooling, as claimed by some political officials (see Biemiller, 1985; Schrag, 1986).

Demographic Changes in the Family and Verbal Test Scores

There are a number of socio-demographic changes in the family that may be in part responsible for trends in SAT-scores, which were recognized by the Wirtz-Howe panel (see item #4 above). One such change is the dramatic changes in maternal labor force participation since the late 1940's and early 1950's. The labor force participation rates for women with children under 18 have increased from about twenty percent in 1950 to more than 60 percent in the early 1980's.[9] If the labor force participation of mothers with young children af-

[9]Information furnished by Prof. Lois Hoffman.

fects cognitive development, we might expect such a trend to be in part responsible for the SAT-score decline. On the other hand, the evidence for such an effect in adolescence is generally lacking (see Alwin and Thornton, 1984). Moreover, the trends in female employment continue to increase through the 1970's and early 1980's, which is incompatible with the stabilization and apparent rise in the SAT scores since the early 1980's.

A second change involves the increase in rates of single-parenthood (see Alwin et al., 1985). Again, if this has developmental consequences for cognitive test scores, and there is some evidence that it might, this may in part account for the SAT-score decline. However, the trends in single-parent households continued to rise through the 1970's and 1980's, which again is inconsistent with the more recent trends in test scores.

Family Configuration and the Growth of Intelligence

The possibility that SAT-score declines might be due to changing family configuration (family size and associated characteristics, such as birth order and child-spacing) was recognized by the authors of On Further Examination, (see Breland, 1977). The report referred specifically to the work on birth order and family size effects on intelligence carried out by Zajonc and his colleagues. In a paper published in Science, Zajonc (1976) had argued that declines in SAT scores coincided nearly perfectly with the entry into college of the larger birth cohorts of the post-War period.[10] And, since the rate of cognitive development had been found to vary by family size, birth order and child-spacing (see Zajonc and Markus, 1975; Zajonc, Markus and Markus, 1979; Breland, 1974), Zajonc argued that the post-World War II increases in fer-

[10]A more or less complete listing of references for this project is: Zajonc (1976, 1982, 1983, 1985, 1986a, 1986b, 1988); Zajonc and Bargh, (1980a, 1980b); Zajonc and Markus, (1975); Zajonc, Markus and Markus, (1979).

tility, the so-called "baby-boom," had a lagged effect on SAT-scores 18 years later (1976:233-35). This effect was transmitted via an increase in family size, increasing numbers of later born children, and diminished spacing of children, factors all linked to decrements in intellectual development (1976:228-30)..

The College Board/ETS advisory panel reviewed this issue (see also Breland, 1977), but concluded that, while the Zajonc (1976) hypothesis "seems sound, it could only account for a small portion of the total SAT-score decline." Despite this conclusion, as well as other critical commentary, the hypothesis is still very much alive. Zajonc and his colleagues have continued to pursue the explanation of the SAT decline in terms of changes in family configuration (Zajonc, 1982, 1983, 1985, 1986a, 1986b, 1988; Zajonc and Bargh, 1980a, 1980b). Indeed, even recently, Zajonc (1986b:48) speculated that "SAT scores will continue to rise for the rest of the century. When today's 4-year-olds take the SAT 14 years from now, the average score will be even higher than it was in 1963 when the 40-point decline began."

Most of the doubt raised regarding the Zajonc hypothesis for the SAT-score decline has focused on the magnitudes of the effects of the critical factors in the confluence model: family size, birth order and child-spacing. There is an extensive literature on the effects of birth order on a wide range of cognitive and social phenomena (see reviews by Sampson (1965), Altus (1965), Warren (1966), Bayer and Folger (1967), Bradley (1968), Sutton-Smith and Rosenberg (1970), Adams (1972), Schooler (1972), and Cicirelli (1978). The support for birth order effects on intellective capacities is generally weak, once family size, and other family socio-economic factors are taken into account (e.g. see Cicirelli, 1978; Lindert, 1977, 1978; Melican and Feldt, 1980; Mercy and Steelman, 1982; Olneck and Bills, 1979; Record et al., 1969;

Steelman and Mercy, 1980; Steelman and Doby, 1983; Velandia, et al., 1978; Wolfe, 1982). Family size has a generally depressing effect on cognitive outcomes, educational and socioeconomic achievements (Blake, 1981, 1985; Duncan et al, 1972).

The confluence model has not been that effective in explaining trends in cognitive scores. For example, Breland (1977) estimated that the effects of family configuration variables on SAT-scores explained only a small portion of the variance. Zajonc's own research (e.g. Zajonc and Markus, 1979) indicates that family configuration accounts for only a small portion of the variance in National Merit scores. And, although assessing effects on educational attainment rather than test scores, Hauser and Sewell (1985) use sibling data to control for socio-economic background, attributing some modest effects to family size and little effect of birth order. Family size effects on educational attainments have been duplicated in several large representative cross-sectional data sets (see Blake, 1981)

Unfortunately, for reasons I elaborate upon below, these issues cannot be resolved within the literature that has developed. There are three related issues of importance in this debate, which can be addressed to only a limited extent in this research. The first one is whether there are inter-cohort differences in cognitive scores in nationally representative samples. The second is whether family configuration variables can be linked to cognitive scores in such data sets. And, the third is whether the presumed link between such variables and cognitive scores can be used to account for the trends in cognitive scores in such representative samples.

Research Methods

These issues cannot be resolved within the SAT data base, without an attempt to control for compositional differences among cohorts of SAT test-

takers, which, to my knowledge has not been done.[11] As mentioned earlier, the Wirtz-Howe panel (1977) concluded that selection factors in the changing composition of SAT test-takers accounted for a large part of the declines between the decade of the 1960's into the 1970's. If this is true, it is difficult to interpret SAT trends as if they represent something about the population of young persons of high school graduation age. For this reason I examine vocabulary test scores in national probability samples.

The Data

In six surveys obtained between 1974 and 1987 the *General Social Survey (GSS)* included ten items measuring verbal ability (NORC, 1987).[12] In each survey approximately 1,500 respondents from a cross-sectional sample of the U.S. were interviewed. Ten vocabulary words were given to respondents, and in each instance they were given five other word choices and asked to select the one that was the "closest to the meaning." The instructions were given as follows:

> We would like to know something about how people go about guessing words they do not know. On this card are listed some words--you may know some of them, and you may not know quite a few of them.
>
> Example. BEAST 1. afraid 2. words 3. large 4. animal 5. separate
>
> On each line the first word is in capital letters--like BEAST. Then there are five other words. Tell me the number of the word that comes closest to the meaning of the word in capital letters. For example, if the word in capital letters is BEAST, you would say "4" since "animal" comes closer to BEAST than any of the other words.

The following items were used:

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[11] Nesselroade (1988) describes some of the problems of generalizing under conditions of selection.

[12] These data were discussed in a NORC press release by Tom Smith and Susan Sample (1986). The present analysis builds upon their work via a detailed analysis of patterns in the GSS data.

a.	SPACE	1. school	2. noon	3. captain
		4. room	5. board	
b.	BROADEN	1. efface	2. make level	3. elapse
		4. embroider	5. widen	
c.	EMANATE	1. populate	2. free	3. prominent
		4. rival	5. come	
d.	EDIBLE	1. auspicious	2. eligible	3. fit to eat
		4. sagacious	5. able to speak	
e.	ANIMOSITY	1. hatred	2. animation	3. disobedience
		4. diversity	5. friendship	
f.	PACT	1. puissance	2. remonstrance	3. agreement
		4. skillet	5. pressure	
g.	CLOISTERED	1. miniature	2. bunched	3. arched
		4. malady	5. secluded	
h.	CAPRICE	1. value	2. a star	3. grimace
		4. whim	5. inducement	
i.	ACCUSTOM	1. disappoint	2. customary	3. encounter
		4. get used to	5. business	
j.	ALLUSION	1. reference	2. dream	3. eulogy
		4. illusion	5. aria	

Responses to this set of items are available from GSS surveys conducted in 1974, 1976, 1978, 1982, 1984 and 1987. The data permit the assessment of short-term trends, as well as variations among subgroups of the population. Here I make use of the number correct of these ten items--and refer to this score as WORDSUM using the GSS neumonic. Table 1 presents the characteristics of the WORDSUM data for these six surveys. These data show that Americans correctly identify the intended response in an average 6 of the 10 words used. Of course, roughly 2.5 words on this list can be identified on average by random guessing.[13]

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[13]Given the relatively small number of items used here, this measure may be less reliable than might be desirable. The Cronbach's alpha reliability of this score is estimated to be .707. If the test was twice the length, the reliability would be .828 (see Lord and Novick, 1968):84).

