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## **The Relationship Between Brain Size and Intelligence**

(Does Size Matter?)

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From philosophers to scientists people have long speculated about what factors affect, predict or measure intelligence. Obviously, much of this speculation has centered on characteristics of the brain. Recent scientific advances have enabled new ways to measure the brains of living people, thus providing new ways to analyze those characteristics in relation to intelligence.

### *Research Question*

Because the brain is the organ most closely associated with intelligence, the question arises whether there is a correlation between brain size and intelligence. This study reviews brain measurements and IQ scores to determine whether a relationship exists.

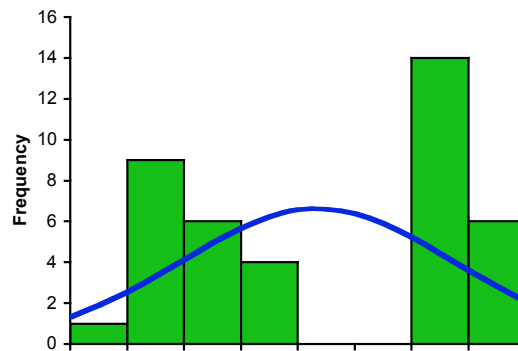
### *Data Collection and Analysis*

In a 1991 study at a large southwestern university (Willerman, Schultz, Rutledge, & Bigler, 1991), 40 right-handed, Anglo-American psychology students were studied. The homogenous sample was selected based on the accessible population and screened to eliminate any who had a history of alcoholism, brain trauma, epilepsy or heart disease. These students were further stratified by including only those who had total Scholastic Aptitude Test scores higher than 1350 or lower than 940 who had agreed to participate in a series of intelligence tests in order to satisfy a course requirement. Further, the sample included only those who had obtained a full-scale IQ of greater than 130 or less than 103 and was equally divided by sex and IQ score. Each of the 40 selected subjects received a Magnetic Resonance Imaging (MRI) scan of their brain at the same facility. The scans were used to compare brain size between these individuals.

This data set was found and summarized in the DASL database (*Brain Size and Intelligence*, 1996). The complete data set included scores for full-scale IQ, verbal IQ and performance IQ Based on Wechler subtests as well as measurements of body weight and subject height. For the sake of simplicity, this analysis has limited the data used to measurements for full-scale IQ and brain size.

### *Findings*

Initial analysis of the data involved reviewing the various test scores and scan results to determine if they exhibited a normal distribution. Due to the manner in which the sample was selected, it is not surprising that the distributions were not normal as shown in Figure 1.



*Figure 1. Full-scale IQ scores*

Because the data were non-parametric, further correlational analysis was performed using the Spearman rank correlation test with a null hypothesis stating that there is no correlation between IQ and brain size measured by the MRI scans. This test revealed an  $r_s$  statistic of 0.47 with a 95% confidence interval of 0.19 to 0.68, a wide spread suggesting a weak positive correlation shown in Figure 2.

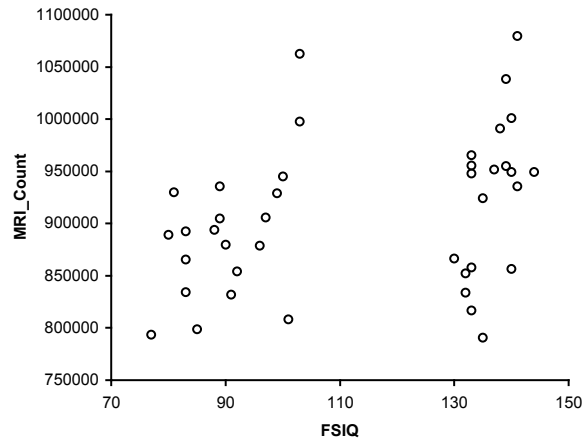


Figure 2. Correlation between full-scale IQ and brain size

### Conclusions

Because the sample was so narrowly defined and did not reflect a normal distribution of the population, these findings are far from definitive. While they suggest a weak correlation between brain size and intelligence, further investigation is required to determine if this assessment will be valid in a random sample that includes a normal distribution of the population. To gain further insight as to whether this correlation would remain significant for the broader population, it would be necessary to broaden the sample to include people of different ages, ethnicities and educational backgrounds, among other factors.

### References

*Brain Size and Intelligence*. (1996). Retrieved July 16, 2004, 2004, from

<http://lib.stat.cmu.edu/DASL/Stories/BrainSizeandIntelligence.html>

Willerman, L., Schultz, R., Rutledge, J. N., & Bigler, E. D. (1991). In vivo brain size and intelligence. *Intelligence*, *15*, 223-228.