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ABSTRACT

In a recent article Jensen proposed the existence of what was termed the sex x race x ability interaction in which the differences in mental ability between the black sexes were larger than the corresponding differences among whites. Three large sources of data that were analyzed failed to reveal the interaction. Since Jensen's own work suggested that the interaction was negligible and appeared inconsistently, it was concluded that the phenomenon does not exist. Though there are differences between blacks and whites on sex differences in college attendance and occupational status, this investigation determined that, counter to what Jensen had proposed, the ability interaction does not cause the race x sex differences in these settings. More appropriate explanations would be environmental determinants as prejudice and a differential emphasis on the role of the female in the white and black culture. (Author)

AN INVESTIGATION INTO THE SEX x RACE x ABILITY INTERACTION

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at the

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In a recent article, Jensen (1971) examined a phenomenon he labelled the sex x race x ability interaction. The term interaction was borrowed from the statistical technique of analysis of variance and indicates, in this context, that ability differences between the sexes are larger in one race than in another. The differences Jensen referred to were those of mental ability, most commonly measured by IQ tests; the interaction described was based on findings of a greater male-female difference among blacks than whites.

This interaction indicated that although there are few, if any, sex differences in general mental ability among whites, among blacks, females outperform males. While Jensen acknowledged that the extent of the interaction was slight, he concluded, based on his review of the evidence, that the interaction was indeed real. The review was, however, hampered by the fact that there have been few investigations of this interaction, studies of race differences or sex differences per se being far more common.

Of the studies available that permit examination of the interaction, support for its existence is not uniformly offered. Jensen cited ten such studies, of which two did not reveal the interaction, one in which the WISC was the dependent measure and one where the Figure Copying Test was employed (z-scores were used to insure uniform interpretation across the different investigations). In both investigations the whites revealed a greater female superiority than the blacks, results contrary to predictions of the proposed interaction. In three of the other eight investigations which demonstrate the interaction, the differences in the female superiority were on the

order of a .05 standard deviation or less between those of the blacks and whites, resulting in a raw score difference of less than one point (.75 or .8 with standard deviations of 15 and 16). In three other studies the differences were between .05 and .1 standard deviation units, which likewise would result in trivial raw score differences. In only three studies then is there an interaction with standard score differences greater than .1.

Given this evidence the reader may well question the purpose in hypothesizing such a phenomenon. In point of fact, the sex differences do differ between the two races in "everyday", or applied occurrences. For example, recent evidence (Scientific Engineering Technical Manpower Comments, 1975) has indicated that the percentage of high school graduates who completed one year of college or more in 1974 was 50.6% of white males and 46.1% of white females. The corresponding figures for blacks were 36.9% males and 42.8% females. Other educational data, cited by Jensen (1971) indicate that in 1964, 67% of the National Merit Scholars were male, while in a scholarship program for blacks similar to the National Merit, only 43% were male.

This interaction is evident in other related settings too. Moynihan, cited in Rainwater and Yancey (1967), noted that according to the 1960 census, black men represented 1.1% of all male professionals while black women were 6% of female professionals. Among male and female technicians black men comprised 2.2% of all males while black women comprised 10% of female technicians. Jensen additionally reported that "black men in central cities had lower median incomes than those of white workers, but the median earnings of black women...

equalled the earnings of white women in the same occupations" (p.110). Even in death rates the sex differences between the races support the notion of an interaction. Whereas white males and females live on the average 67.1 and 74.8 years respectively, among blacks, the figures are 61.5 for males and 71.2 for females, a female superiority of 7.7 years among whites compared to one of 9.7 among blacks (New York Times, 1975).

Jensen's explanation of the development of the interaction is directly related to this later type of evidence, that is, it is a result of biological differences between males and females which in turn are influenced by environmental forces. Thus, it is widely acknowledged that females are more resistant to stress and stressful situations than are males, a superiority that reveals in itself the greater male incidence of stillborn fetuses and early infant deaths, learning disabilities as well as infantile autism, childhood schizophrenia and other behavioral disorders (Bentzen, 1963). This early sex difference in resistance to stress interacts with differences in the environmental conditions under which blacks and whites are raised. Because American blacks are brought up in admittedly more impoverished and hence stressful circumstances than are whites, black females, who are more capable of overcoming these conditions than are their male counterparts, are at an advantage. With regard to whites, given the absence of such negative conditions, this sex difference would not be manifest. It is Jensen's contention that this ability interaction leads in turn to the interaction in the "everyday" settings mentioned previously. This investigation sought

to determine whether the ability interaction is a viable concept. Because of the ethereal nature of support in the literature, multiple sources of data were examined to insure that the proposed phenomenon was not a function of the data alone. In addition, because of ambiguity in the definition of the term stress, it was defined in this study in two manners, both socioeconomic and racial. As most blacks are raised in poorer socioeconomic conditions than are whites, environmental stress was defined as socioeconomic status (SES). Because it is possible, too, that racial prejudice with its related difficulties, and not SES, may have been what Jensen was referring to, racial sex differences within SES levels were examined too. In this manner, three measures of mental ability were examined to determine whether the hypothesis that the female superiority in measures of mental ability is greater among blacks compared to whites would be supported.