Insert Table 1 Here

This score exhibits a slight, but not statistically significant historical trend over the 13 years studied; which is especially impressive given the sample size.[14] There appears to be a very slight downward trend between the early surveys and the last, undertaken in 1987. However, as noted, this difference is quite small relative to the sampling variability present. There is, thus, much more evidence in favor of the hypothesis of constancy than one of change over this 13-year period.

Cohort Differences in Vocabulary Scores

While there is little, if any, temporal trend over the years of the GSS surveys, there are clear cohort patterns. Table 2 presents average vocabulary scores by 5-year birth cohort categories and the year of the GSS survey. Evident in these figures is a general incremental trend of increasing knowledge of vocabulary across cohorts, from those born early in the century through the post-World War II period, but these changes are dramatically countered in these data by a decline in vocabulary scores for the cohorts born after 1950. This decline, like that observed in Figure 1 for SAT-scores, is relatively systematic; however, unlike the SAT trend, the vocabulary score downward trend continues through the most recent birth cohorts.

Insert Table 2 Here

There are several possible interpretations of these results, although most explanations can be grouped into two categories: (1) those referring to differences in birth cohort experiences, or (2) those that point to aging and

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[14] A significant one-tailed ($p < .05$) inter-year difference in this case requires that these differences exceed a magnitude of approximately .12 on the 1 to 10 scale used.

life cycle processes.[15] According to the first type of explanation, one hypothesis is that birth cohorts differ in a wide range of experiences tied to the historical time in which their development occurs (Mannheim, 1952; Ryder, 1965). Birth cohorts experience different social and economic conditions, which might explain some of these differences. For example, birth cohorts may differ in their average amount or quality of formal schooling, or in the average number of siblings they experience, or in some other essential ingredient in their development. A second hypothesis suggests that factors tied to the life cycle, or aging, may better explain the decline. Specifically, it may be that at some periods in the life cycle individuals may acquire more knowledge as they experience more of life. Or, biological and cognitive processes of aging may make persons more or less ready to learn and retain what is learned at a given age. In the case of vocabulary knowledge, one might argue that the longer a person lives, the more likely s/he will acquire knowledge of vocabulary, but after some point in later life, individuals, on the average, may tend to lose the capacity to retain such knowledge.

Cohorts, Schooling and Vocabulary Scores

As one might expect, the amount of schooling experienced by respondents is strongly related to their vocabulary knowledge ($r = .52$, $p < .000$), and cohorts differ in their exposure to formal schooling. At the turn of the century, for example, 7.9 percent of the population 14-17 years old were enrolled

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[15]There is also a third potential explanation, having to do with selectivity in the population of young persons in the GSS data. In brief, because the GSS does not interview persons enrolled in college, unless they are living at home. Thus, the youngest age groups--cohorts born after 1955--may underrepresent parts of the distribution of schooling, possibly those who would have high scores on the vocabulary test used here. Presumably, however, this can be ruled out by controlling statistically for cohort differences in amounts of schooling in the analysis of cohort differences, as I suggest below.

in high school, whereas in 1970, 92.9 percent were so enrolled. In 1900, 4 percent of the population 18-21 years of age was enrolled in post-secondary universities and colleges, whereas some 53 percent of this subpopulation in 1970 were college students (Collins, 1979).

However, if vocabulary learning is correlated with schooling, that is, if the greater exposure of young persons to secondary and post-secondary schooling leads to the acquisition of more vocabulary knowledge, then one might actually expect the reverse of what is presented in Table 2. On the basis of this reasoning one would expect younger cohorts to have greater rather than lesser knowledge of vocabulary, and thus, it is not obvious how the exposure to greater amounts of schooling would lower the vocabulary scores of the younger birth cohorts, unless one posits some rather massive and systematic changes in the nature and/or quality of schooling.

Even though it seems implausible that differential exposure to schooling accounts for the cohort differences in the more recent time period, it is clear that in order to assess trends in verbal scores, it is desirable to control for different levels of schooling. In Figure 2 are presented two sets of average cohort vocabulary scores from the GSS data. The unadjusted scores are comparable to the "total" figures given in Table 2 for the 5-year birth cohort categories, although in Figure 2 the figures are given for each one-year birth cohort.[16]

Insert Figure 2 Here

The adjusted averages in Figure 2 take into account cohort differences in average amounts of schooling, using a linear covariance adjustment (see Blalock, 1972). These figures essentially remove any differences in vocabu-

[16]The GSS obtains the *age of respondent* by asking date of birth. Such reports are very accurate, so I feel confident that the use of one-year intervals does not force undue precision on the data.

lary scores across cohorts that are due to differences in amounts of schooling. In the present case this serves to accentuate the observed inter-cohort vocabulary score differences, rather than reduce them. And, the pattern over birth cohorts seems to reveal an even longer-term trend toward less vocabulary knowledge among members of more recent cohorts. In other words, schooling seems to act as a suppressor variable in assessing the relationship between cohort differences and vocabulary scores (see Darlington, 1968), because while the younger cohorts have lower vocabulary scores, they also have the most schooling. It appears, thus, that if the older cohorts (at least those born after 1910) had the same exposure to secondary and post-secondary schooling as did the younger cohorts, their vocabulary knowledge would be even higher than observed. And, one might reasonably argue that the vocabulary knowledge of the youngest cohorts should be higher than it is, given their greater amounts of schooling.

The inter-cohort differences in vocabulary scores are, thus, clarified by holding the amount of schooling constant, as in the adjusted trend line given in Figure 2. This long-term decline in verbal scores is significant in its implications. It suggests that, independent of the *amount* of schooling received, birth cohorts since 1910 have a diminished knowledge of vocabulary.

The findings differ from the SAT results reported above in two ways: (1) the downward trend follows a much longer time period, or range of cohorts, and (2) the vocabulary trends in the most recent time period, specifically the 1980's, do not show the same rebound for the youngest cohorts, as do the SAT results.

Understanding Inter-Cohort Patterns

As stated above, we can imagine two major types of explanations for the inter-cohort vocabulary trends observed here. On the one hand, with age and

maturity persons may acquire greater knowledge of vocabulary, or on the other, cohort experiences, net of amount of schooling differentials, may explain these results. In the following I explore both of these possibilities, with special attention to the demographic hypotheses regarding family size that have been advanced for downward trends in verbal scores in school cohorts graduating in the 1960's and 1970's.

Aging Explanations

If aging increases knowledge of vocabulary, then one might expect representatives of the same cohorts to reveal higher average vocabulary scores over time. In order to examine such *aging* effects, while at the same time controlling for level of schooling, I employed multiple regression techniques. In Table 3 are presented results from three regression models: (1) the first including a set of 12 dummy variables representing the 13 five-year cohort categories employed above (omitting the 1946-50 birth cohort),[17] (2) the second including these dummy variables, plus the amount of schooling completed (entered as a centered score),[18] and (3) the last including the foregoing variables and a linear variable representing the age at the time of the survey.[19]

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[17]The choice of which category to delete is completely arbitrary, but I chose the 1946-50 cohort because this was the apparent turning point in the SAT-score decline. If the SAT-score decline is real, then we would expect our vocabulary scores subsequent to this time to be decreasing (negative coefficients), and we should not expect great differences prior to that time.

