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Differential Effects of Age Upon Intellectual Functions Differing in Degree of Genetic Conditioning

By D. THOMPSON*

INTRODUCTION

It seems to be relatively well established by such investigators as Jones and Conrad (2), Miles and Miles (4), Lorge (3), Wechsler (5), Weisenberg, Roe and McBride (6), and Foulds and Raven (1), that age *does* have a differential effect upon various intellectual functions. Whereas this knowledge has already been utilized in the detection of intellectual deterioration, the etiology involved is still somewhat obscure. Various writers, such as Wechsler (5), have implied that the function which withstand the assaults of age best are habitual and informational in character and that those which show the earliest decrements involve problem solving and reasoning abilities. It is thus further implied that functions more largely contingent upon environmental exposure may be damaged very little by advancing age, whereas those depending upon ability to solve relatively unique problems, and thus less dependent upon exposure, may suffer more.

This sets the problem and expectation of the present study; it is that functions more environmentally conditioned should be less adversely, or more favorably, affected by age than those more largely genetically conditioned. For purposes of this study, parent-child correlation has been adopted as a measure of degree of genetic conditioning, and test and retest scores over a thirty-year period have been used to reflect the effects of age. It is herein proposed to investigate the relationship between the magnitude of parent-child correlations for the various sub-tests of Army Alpha and the size of the sub-test score differences (1950-1919) over a thirty year period.

METHOD

A previous study by Owens provided the latter data for the present investigation. The college over the years 1919-1927 gave Army Alpha, form 6, in the same manner as the A.C.E. is given today, except that it was not mandatory that a student take this ex-

*The present study is one aspect of a larger study supervised by W. A. Owens, sponsored by the Office of Naval Research.

amination. In 1950, 127 males who had taken the test as college freshmen in 1919 were retested with the same examination, thereby providing the data for the age changes herein reported.

In this latter investigation, students at Iowa State College whose parents had also attended Iowa State and taken Army Alpha were administered the same examination during 1951 and 1952. A total of 85 parent-child combinations was obtained, and product-moment correlations were computed by sub-tests for the group.

"D" scores (1950-1919) for the eight sub-tests of Army Alpha had been computed for the research done in the longitudinal study previously mentioned. These "D" scores were computed from test and retest scores, both of which were recorded as normalized standard scores from norm distributions composed of 1000 comparable cases. Subject by subject, the mean "D" scores of the sub-tests which showed significant parent-child correlations were subtracted from the mean "D" scores of the remaining sub-tests. The statistical test used was a simple t-test of the significance of the mean of the differences between the two categories of "D" scores.

RESULTS

Sub-test 2 (Arithmetical Problems), 4 (Synonym-Antonym), and 7 (Analogies) showed significant correlation coefficients at the 10% per cent level of confidence. The coefficients were 0.19, 0.31, and 0.19 respectively. The "t" value of 5.39 for the test of the mean of the difference scores was significant at the one per cent level of confidence.

DISCUSSION

It would seem to be desirable to make some comments as regards the functions represented by the sub-tests in each group. A component analysis of Army Alpha was done by McHugh and Owens on the data of the study by the latter previously mentioned. It seems reasonable, since the study was based on the data of the present one, that these results should be most applicable.

All sub-tests showed large weighings on the first principal component. This could be simply interpreted as indicating that all sub-tests showed a substantial amount of "G".

The various weightings on the second component are of particular

*The 10 per cent level of confidence was chosen for three reasons. First, due to the restriction in range caused by the homogeneity of the group all correlation coefficients were depressed. Second, since sample size could not be increased, it was decided to lower the level of confidence and increase the risk of accepting a chance result in preference to discarding data of probable meaning. Third, there was an apparent gap in the size of r's obtained (.19 and .08) suggesting that a difference in this level was reasonable.

value to this interpretation, in that they show sub-tests 2 (Arithmetical Problems), 6 (Number Series Completion), 7 (Analogies), to stand in opposition to sub-tests 4 (Synonym-Antonym), 5 (Disarranged Sentences), and 8 (Information). It seems reasonable to hypothesize that the former all place some premium upon ability to see relationships or to reason quantitatively, whereas verbal ability or verbal memory to be at a premium in the latter. If this interpretation is correct, the writer's original hypothesis is supported. Clearly the amount of information at one's command and the size of his vocabulary *are* conspicuously conditioned upon his environmental exposure and might be expected to increase with age. However, the suggested interpretation should be made cautiously since the cluster positions of sub-tests 4 and 6 are the reverse of expectation. It therefore seems that, whereas it may be stated with reasonable confidence that the Alpha sub-tests *are* differentially effected by age in accordance with the degree of their genetic conditioning, there still remains considerable doubt as to the intellectual abilities represented in the functions most and least favorably affected.

CONCLUSION

Age does appear to have a differential effect upon functions differing in degree of genetic conditioning.

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