METHOD

Three tests, each administered by separate organizations, the Psychological Corporation, the Pennsylvania State Department of Education and the American Institutes for Research[1] to three different groups of subjects, provided the data used in this study.

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The tests, the WISC-R, the Pennsylvania Educational Quality Assessment (EQA) Goal III and the Project TALENT aptitude measure, were administered to the subjects according to procedures outlined by the test developers.

The WISC-R, the revised version of the Wechsler Intelligence Scale for Children was administered in the early 1970s to 2,200 children, ages 6 to 16, by the Psychological Corporation to provide the standardization sample for the test. The subjects were carefully matched on the factors: sex, race, occupation of father, region of the country and type of locale. Region was categorized into one of four divisions: the Northeast, North Central, South and West; the type of locale into two: urban and rural.

Of particular interest to this investigation were the factors of race, sex and occupation. Subjects were categorized as white, black or "other". Those classified as "other" were not included in the analyses of this study, only 25, (1% of the sample) were so classified and were thus excluded. Of the remainder, 1,870, 85%, were white and 305, 14% were black. Of the whites, 945 were male and 935 female; the corresponding figures for the blacks are 143 male and 162 female. Father's occupation, the measure of SES, was divided into five levels, from professional to unskilled worker.

The second data source was the aptitude measure of Project TALENT, a large scale study of national scope which tested, in 1960, about 400,000 high school students in grades 9 through 12. Its purpose was to provide both an indication of abilities among the nation's high school students and follow-up the students for a period

of 20 years after their graduation from high school. The dependent variable in this study was the composite index of IQ, composed of scores on three tests, each given a different weight to yield the composite score. The subtest weighted the most was reading comprehension while abstract and arithmetic reasoning, comprising the latter two portions of the index, were each given nearly identical, though smaller weights.

The students included in the sample of this study were in the ninth grade in 1960. Questions pertaining to race and ethnicity were not included in the original testing but were asked of these respondents in the five-year follow-up after they were graduated from high school. Due to a bias in the response rates, in particular the tendency of those in the upper socioeconomic levels to be more diligent in responding than others, differential weighting of the responses was carried out from each SES and racial group. The weightings resulted in a total sample of 3,579. Of those, 3,371 or 94.19% were white while 208 or 5.81% were black, with each racial group nearly evenly divided into males and females. Three SES levels were included, composed of parent's education, income and related data.

The third source, the EQA, is a series of 10 measures, eight affective and two cognitive, developed by the Pennsylvania State Department of Education. It is given to all fifth-, eighth-, and eleventh-grade students in Pennsylvania within a three-year cycle; in any one year, therefore, about one-third of the students in these grades participate. In the Spring, 1974 sequence, which provided

the data utilized in this study, 152,944 students in all three grades, about 50,000 in each, fairly equally divided by sex, were eligible to take the tests. However, students attending school in Philadelphia were not included in this testing and as a result, the sample represents one-third of the eligible students in the state with the exception of those residing in Philadelphia. There were three levels of SES, composed of both father's occupational level as well as mother's educational attainment.

Of interest to this study were the two measures of basic mathematical and verbal skills. Each test contained 30 items to be completed within 15 minutes. The verbal consisted of general analogies while the math was of the type where two statements are given and the student indicates whether they are equal, one is greater than the other or not enough information is given to answer. It tested concepts including arithmetic skills, measurement, geometry, algebraic notions and number concepts.

DESIGN

Although the tests analyzed were different, the analysis of each was identical. All three data sources therefore, were analyzed by means of a three-way analysis of variance (ANOVA) in which the factors were sex, race and SES. Project TALENT and the EQA measures, containing three levels of SES were analyzed by a 2 x 2 x 3 ANOVA. The WISC-R, on the other hand, containing five SES levels, was subject to a 2 x 2 x 5 ANOVA; all three measures had subjects nested in all cells.

To overcome the limitations to the standard ANOVA presented by the disproportionate sample sizes, a multiple regression approach to ANOVA was performed (Kerlinger & Pedhazur, 1973). With dummy coding of the predictor variables, race, sex and SES, dummy vectors were created and tests of the significance of the interactions, as well as the contribution of each variable, were carried out. This procedure simulates well the standard ANOVA, without the complications presented when factors and interactions are not orthogonal.