[18]Schooling is centered so that the coefficients for the cohort categories may be interpreted as differences in adjusted means of a given category and the omitted category (1946-50) (see Blalock, 1972).

[19]This variable was coded as 1974 = 0, 1976 = 2, 1978 = 4, etc, which is perfectly correlated with age holding cohort constant. The expectation is that, if vocabulary increases linearly with age, this variable should show some significant, and interpretable, effect.

The coefficients in Table 3 are very revealing in light of the above discussion of the results in Figure 2. Birth cohort categories before and after 1946-50 show systematic downward trends from those being born in 1911 or after, once the amount of schooling is controlled (column 2). Cohorts prior to that--those aged 76 or older in 1987--are incompatible with this pattern, and the biological effects of aging might best explain this deviation. There is wide variability in the cognitive functioning of older persons, but there is enough dementia at this age to render this small decline in the oldest cohorts as partially due to such biological processes of aging (see Schaie, 1983).

The gross inter-cohort differences, however, only account for some 2 percent of the variance in vocabulary scores (see the coefficients of determination for model 1). With the addition of schooling to the model (see model 2), the overall variance explained is dramatically increased, due to schooling's selectivity on vocabulary knowledge and its apparently strong role in shaping vocabulary knowledge. It should be pointed out as well that, due to the suppressor effect involving education, the cohort differences actually contribute uniquely nearly 4 percent of the explained variance in verbal scores, once educational differences among cohorts are removed.[20]

Interestingly enough, the evidence for the effect of aging is weak. Assuming the results in Table 3 (see model 3) assess the effects of aging, this would suggest a minimal role of aging in the general patterns shown in Figure 2. Obviously, for the cohorts examined in the present analysis we can only assess the effects of 13 years of aging, and this may not be adequate for pur-

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[20]The relevant coefficient here is the increment to the explained variance due to the addition of the cohort dummy variables, compared to a model that includes only schooling. This figure (.309 - .272 = .037) is nearly twice that shown above for the raw inter-cohort differences, which have not been adjusted for the effects of education (R^2 = .0201).

poses of estimating the effects of aging. If, on the other hand, there are secular trends or "period" effects that are cancelling out the effects of age (see Glenn, 1977), the present results for aging may be spurious, in which case the effects of cohort might reveal an aging effect. But, if we can assume period effects are not operating, this analysis suggests that aging effects are inconsequential.

This is essentially the conclusion offered in longitudinal studies of cognitive functioning. For example, Schaie (1983:127) concludes that "reliably replicable age changes in psychometric abilities of more than trivial magnitude cannot be demonstrated prior to age 60." Schaie goes on to say that, if anything, a decrement is shown in old age, noting that a "reliable decrement can be shown to have occurred for all abilities by age 74." Schaie's results are based on a 21-year panel study of Seattle adults, and his conclusion is supported by other longitudinal studies (e.g. Cunningham and Owens, 1983).

There are a number of studies of the relationship of age and vocabulary knowledge (see the review of these by Botwinick (1967)). Some studies have shown that vocabulary scores increased with age and others have shown a negative relationship. The problem is that few of these studies have attempted to either (1) control for cohort differences by following the same panel, as in Schaie's (1983) research, or (2) control for cohort differences using longitudinal replications of surveys with statistical controls, as I have attempted here. When such controls are used, there is very little basis for the conclusion that aging contributes to net changes in vocabulary knowledge.

Demographic Explanations

As noted earlier, Zajonc (1976) suggested that SAT-score declines from the early 1960's through the late 1970's were due to the lagged effects of in-

crements in post-World War II fertility. In order to ascertain the potential for lagged-fertility rates to explain cognitive score declines, one would expect there to be a lagged association at the cohort level between increasing fertility rates and verbal scores since the late forties. And if intercohort differences in family configuration affect vocabulary knowledge, then we would expect it to follow fertility in a such a lagged fashion across all historical periods, unless of course the relationship was limited to a shorter time period.

In order to understand the potential for such a relationship the adjusted vocabulary scores and the lagged fertility rates for year-to-year birth cohorts are presented in Figure 3. For purposes of comparison, I also present the SAT verbal scores (from Figure 1).[21]

Insert Figure 3 Here

These results indicate that fertility rates gradually increased from the 1940's through the late 1950's, and then returned to 1940's levels in the decade of the 1960's. The trend in lagged fertility rates is almost exactly mirrored in the changing patterns of SAT-scores up until the mid- to late-1970's. From about 1975 onward, both lagged fertility rates and SAT score averages experienced a fairly regular decline. In 1981 SAT score averages began to reverse themselves, but this change is clearly not mirrored in the lagged rates of fertility. Similarly, the adjusted (for schooling differences) vocabulary score averages seem to roughly mirror the pattern of fertility rates, that is, cohorts of greater size have lower average WORDSUM scores, up until the late 1970's, but after that time, there seems to be an irregular

[21]Fertility rates were calculated as the number of births per 1,000 women aged 15-44, smoothed using 3-year moving averages. These figures were obtained from Arland Thornton. He is not responsible for any errors of interpretation in the use of these data.

between-cohort pattern. There is a slight short-lived increase in the adjusted WORDSUM scores after 1977, which would be consistent with the family configuration hypothesis; however, the SAT score averages do not seem to follow the same pattern, since the reversal in the SAT scores does not occur until the early 1980's.

The evidence presented to this point does not show a consistent role for changes in rates of fertility in explaining verbal test declines over the past century. There is some evidence that differences in fertility may have been related to test score declines during the 1960's and 1970's, but this association does not appear to extend beyond this period. To be specific, there does not seem to be a relationship between the lagged fertility rate and verbal test scores in the period prior to the 1960's or in the period after the 1970's.

It is not clear, however, that these patterns should tell us anything about the effects of family size, since the fertility rates by themselves only gauge the net addition of children in a given year, not the cummulative effects on family size. Moreover, it is well-known that causal analysis of this type cannot safely proceed using aggregate cohort data, since the aggregate-level relationship may in principle be different from the within-cohort relationship (see Duncan, Cuzort and Duncan, 1961). Thus, we must seek another solution to the evaluation of this issue, which I pursue in the following section.

Family Size and Verbal Scores

One approach to estimating the link between intercohort differences in family experiences is to estimate the within-cohort effects of family experience variables, and then use these estimates to adjust the vocabulary knowledge trends for the effects of cohort composition on family size. It is

possible to estimate the individual-level relationship of number of siblings and vocabulary knowledge. This would then permit an examination of the extent to which the inter-cohort trends in vocabulary knowledge can be accounted for by cohort differences in family size experiences. The GSS data contain a measure of *number of siblings*, and the zero-order relationship of number of siblings with vocabulary knowledge is shown in Table 4. The table presents average vocabulary scores by the respondent's number of siblings.[22]

Insert Table 4 Here

As depicted in this table, there is a clear and consistent decline in vocabulary scores with increments in number of siblings, accounting for some 8 percent of the variance in these scores. Of course, as this table also shows, the respondent's number of siblings is related to a number of additional exogenous factors--years of schooling, parental education and race--all of which are known to be related to vocabulary knowledge (see table below), and which could be producing a spurious relationship of family size and vocabulary knowledge.

