

ABSTRACT REASONING AND SPATIAL ABILITIES
AMONG AMERICAN, BRITISH
AND JAPANESE ADOLESCENTS

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This study investigates the abstract reasoning and spatial relations abilities of American, British and Japanese 13-15 year olds with the Differential Aptitude Tests. The mean IQs of American and British adolescents were found to be virtually identical on both abilities, while Japanese adolescents obtained mean IQs of 104.5 for abstract reasoning and 114.0 for spatial ability. These results confirm previous studies showing that the Japanese have high abstract reasoning ability and unusually high spatial ability.

During the last decade there has been some interest in the intelligence of the Japanese. It has been claimed by the first author that different samples of Japanese, tested with different tests, obtain mean IQs in the range of 103-114, and that the Japanese have the highest intelligence in the world (Lynn, 1977, 1987). Some other investigators have published studies in general agreement with this position, but others have dissented. Among those whose work supports this position, Hilger, Klett and Watson (1976) obtained a mean IQ of 138 for Japanese children on a drawing test of intelligence, and Misawa, Motegi, Fujita and Hattori (1984) reported a mean of 113 for Japanese children on the Columbia Mental Maturity Scale, an American test of abstract reasoning. On the other hand no overall difference between Japanese and American children on a battery of intelligence tests was found by Stevenson, Stigler, Lee, Lucker, Kitamura and Hsu (1985). Thus the existing data exhibit a range of different results which make the present position unsatisfactory.

It has been suggested by the first author that the explanation for these conflicting results lies in the unusual pattern of abilities among the Japanese (Lynn, 1987). It is possible to consider the concept of intelligence from two points of view. On the one hand, intelligence can be regarded as a single entity which determines the level of performance on all cognitive

Subjects	Age	Abstract Reasoning		Space Relations		IQ
		Mean	SD	Mean	SD	
Boys	13	30.0	10.9	103.3	10.6	105.7
Girls	13	29.3	11.1	102.3	9.6	102.7
Boys	14	33.2	10.2	104.1	11.9	108.1
Girls	14	32.4	10.5	103.0	10.5	103.6
Boys	15	34.3	9.9	102.9	11.8	105.5
Girls	15	33.5	10.2	101.8	10.4	101.2
All Boys				103.4		106.4
All Girls				102.4		102.5
Total Sample				102.9		104.5

Table 1 Mean Scores of British 13-15 Year Olds and IQs on the American DAT.

problems. This view was advanced early in the century by Spearman (1904), who designated this broad ability as *g* (general intelligence) and considered that it was expressed most clearly in the solution of abstract reasoning problems. This view is considered by many contemporary psychologists to be substantially correct (e.g. Eysenck, 1982; Jensen, 1980).

However, this conceptualization has been subject to some refinement. It was proposed by Burt (1949) and Vernon (1950) that Spearman's general intelligence (*g*) could be divided into two broad groups of abilities which are generally designated the verbal and the visuospatial abilities. These two groups can themselves be split into several narrower primary abilities. Thus, the verbal group factor can be split into verbal reasoning, vocabulary, verbal memory, word fluency, arithmetical ability and possibly foreign language ability. Similarly, the visuospatial group factor can be split into different kinds of spatial comprehension and memory.

The division of Spearman's *g* into the two broad groups of verbal and visuospatial abilities has been widely accepted as a useful elaboration of Spearman's original thesis. There is considerable evidence that the two groups of abilities are represented in different parts of the brain, the verbal abilities being located in the left cerebral hemisphere and the visuospatial abilities in the right (Bradshaw and Nettleton, 1983). This generalization applies to the 96 per cent or so of the population who are right handed and to about half of the left handers.

This distinction between general intelligence (Spearman's *g*) and the verbal and visuospatial group factors has been employed by the first author for the analysis of the abilities of the Japanese. The proposal is that the Japanese have a slight advantage over whites (Caucasians) in the United States and Britain for Spearman's *g* and a quite substantial superiority for the visuospatial abilities. On the other hand their verbal abilities are relatively weak. The existing evidence from which this thesis is advanced is summarized in Lynn (1987).

It is considered that the pattern of abilities which appears to exist among the Japanese is sufficiently interesting to merit further study. This is the objective of the present paper. The study to be described has been designed to provide a simple and straightforward test of the hypothesis that Japanese children are slightly superior to white children from North America

<u>Locations</u>	Subjects	N.	Age	Abstract Reasoning			Space Relations		
				Mean	S.D.	IQ	Mean	S.D.	IQ
Country	Boys	27	13	33.6	7.7	108.2	33.1	9.8	115.0
	Girls	14	13	32.6	6.9	106.8	30.1	10.7	110.3
Country	Boys	20	14	36.8	9.1	109.0	43.1	14.0	123.8
	Girls	8	14	42.2	5.2	116.4	42.2	6.0	122.5
Country	Boys	16	15	38.8	8.8	109.0	42.5	11.5	117.9
	Girls	16	15	38.6	4.4	108.7	38.5	10.8	112.8
Town	Boys	38	14	39.4	5.8	112.5	43.1	11.2	123.8
	Girls	39	14	37.8	7.1	110.4	42.7	9.6	123.2
	Boys	101				110.1			120.5
	Girls	77				110.0			118.6
	Total	178				110.1			119.6

Table 2 Mean Scores of Japanese 13-15 Year Olds and IQs on the American DAT.

and Britain with regard to Spearman's g and are more markedly superior on spatial ability.