RESULTS

The results of the analyses of the sex x race interaction have been summarized in Table 1, while the results of the analyses of other main effects and interactions are summarized in Table 2. The analyses of the sex x race interactions revealed that only two achieved statistical significance, both of which involved mean differences between the white sexes that were greater than those of the blacks, an interaction opposite to the direction hypothesized by Jensen (1971). The remaining interactions, in addition to failing to achieve significance, revealed no uniform pattern of sex differences by race. Of the 10 analyses, five demonstrated interactions in the direction of that proposed by Jensen and five did not. Much as Jensen had found in his review, the interaction appears inconsistently.

The two way, sex x race interaction of the WISC-R full-scale IQ did not reach statistical significance, F (1; 2,155)=.039, $p > .05$. The mean IQ scores of white males and females were 103.062 and 101.402 respectively, an IQ score difference of 1.660 in favor of

the males. The analysis of the Project TALENT data on the other hand, involving as did the WISC-R a fairly "pure" measure of cognitive ability, did not support the interaction. The sex differences by race, which did not achieve significance, F (1; 3,566) =.215, $p > .05$, revealed a greater female superiority among whites than blacks. White males had a mean of 150.947 compared to a mean of 90.460 while black females had a mean of 92.031. The resultant male-female sex differences of -5.339 for whites and -1.571 for blacks were in a direction opposite to that predicted by Jensen's hypothesis. In addition, the direction and extent of these sex x race differences remained constant across SES levels in both the WISC-R and TALENT measures, thereby indicating that SES [redacted] little, if any, effect on the hypothesized interaction.

Discussion of the results of the EQA math and verbal tests is complicated by the effect of age which necessitated a separate analysis at each of the three grade levels. Nevertheless, an examination of the results in Table 1 indicates that for these tests too, the nature of the interaction is far from consistent. Of the three grade levels, students in grade five received means most strongly in a direction opposite to the proposed interaction, results which reached statistical significance in fact, on the verbal measure. White males at this grade level received a mean of 17.843 compared to the females' 19.015, a male-female difference of -1.172. Black males on the other hand received a mean of 13.738 compared to 14.244 received by black females, a difference of -.506. This interaction was statistically significant at the .01 level,

F (1; 43,946)=9.165. On the math subtest, grade five white males received a mean of 19.260 while the white females received a mean of 19.447, a male-female difference of -.187. Black males received 15.041 as the mean, inferior by .038 points to the female mean of 15.079. This interaction did not reach significance, F (1; 44,088) =1.899, $p > .05$.

The results of the verbal and math EQA subtests for grade eight were more consistent with the hypothesized interaction, although neither sex x race analysis was significant, verbal F (1; 47,970) =.754, $p > .05$; math, F (1; 47,904)=3.649, $p > .05$. The mean of white males on the verbal was 15.985 while for females it was 16.281. Among blacks, males had a mean verbal score of 11.445 compared to 11.495 for females. The whites as a result had a sex difference favoring females of .296, for the blacks it was a male superiority of .050. On the math portion white males received a mean of 15.805 compared to 15.611 received by females, a difference of .194. Black males obtained a mean of 10.086 while black females received 10.365, a male-female difference of -.279.

The analysis of the grade 11 verbal and math EQA tests revealed a sex x race interaction on the verbal measure that achieved statistical significance, F (1; 43,946)=5.130, $p < .05$. The white males on this measure obtained a mean of 17.026 compared to 17.098 for the females. The resultant female superiority was slight, .072. Black males on the other hand, who had a mean of 12.813 were superior by .614 to the black females' mean of 12.199, an interaction not in the direction of that proposed by Jensen. The results of the

math test revealed no interaction F (1; 43,860)=.432, $p > .05$. The white males obtained a mean of 19.508, 1.007 greater than the females' 18.501. Black males received a mean that was similarly greater than that of the females'. Black males obtained a mean of 14.013 while the females received one of 13.039, a difference of .974 in favor of the males.

DISCUSSION

The failure of the sex x race interactions to approach statistical significance does not permit acceptance of the hypothesis forwarded by Jensen (1971). This stated that because of both the female's ability to resist stress and the stressful conditions under which most American blacks have been raised, black females are better able than black males to deal with their environments. As it relates to the hypothesis under investigation, however, he was not specific as to what variables within the environment affect the sex difference in resistance to stress. It has been repeatedly shown, for example, that blacks are, on the whole, poorer than whites and live in socioeconomically disadvantaged situations more often than whites. Thus, the environmental disadvantage mentioned by Jensen could be an economic one. The analysis of the data by means of the three-way interaction allows one to ascertain the extent of the sex x race interaction while taking into account differences in socioeconomic status. In this manner, if the interaction was influenced more by socioeconomic than by racial variables, the degree of the sex differences of blacks and whites within SES levels should have been

similar, results not found in this study.