Ethnicity and Vocabulary Knowledge

Tables 5 and 6 present the vocabulary scores by race and the amount of schooling. These results illustrate the potential importance of ethnicity and the amount of schooling in understanding variation in vocabulary scores, since for every level of education, whites have higher average vocabulary scores than non-whites, and within-race, vocabulary knowledge increases with greater amounts of schooling. This suggests a need to examine these processes

[22]It is not possible to assess the independent effects of birth order and child-spacing because the GSS surveys do not contain such measures. However, family size is the exogenous variable in this model, so it is still possible to assess its reduced-form, or total effect (see Alwin and Hauser, 1975).

separately for blacks and whites, since the other factors of interest may operate differently in the two subpopulations.

Insert Tables 5 & 6 Here

These results further illustrate the importance of controlling for the respondent's amount of schooling, as well as that of his/her parents, a primary determinant of the amount of schooling obtained. It also suggests that other socio-economic background variables correlated with parental education might also be important. Thus, in the following analysis I control for race/ethnicity, parental schooling and paternal occupational variation in assessing the independent effects of family size and schooling on the vocabulary score.

The Net Effects of Family Size

In order to control for these factors, I again turned to multiple regression techniques. I regressed the vocabulary score on four variables, separately for blacks and whites: mid-parent education, father's occupational prestige, number of siblings and years of schooling completed.[23] The regressions of the WORDSUM score on these variables also contained the set of birth cohort dummy variables, so as to estimate the intra-cohort effects of these variables. In other words, by including the cohort differences in the model, the remaining effects represent *pooled within-cohort* regression coefficients, essentially holding cohort variation constant. These results (absent the effects of cohort differences) are shown in Table 5. The regression coefficients show that among whites all of these variables are statistically sig-

"fathers" "families" Imputed

[23]Family size is measured as the number of siblings reported by the respondent to the GSS survey. Family socio-economic status is measured by two variables: the respondent's schooling and mid-parent schooling (the average of the amount of schooling of mother and father) are measured as the number of years of schooling completed, and the father's occupational prestige is measured using units of Hodge-Siegel-Rossi prestige scores.

nificant in a sample of some 7,785, but only schooling is significant in the smaller sample of blacks (n = 1,016).

Insert Table 7 Here

There are some similarities in the results for blacks and whites, such as the important reduced-form effect of mid-parent schooling and the strong influence of respondent's schooling. In both cases the metric coefficient is slightly smaller among blacks compared to whites. With regard to the family size variable, there seems to be little similarity between blacks and whites. There is no effect of family size on WORDSUM among blacks, but a small significant effect among whites. The reduced-form effect for blacks is more than one-half the size as that for whites, and the structural coefficient of family size among blacks is virtually zero.

Two observations can be made about the effects of family size among whites. First, more than one-half of the reduced-form effect (i.e. its total effect under this model (see Alwin and Hauser, 1975)) is accounted for by the intervening effect of amount of schooling. Second, the effect of family size does not stand out as the most important intra-cohort family background experience relevant to the development of vocabulary knowledge. Parental schooling seems to be somewhat more important, and in combination with paternal occupational prestige, these are among the most important socio-economic experiences affecting vocabulary knowledge.

The above results do not allow us to assess the total picture regarding the family configuration hypothesis, since the GSS data set contains no individual-level information on birth-order and child-spacing experienced by the respondent. Thus, we may have biased estimates of the effects of the four predictor variables included in this set of regressions. Knowing this, we

must temper whatever conclusions are set forth about family configuration and trends in vocabulary knowledge.

Family Size and the Vocabulary Trend

The above results may also be used to assess the extent to which *between-cohort* differences in family size might explain the WORDSUM trends displayed in Figure 2. Here I analyze the extent to which intercohort differences in family size can explain the trends in vocabulary knowledge. For this purpose I examine the role of family size in accounting for the differences among cohorts in vocabulary knowledge, once other predetermined variables have been controlled statistically. These analyses are presented in Table 8. Here are presented cohort effects for four different models, all of which control for parental socio-economic background (mid-parent amount of schooling and father's occupational prestige). The results are limited to whites, since family size has no apparent effect among blacks (see Table 7).

Insert Table 8 Here

The four models are as follows. The first model is a baseline model that represents the effects of family socio-economic background (mid-parental amount of schooling and father's occupational prestige), and cohort categories.[24] The second model includes family size with the variables in the first set. This permits an assessment of the extent to which the inclusion of family size reduces the inter-cohort differences in vocabulary knowledge. Essentially we compare the contribution to variance explained due to the cohort categories, before and after the inclusion of the family size variable into the model. The third model adds respondent's schooling to the equation, allowing the estimation of the indirect effect of family size on vocabulary

[24]As above, we have represented cohorts using a set of dummy variables, grouping birth cohorts in 5-year categories.

knowledge, via exposure to amounts of formal schooling. The fourth model excludes family size, but includes schooling, SES background and the cohort categories.

These results suggest the following: First, family size has a decremental effect on vocabulary knowledge, net of cohort and socio-economic background, a finding compatible with a substantial amount of literature. Second, the effect of family size is relatively small, compared to the effects of other aspects of the family. Third, the major portion of the reduced-form effect of family size is transmitted via respondent's schooling, meaning that virtually none of the cohort differences in vocabulary knowledge can be attributed to inter-cohort differences in family size experiences.

The Seventies

Changes in family structure were believed to have been more important in explaining the post-1970 SAT-score declines than the pre-1970 declines (Wirtz et al., 1977). For this reason I reanalyzed these models using just those persons born after 1950. The cohorts reaching high school graduation in the late 1960's and the 1970's (born 1951 onward) are those who are referred to within the framework of this reasoning. On this basis we would expect family size to provide an even stronger role in accounting for inter-cohort patterns of vocabulary knowledge within this subpopulation. These results are given in Table 9. The figures given there are based on the same models as those given in Table 8, but based on only those cohorts born after 1950.

Insert Table 9 Here

The results for this youngest subgroup of the white population do not vary at all from those for the entire population. A systematic decline is seen across the cohorts born since 1950, little of this decline is explained by cohort differences in family size, and a substantial portion of the change

is accounted for by the amount of schooling. But even holding constant schooling differences between cohorts, there are statistically significant differences in cohort scores on vocabulary measure. There is, thus, little basis in these results for the hypothesis that family size changes in the cohorts born since the post-World War II period are responsible for changes in vocabulary knowledge observed during that time.

Family Size and Inter-Cohort Trends in Vocabulary Knowledge

By comparing the explained variance of our several regression models, it is possible to render some assessment of the extent to which the cohort trends in vocabulary knowledge are explained by cohort differences in family size experiences. This information is given in Table 10 for all whites in the GSS data set (panel I) and whites born since 1950 (panel II). The coefficients of determination, or R^2, are presented for several sets of regression models in which the cohort categories are added to an equation containing other predictor variables. Thus, the first set of models assess the extent to which cohort factors contribute to the R^2, once parental education and paternal occupational prestige are in the model. The second set of models assesses the contribution of the cohort categories after family size is added to the basic model. Following the general framework of the regression models presented in Tables 8 and 9, the third and fourth set of models assess the effects of the cohort categories, net of family background and schooling.

Insert Table 10 Here

The comparison of the increments in the R^2 values for the first two sets of models indicates the extent of the cohort differences explained by family size. This figure, .043 - .041 = .002, indicates a very small net reduction in the inter-cohort differences in vocabulary knowledge due to differences in

family size. In the case of young whites a similar conclusion is reached, little of the cohort trend in vocabulary knowledge is accounted for by cohort differences in family size, despite the effect of family size on the vocabulary score. In short, the effect is simply not large enough to account for a trend of such magnitude.

Discussion

If the cohort differences in vocabluary knowledge reflect a trend in the social experiences of young persons, it is undoubtedly related to some of the social processes that contributed to the SAT-decline. However, the "trend" in vocabulary knowledge is not as steep a decline as the SAT-downturn over the 1960's and 1970's. Moreover, the vocabulary trend continues into the cohorts born in the early 1960's, whereas the SAT has apparently turned around.

In assessing long term trends in cognitive and verbal skills, it is important to place such considerations within the larger context of social change. Thus, in the previous presentation, I have discussed these trends in the context of the SAT-score declines of the 1960's and 1970's and public discussion of those apparent changes. As the several reports on the SAT-decline suggest, it is not possible to consider the SAT-decline without taking into account the importance of the transformation of post-secondary educational opportunities in the United States during the 1960's and into the 1970's. Indeed, one of the most important interpretations of the SAT-decline was that the SAT-test-taking population systematically changed its composition. Specifically, as indicated earlier, the advisory panel to the College Board suggested that most of the decline was actually a reflection of the fact that in the beginning of the 1960's massive numbers of lower-income and minority group young persons attended post-secondary schools.

This pattern continued until the 1980's, when black college enrollment began to decline. Recently, Hauser (1987a) tabulated data for high school graduates in the October Current Population Surveys of 1968 to 1985. He showed that the percentage of whites entering college declined from about 55 percent in the late 1960's to 47 percent in 1974, remained at about 50 percent through 1980, and then gradually rose to nearly 60 percent in 1985. Blacks, on the other hand, gradually increased in their percentage enrolled in college from about 39 or 40 percent in the late 1960's to a high of 51 percent in 1974 (the low point for whites), and then gradually declined to about 40 percent in the early 1980's.

Higher enrollment rates of socio-economically disadvantaged groups over this time period may help explain some of the SAT-score decline, although it will hardly explain the trends in vocabulary test scores reported here.[25] Presumably college enrollment rates are somewhat reflective of the SAT test-taking population, and thus, factors that affect college enrollment rates may also be affecting the SAT-score trends. Hauser (1987b) speculates that one plausible source of the decline in black enrollment rates over this decade is "the shift away from direct grants toward loans to finance college attendance." He theorizes that given the black-white income distributions, young blacks may "discount the future more heavily than whites at every income level." Moreover, black families are less likely to be able to absorb "the cost of a loan, again, regardless of income" (p. 21). Citing findings from the National Center for Research in Vocational Education's analysis of the High School and Beyond data of 1980, Hauser (1987b:22) concludes that the decline in young black's college plans relative to their aspirations "points

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[25]The main reason for this is that the data here are presumed to be representative of the general population. This is not the true of the SAT-test-taking groups.

in the direction of the lack of financial support as a key variable in explaining observed changes in college entry." Thus, the withdrawal in the early 1980's of financial assistance to low-income students in the form of basic grants may have had an unexpected effect on the nature of the SAT-score trends, essentially reversing the nearly two-decade decline. By discouraging college attendance among low-income students, including larger proportions of blacks and other minorities, the removal of "basic grant" financial assistance may in part be responsible for the recent upturn in SAT scores.[26]

In assessing the longterm patterns of vocabulary knowledge, one cannot ignore the changes in the perceived value of education in the early 1970's. Freeman (1976) and others noted that high school graduates in the early 1970's were perceiving a changing job market. By the early 1970's the cohorts born in the post-World War II "baby boom" were competing for jobs, and college graduates were experiencing declining salaries, more scarce job opportunities, and dwindling career prospects. A "college education" was seen as less of a necessity, and college enrollments began to decline, and the perceived value of education among potential matriculants to post-secondary institutions was on the wane (Freeman, 1976).

Socio-Economic Differences in Vocabulary Knowledge

For several decades there has been tremendous concern in the United States with differences in educational opportunities. The fact that equal educational opportunities have not been achieved is reflected to some extent in the vocabulary data presented here. It is also a distinctly plausible possibility, for example, that because of cultural/ethnic differences blacks and

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[26]The irony in this is that the Reagan administration may be, as it has claimed, responsible for the upturn in SAT-scores. It may not, however, be for the reasons given--the emphasis on "basic education--but rather, because of the reduction in "basic grant" financial assistance.

whites do not learn the same "vocabulary," even controlling for socio-economic levels. This is, of course, not inconsistent with any of the conclusions drawn here. The fact that vocabulary knowledge does depend on ethnic background may be read as a failure of schools to deliver the same education to all groups. On the other hand, the racial differences observed here may not reflect differing quality of schooling but a different cultural context in which learning occurs.

I cannot resolve these matters here--although both arguments seem plausible. There is no available "test" within the present data set that would distinguish them. At the same time, it is clear that schooling, among both blacks and whites, promotes learning of vocabulary knowledge, as measured here (see Tables 5 and 6). Thus, more schooling produces more of the type of vocabulary as assessed here. Thus, if there is a cultural bias in this measure, it seems to be related to increased exposure to the mass schooling system. Whatever the case, socio-economic and ethnic factors are related to vocabulary knowledge, and if the socio-economic and ethnic composition of SAT-score changed significantly, one would naturally expect the SAT-score to change. This issue, to my knowledge, has not been directly addressed.

While I doubt that the socio-economic and ethnic composition of the SAT-test taking population would account for all of the changes in SAT scores, such factors may potentially explain some of it. And, as suggested above, the recent leveling-off of the SAT-score trend is to some extent correlated with the failure of recent cohorts of lower socio-economic groups to attend college in rates equal to previous cohorts. In any case, such factors cannot be used as a basis for interpreting the present reported trends in vocabulary knowledge, since race and socio-economic background have been controlled throughout this analysis.

The Family and Inter-Cohort Differences in Vocabulary Knowledge

There is little question that the family has experienced considerable change in the past several decades. Aside from socio-economic changes, a number of factors have changed which are theorized to affect the contexts of child-rearing and potentially the outcomes of child development. Maternal employment is at an all-time high, children are increasingly experiencing the single-parent family, and there have been significant changes in numbers of siblings. Throughout the 1960's and 1970's cohorts of children were experiencing larger numbers of siblings than had been the case previously and since. My analysis of trends in vocabulary knowledge suggest that changes in family size probably had nothing to do with knowledge declines over the cohort categories studied. And, as suggested above, one might further conclude from such findings that it is unlikely that family size changes could account for much, if any, of the SAT-score decline.

Even so, one might argue that this analysis has omitted important aspects of family experience, which could be responsible for these trends. Specifically, one might argue that, since birth-order and child-spacing, two additional components of the Zajonc-Markus "confluence" model, were not included in this analysis of trends in verbal scores, the present results are incomplete, leading to the wrong conclusions. This is a distinct possibility that cannot be ignored.

Such an argument would apparently assume that birth-order and spacing have an independent effect on vocabulary knowledge, net of family size and socio-economic factors. However, the weight of the evidence regarding the effects of birth-order and birth-spacing leads to the conclusion that either (a) birth-order and child-spacing have no effect on intellectual performance, once family size and family socio-economic factors are controlled, or (b) they have

only small effects, and effects that are inconsistent across family sizes (see Cicirelli, 1978; Lindert, 1977, 1978; Melican and Feldt, 1980; Mercy and Steelman, 1982; Olneck and Bills, 1979; Record et al., 1969; Steelman and Mercy, 1980; Steelman and Doby, 1983; Velandia, et al., 1978; Wolfe, 1982). Thus, it is unlikely that the inclusion of these variables would render a different conclusion from that drawn here regarding the family configuration hypothesis.