In addition, had Jensen's hypothesis been supported by the data, one would have expected the sex differences, regardless of race, to increase with a corresponding decrease in the SES level. This is in accordance with the hypothesis stated by Jensen: "sex differences should increase, up to a point, in proportion to the unfavorableness of the environmental conditions" (1971, p. 122). Thus, greater sex differences should have appeared in lower socioeconomic levels than in higher ones. In fact, the results of the present study indicate that this was not the case.

To explore further the validity of this aspect of his hypothesis, sex x SES interactions were examined. As mentioned, these were negligible and failed to achieve statistical significance. Thus, it could not be argued, from the evidence of this investigation, that increasing socioeconomic deprivation leads to greater sex differences.

On the other hand, Jensen may have had racial and not socioeconomic factors in mind when discussing "environmental disadvantage". SES therefore, would not have uncovered these sources of disadvantage in the analyses of the data. Such racially determined variables may include prejudice and discrimination, which being stressful, could lead to a female superiority among blacks.

However, the analyses in this study attempted to control both socioeconomic and racial aspects of environmental sex x race interaction, the extent of the sex differences between the two races would have been similar regardless of SES level. The fact that in every measure of cognitive ability this type of result failed to

appear lends additional support to the conclusion that the sex x race interaction does not exist. Although the logic of the scientific method does not permit acceptance of this, the null hypothesis, other conclusions are difficult to reach: It is possible, though improbable, that aspects of the environment, other than racial or socioeconomic ones, may lead to the hypothesized interaction. However, this is unlikely as these are the most prominent features of the disadvantaged environments under which many American blacks are raised. Thus, although the interaction was referred to as one of sex x race, in actuality, sex x environmental disadvantage would have been more appropriate.

It is, therefore, the conclusion of this investigator that future researchers in this area would benefit from an examination of the attributes that lead to the interaction in the "applied" settings. This type of interaction, manifest by differences in college attendance and occupational categories, may appear in other situations as well, where environmental attributes may similarly influence the interaction. Jensen's hypothesis, by no means an illogical one, was not the most parsimonious one possible. More fruitful avenues of research for investigators in this area would be to explicate the environmental attributes that may lead to the interaction.

Table 1

Summary of Mean Sex x Race Differences
on All Dependent Measures

Dependent Measure		White $\bar{X}_m - \bar{X}_f$	Black $\bar{X}_m - \bar{X}_f$	Significance Level
WISC-R Full Scale		1.660	.467	NS
Project TALENT		-5.339	-1.571	NS
EQA Verbal	Grade 5	-1.172	- .500	$p < .01$
	Grade 8	- .296	.050	NS
	Grade 11	- .072	.614	$p < .05$
EQA Math	Grade 5	- .187	- .038	NS
	Grade 8	.194	- .279	NS
	Grade 11	1.007	.974	NS

Table 2

Summary of Differences on All Variables on All Dependent Measures

Test		Sex	Race	SES	SxR	SxSES	RxSES	SxRxSES
WISC-R Full Scale		NS	***	***	NS	NS	NS	NS
TALENT		NS	***	***	NS	NS	*	NS
EQA VERBAL	Grade 5	NS	***	***	**	NS	NS	NS
	Grade 8	NS	***	***	NS	NS	NS	NS
	Grade 11	NS	***	***	*	NS	**	NS
EQA MATH	Grade 5	NS	***	***	NS	NS	NS	NS
	Grade 8	*	***	***	NS	NS	NS	NS
	Grade 11	***	***	***	NS	NS	***	NS

* $p < .05$

** $p < .01$

*** $p < .001$

REFERENCES

Bentzen, F. B. Sex ratios in learning and behavior disorders. American Journal of Orthopsychiatry, 1963, 33, 92-98.

Jensen, A. R. The race x sex x ability interaction. In R. Cancro (Ed.), Intelligence: Genetic and environmental influence. New York: Grune & Stratton, 1971.

Kerlinger, F. N. & Pedhazur, E. J. Multiple regression in behavioral research. New York: Holt, Rinehart and Winston, 1973.

New York Times, October 12, 1975.

Rainwater, L., & Yancey, W. L. (Eds.), The Moynihan report and the politics of controversy. Cambridge, MA: The MIT Press, 1967.

Scientific Engineering Technical Manpower Comments, 1975, 12.