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Table 1. Population Characteristics for 10-item Vocabulary Score, GSS Samples 1974-1987 (n = 9,185)

# Correct Wordsum	Year of Study					
	1974	1976	1978	1982	1984	1987
0	.7	.6	.7	.8	1.3	1.7
1-2	5.1	4.6	5.7	5.4	5.6	4.9
3-4	17.7	19.0	18.4	17.1	17.4	18.4
5-6	37.4	35.6	35.9	37.5	34.6	36.6
7-8	23.7	23.8	24.9	25.0	26.4	24.4
9-10	15.5	16.4	14.5	14.2	14.8	14.0
Mean	6.02	6.04	5.96	5.97	5.99	5.93
St. Dev.	2.21	2.23	2.23	2.16	2.25	2.25
N	1449	1438	1486	1728	1403	1681

SOURCE: SUM.7

Table 2. Average Vocabulary Score By Birth Cohort Categories and Year of the GSS Survey: GSS Samples 1974-1987 (n = 9,155).*

Birth Cohort	Year of Study						Total
	1974	1976	1978	1982	1984	1987	
1900-1905	5.420	5.471	5.402	5.341	5.727	5.341	5.437
	(162)	(140)	(112)	(71)	(44)	(30)	(559)
1906-1910	5.897	5.915	5.361	5.466	5.740	5.607	5.683
	(87)	(82)	(72)	(58)	(50)	(39)	(388)
1911-1915	6.295	6.454	6.063	5.606	6.175	5.830	6.076
	(95)	(108)	(80)	(98)	(57)	(67)	(505)
1916-1920	5.982	6.467	6.155	6.112	6.227	5.682	6.106
	(110)	(105)	(97)	(97)	(88)	(90)	(587)
1921-1925	6.191	6.025	6.321	6.049	5.785	5.669	6.015
	(115)	(120)	(109)	(129)	(93)	(108)	(674)
1926-1930	6.242	5.932	6.130	6.257	5.936	5.813	6.074
	(120)	(88)	(108)	(132)	(94)	(91)	(633)
1931-1935	6.109	6.526	6.523	6.051	5.877	5.989	6.178
	(128)	(97)	(88)	(109)	(73)	(99)	(594)
1936-1940	6.281	6.160	5.949	6.415	6.255	5.984	6.166
	(128)	(131)	(137)	(115)	(98)	(110)	(719)
1941-1945	6.279	6.212	6.240	6.455	6.333	6.086	6.263
	(154)	(146)	(150)	(154)	(120)	(159)	(883)
1946-1950	6.466	6.130	6.252	6.524	6.655	6.563	6.425
	(178)	(184)	(202)	(173)	(171)	(175)	(1083)
1951-1955	5.253	5.774	5.912	6.035	6.069	6.057	5.879
	(158)	(159)	(205)	(261)	(160)	(220)	(1163)
1956-1960	4.800	5.260	4.983	5.501	5.621	6.122	5.589
	(10)	(73)	(120)	(222)	(198)	(219)	(842)
1961-1965				5.067	5.385	5.467	5.362
				(101)	(156)	(268)	(525)
N	(1445)	(1433)	(1480)	(1720)	(1402)	(1675)	(9155)

* Sample sizes in parentheses
SOURCE: SUM.5; SUM.10

Table 3. Partial Regression Coefficients in the Prediction of Vocabulary Scores: GSS Samples.

	(1)	(2)	(3)	(4)
Born 00-05	-.979*	.578*	.567*	
Born 06-10	-.755*	.747*	.743*	
Born 11-15	-.374*	.766*	.764*	
Born 16-20	-.344*	.585*	.585*	
Born 21-25	-.434*	.339*	.340*	
Born 26-30	-.374*	.301*	.300*	
Born 31-35	-.271	.217	.216	
Born 36-40	-.280*	.143	.141	
Born 41-45	-.163	.063	.063	
Born 46-50†	6.450	5.891	5.930	
Born 51-55	-.571*	-.412*	-.409*	
Born 56-60	-.867*	-.590*	-.574*	
Born 61-65	-1.093*	-.726*	-.694*	
Schooling		.400*	.400*	
Age			-.007	
R^2	.0201	.3093	.3095	

Source: SUM.15R

*$p < .01$

†The cohort born between 1946 and 1950 serves as the reference category in this analysis and all cohort coefficients are interpreted as deviations from the mean (or adjusted mean) for this category. The coefficients in this row are, in model (1) the mean score for this category, and in subsequent models, the adjusted mean score for this category, adjusted for differences in schooling and age.

Table 4. Relationships of Number of Siblings with Vocabulary Knowledge, Amount of Schooling and Other Exogenous Variables.

Number of Siblings	n	Wordsum	Years of Schooling	Mid-parent Education	% Black
0	499	6.83	13.33	10.55	13.0
1	1,370	6.75	13.41	11.01	6.1
2	1,531	6.45	13.07	10.99	7.5
3	1,447	6.15	12.55	10.30	8.6
4	1,083	5.91	12.09	9.70	10.9
5	813	5.68	11.44	9.10	15.3
6	631	5.43	11.09	8.62	14.4
7	504	5.12	10.32	8.02	19.9
8	382	5.26	10.51	7.66	23.6
9	285	5.18	10.19	7.68	19.0
10	223	5.01	10.29	7.29	26.3
11	150	4.77	10.09	7.36	25.6
12+	303	4.59	9.72	6.69	33.5
Total	9,221	5.98	12.06	9.73	12.8
η^2		.08	.13	.12	.04

Source: SUM.14

Table 5. Average Levels of Vocabulary Scores By Education and Ethnic Status: GSS Samples 1974-1987 (n = 9,166).

Education	Ethnic Status					
	White	n	Black	n	Other	n
0-5	3.195	(128)	2.808	(78)	2.857	(7)
6	3.811	(90)	3.244	(41)	1.750	(4)
7	4.256	(156)	3.049	(41)	2.778	(9)
8	4.759	(536)	4.192	(73)	3.625	(8)
9	4.607	(295)	3.560	(75)	3.375	(8)
10	5.248	(464)	3.964	(110)	4.100	(10)
11	5.231	(428)	4.246	(142)	5.000	(11)
12	6.019	(2671)	4.696	(450)	4.211	(38)
13	6.503	(549)	5.160	(125)	5.500	(8)
14	6.906	(617)	5.358	(148)	4.706	(17)
15	7.154	(272)	5.574	(54)	6.167	(6)
16	7.894	(736)	6.206	(97)	4.429	(14)
17	8.072	(208)	6.148	(27)	8.500	(2)
18	8.246	(171)	7.364	(22)	5.833	(6)
19	8.429	(91)	7.000	(7)	5.750	(4)
20	8.714	(105)	7.714	(7)	9.000	(2)
Mean	6.174		4.649		4.373	
St. Dev.	2.167		2.007		2,591	
b_{yx}	.368		.251		.239	
r^2_{yx}	.283		.189		.137	
N	7517		1497		152	

SOURCE: SUM.5; SUM.3; SUM.4R; SUM.5C

Table 6. Average Vocabulary Scores By Education, Ethnicity and Year of the GSS Survey: GSS Samples 1974-1987 (n = 9,014).

Education	1974		1976		1978		1982		1984		1987	
	White	Black	White	Black	White	Black	White	Black	White	Black	White	Black
Less than 8	3.813	3.448	4.058	3.091	3.714	3.059	3.792	2.886	3.500	3.385	3.625	2.457
	(80)	(29)	(86)	(22)	(70)	(17)	(48)	(44)	(50)	(13)	(40)	(35)
8	4.892	4.769	5.009	4.636	4.700	3.556	4.711	4.350	4.603	3.667	4.419	3.714
	(111)	(13)	(107)	(11)	(110)	(9)	(83)	(20)	(63)	(6)	(62)	(14)
9-11	5.280	4.209	5.165	4.355	4.991	3.862	5.054	4.010	5.071	4.049	4.858	3.747
	(211)	(43)	(230)	(31)	(212)	(29)	(203)	(100)	(183)	(41)	(148)	(83)
12	6.075	5.250	6.156	4.522	6.146	4.843	5.888	4.558	5.993	4.959	5.817	4.545
	(441)	(44)	(473)	(23)	(486)	(51)	(455)	(138)	(411)	(49)	(405)	(145)
13-15	7.000	4.960	6.885	5.000	6.720	5.414	6.764	5.526	6.799	5.357	6.657	5.254
	(223)	(25)	(209)	(20)	(243)	(29)	(259)	(95)	(259)	(28)	(245)	(130)
16	8.183	6.375	8.089	7.167	7.944	6.000	7.933	6.280	7.574	6.417	7.693	5.946
	(120)	(8)	(124)	(6)	(107)	(9)	(119)	(25)	(129)	(12)	(137)	(37)
17+	8.295	6.000	8.512	6.000	8.372	7.000	8.519	7.000	8.175	6.167	8.070	7.105
	(88)	(4)	(80)	(3)	(94)	(3)	(81)	(8)	(103)	(6)	(129)	(19)
Mean	6.212	4.657	6.194	4.474	6.121	4.592	6.141	4.716	6.207	4.768	6.192	4.635
St. Dev.	2.184	1.867	2.183	2.091	2.206	1.915	2.097	2.168	2.176	2.003	2.160	2.011
b_{yx}	.413	.215	.398	.250	.405	.305	.406	.337	.412	.293	.416	.345
r^2_{yx}	.284	.111	.257	.137	.255	.209	.276	.202	.254	.155	.277	.231
N	1274	166	1309	116	1322	147	1248	450	1198	155	1166	463

SOURCE: SUM.5B; SUM.11R

Table 7. Intra-cohort Effects of Family Background Factors on Vocabulary Knowledge by Race.

	(1)		(2)	
	(a)	(b)	(a)	(b)
White (n = 7,785)				
Mid-parent education	.165**	.281**	.067**	.114**
Father's Occupation	.017**	.097**	.007*	.039*
Number of Siblings	-.125**	-.176**	-.055**	-.078**
Years of Schooling			.340**	.491**
R^2		.176		.335
Non-white (n = 1,016)				
Mid-parent education	.116**	.217**	.028	.053
Father's Occupation	-.003	-.018	-.006	-.034
Number of Siblings	-.033	-.064	-.012	-.024
Years of Schooling			.277**	.467**
R^2		.070		.200

Source: SUM.13R

*p < .01
**p < .001

(a) Metric coefficient
(b) Standardized coefficient

Table 8. Partial Regression Coefficients (Metric Form) for the Regression of Vocabulary Knowledge on Family Socio-Economic Background, Amount of Schooling and Cohort: GSS data (1974, 1976, 1978, 1982, 1984, 1987), Whites only (n=7530)

Variable/ Cohort Category	(1)	(2)	(3)	(4)
Mid-parent Education	.195***	.165***	.067***	.076***
Father's Occupation	.018***	.017***	.007***	.007***
Years of Schooling			.340***	.354***
Born 00-05	-.304**	-.170	.563***	.537***
Born 06-10	.004	.101	.778***	.764***
Born 11-15	.348**	.404**	.858***	.853***
Born 16-20	.369**	.400**	.705***	.705***
Born 21-25	.190	.208	.422***	.423***
Born 26-30	.200	.211	.416***	.420***
Born 31-35	.220	.195	.294**	.309**
Born 36-40	.111	.111	.215*	.219*
Born 41-45	.123	.090	.140	.156
Born 46-50	6.300	6.279	6.035	6.033
Born 51-55	-.584***	-.581***	-.436***	-.431***
Born 56-60	-.903***	-.853***	-.598***	-.609***
Born 61-65 or later	-1.339***	-1.354***	-.889***	-.864***
Family Size		-.125***	-.055***	
R^2	.149	.176	.335	.330

NOTE: R^2 for cohorts alone is .022
R^2 for MPE,FOC,SCHOOL is .288
R^2 for MPE,FOC is .106
R^2 for MPE,FOC,FSIZE is .135
R^2 for MPE,FOC,FSIZE,SCHOOL is .293
R^2 for Family Size only is .070
R^2 for Fertility Rate only is .005
R^2 for Cohort Size only is .000
R^2 for FSIZE,FERT,CSIZE is .072.

SOURCE: SUM.17R & SUM.17R2

Table 9. Partial Regression Coefficients (Metric Form) for the Regression of Vocabulary Knowledge on Family Socio-Economic Background, Amount of Schooling and Cohort: GSS data (1974, 1976, 1978, 1982, 1984, 1987), Young Whites only (n=1890)

Variable/ Cohort Category	(1)	(2)	(3)	(4)
Mid-parent Education	.228***	.204***	.108***	.116***
Father's Occupation	.019***	.019***	.009**	.009**
Years of Schooling			.361***	.377***
Born 1951	5.931	5.891	5.622	5.631
Born 1952	-.242	-.280	-.240	-.218
Born 1953	-.467*	-.459*	-.202	-.195
Born 1954	-.194	-.182	-.042	.046
Born 1955	-.381*	-.320	-.163	-.189
Born 1956	-.431*	-.392*	-.197	-.209
Born 1957	-.629**	-.546**	-.266	-.298
Born 1958	-.476*	-.407	-.165	-.190
Born 1959	-.871***	-.872***	-.545**	-.530**
Born 1960	-.581*	-.468*	-.274	-.292
Born 1961	-.978***	-.991***	-.719**	-.700**
Born 1962	-.756**	-.770**	-.345	-.318
Born 1963	-.684**	-.719**	-.384	-.350
Born 1964	-.970**	-.992**	-.442	-.406
Born 1965 or later	-1.597***	-1.609***	-.912***	-.874***
Family Size		-.128***	-.071***	
R^2	.203	.226	.349	.342

NOTE: R^2 for cohorts alone is .019
R^2 for MPE,FOC,SCHOOL is .331
R^2 for MPE,FOC is .172
R^2 for MPE,FOC,FSIZE is .194
R^2 for MPE,FOC,FSIZE,SCHOOL is .336
R^2 for Family Size only is .061
R^2 for Fertility Rate only is .002
R^2 for Cohort Size only is .007
R^2 for FSIZE,FERT,CSIZE is .072

SOURCE: SUM.17RY

Table 10. Coefficients of Determination for the Regression of Vocabulary Knowledge on Family Socio-Economic Background, Family Size, Amount of Schooling and Cohort: GSS data (1974, 1976, 1978, 1982, 1984, 1987), Whites only (n=7530)

Model		R^2	Comparison	Increment R^2
Part I (Whites)				
1	MPE, FOC	.106		
1A	MPE, FOC, + COHORT	.149	1A vs. 1	.043
2	MPE, FOC, FSIZE	.135		
2A	MPE, FOC, FSIZE, + COHORT	.176	2A vs. 2	.041
3	MPE, FOC, FSIZE, SCHOOL	.293		
3A	MPE, FOC, FSIZE, SCHOOL, + COHORT	.335	3A vs. 3	.042
4	MPE, FOC, SCHOOL	.288		
4A	MPE, FOC, SCHOOL, + COHORT	.330	4A vs. 4	.042
Part II (Young whites)				
1	MPE, FOC	.172		
1A	MPE, FOC, + COHORT	.203	1A vs. 1	.031
2	MPE, FOC, FSIZE	.194		
2A	MPE, FOC, FSIZE, + COHORT	.226	2A vs. 2	.032
3	MPE, FOC, FSIZE, SCHOOL	.336		
3A	MPE, FOC, FSIZE, SCHOOL, + COHORT	.349	3A vs. 3	.013
4	MPE, FOC, SCHOOL	.331		
4A	MPE, FOC, SCHOOL, + COHORT	.342	4A vs. 4	.011

Figure 1. Scholastic Aptitude Test Score Means, 1951-52 to 1976-77.

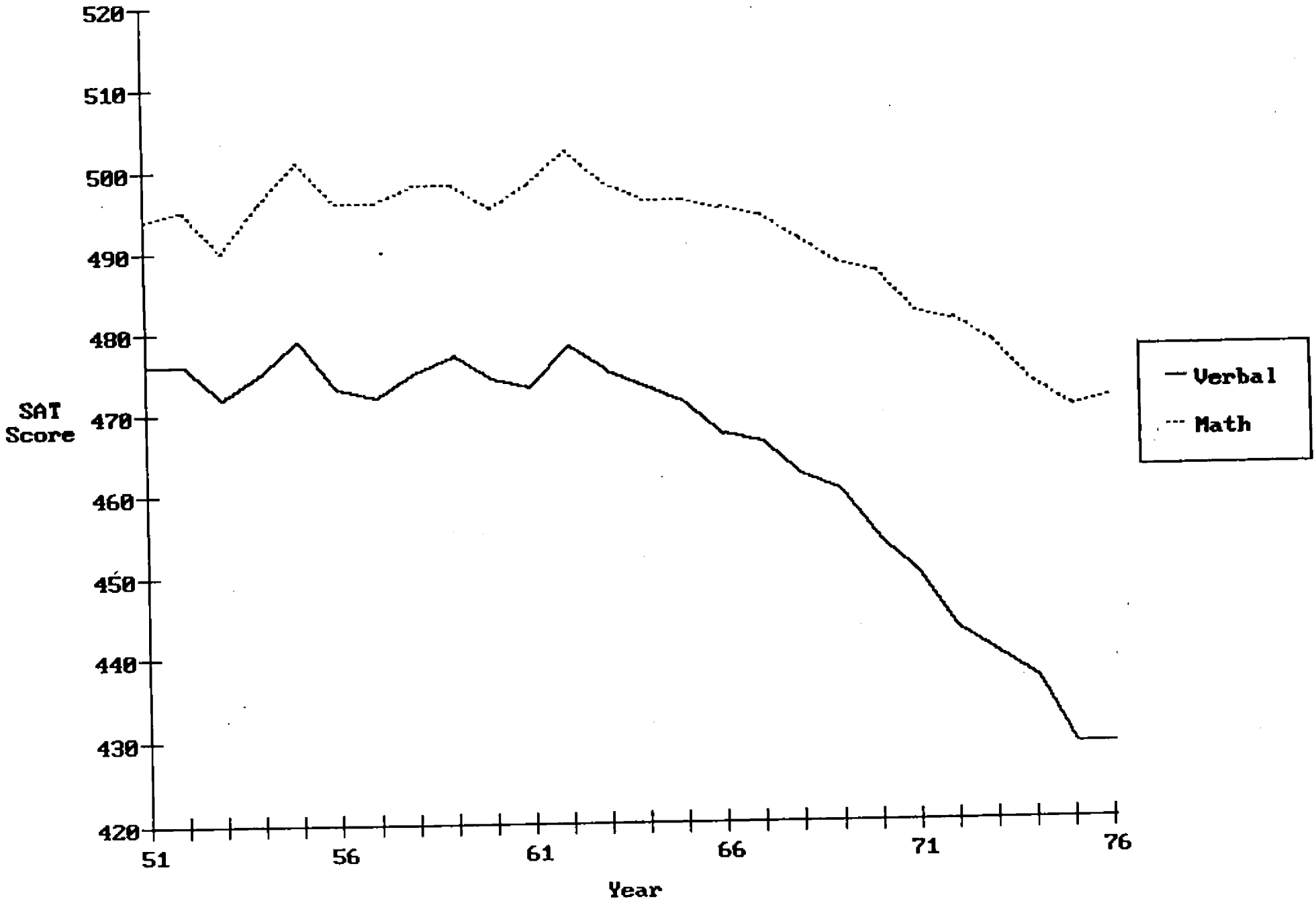

Figure 2. Average Vocabulary Scores By Birth Cohort
Adjusted for the Effects of Educational Differences

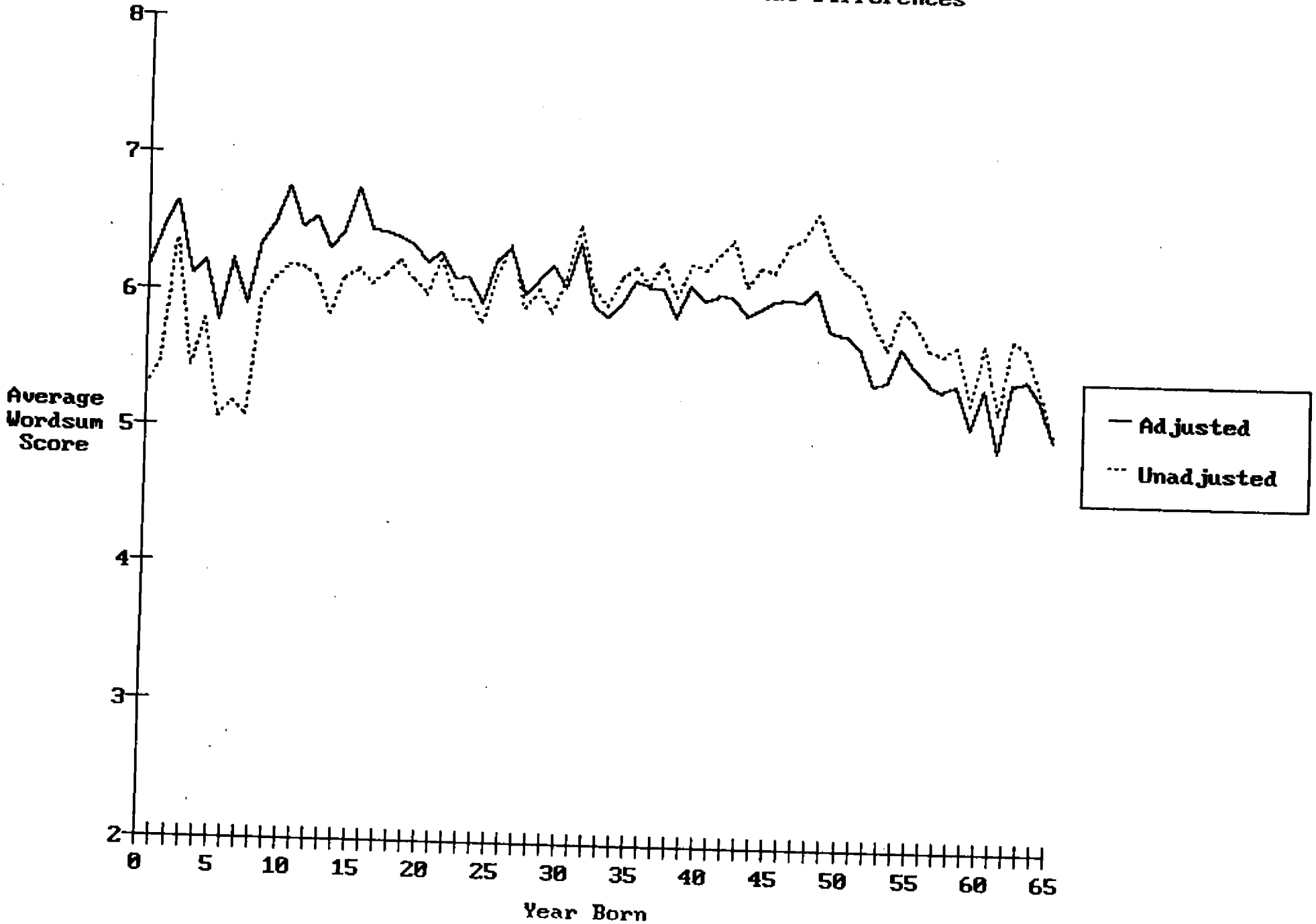

Figure 3. Lagged Fertility Rates and Cognitive Scores: 1934-65 Birth Cohorts