Method

The tests used in this study were the abstract reasoning and space relations scales of the Differential Aptitude Test (DAT), Form S (Bennett, Seashore and Wesman, 1973). Each scale takes 25 minutes. The abstract reasoning scale consists of geometric design series problems similar to those in Raven's Progressive Matrices. There are no sex differences on this scale. The space relations scale consists of problems involving the transposition of two dimensional designs into three dimensional shapes and requires visualization. Boys tend to do better on this test than girls with a mean advantage of approximately 0.20 of a standard deviation. This sex difference is a well-known feature of spatial tests.

The DAT was first developed in the United States in 1947 for the 13-18 year age range. It was re-standardized in 1972 on approximately 64,000 adolescents throughout the United States. The test was standardized in Britain in 1978 on approximately 10,000 adolescents drawn as a representative sample stratified for school type, region and source of school finance (Hodgkiss, 1978). It is considered that the representativeness of the samples and their very large sizes should make the norms highly accurate for both the United States and Britain.

The abstract reasoning and space relations scales of the DAT were administered in two schools in Japan in 1985. One was the junior high school serving all 7th-9th grade children (i.e. 13-15 year olds) in a fishing village in Honshu, the largest of the four principal islands of Japan. All the children in this school were tested who were present on the day of the administration of the test. The second school was in Ichikawa, Chiba, a dormitory town outside Tokyo which was selected as a typical urban school. All the eighth grade children (i.e. fourteen year olds) in the school were tested. The Japanese test administrator was not aware at the time of the administration of the tests that previous studies had shown that Japanese children have high spatial ability and that this finding was being checked in the present investigation.

Results

We consider first the scores of American and British adoles-

cents on the two scales. These are displayed in Table 1. The British means for boys and girls separately aged 13, 14 and 15 have been read off the standardization tables of the British manual. These means have been converted to IQs using the U.S. means given in the American Manual. Table 1 shows these means and corresponding IQs compared with an American mean of 100 (SD 15). The bottom row gives the total overall means of 102.9 for abstract reasoning and 104.5 for space relations for the entire British sample.

At first sight it seems that the British means are somewhat higher than the American but this apparent superiority is explicable. Two factors have to be taken into account. Firstly, it has been calculated that the mean IQ of children in the United States has been increasing by approximately 3 IQ points per decade over the period 1932-1978 and increases of about the same magnitude have also been taking place in Britain and Japan (Flynn, 1984; Lynn and Hampson, 1986). Since the American standardization of the DAT was carried out in 1972 and the British standardization in 1978, it is evident that the American means need to be increased by approximately 1.8 IQ points for a comparison with the British means as of the year 1978. It is also necessary to take into account the contribution of black American children to the American norms. It is well-known that black children score lower than white children on intelligence tests and the presence of substantial numbers of these in the American DAT standardization sample will yield a lower mean than would be achieved by white children alone. The mean IQ of American white children is approximately 101.7. This is the figure given by Jensen and Reynolds (1982) derived from the standardization of the WISC-R and calculated in relation to a mean IQ of 100 for all American children. This is considered to be sufficiently accurate for our present purposes.

Thus, to compare British children with white American children for the year 1978 it is necessary to add $1.8 + 1.7 = 3.5$ IQ points to the American mean of 100. The white British mean for abstract reasoning is now 0.6 IQ points lower than the white American mean (102.9 and 103.5 respectively) and the British mean for space relations is 1.0 IQ points greater than the American mean (104.5 and 103.5 respectively). Strictly speaking the British means are, in a statistical sense, significantly different from the American means ($t = 2.63$ and 4.38 respectively), but

probably few would wish to maintain that a difference of around 1 IQ point has real significance. We propose that the upshot of this discussion is that the means of British and white American children on both abstract reasoning and space relations are for practical purposes virtually identical.

We turn now to the Japanese means which are set out in Table 2. The data shown are the mean raw scores and standard deviations of boys and girls separately for the four samples (i.e. 13, 14 and 15 year olds in the village school and 14 year olds in the town school) and the equivalent IQs based on an American mean of 100 (SD 15).

Looking first at abstract reasoning, it will be seen that the Japanese obtain an overall mean of 110.1. However, this figure needs adjustment of the same kind as the British mean. The Japanese data were collected 13 years later than the American standardization sample data, so the American mean needs to be increased by 3.9 IQ points to give a figure as of 1985. A further 1.7 IQ points need to be added for a comparison between Japanese children and American white children only. These two adjustments bring the American mean up to 105.6 IQ points. It appears therefore that the Japanese sample scored higher than the American sample by 4.5 IQ points. This difference is statistically significant ($t = 3.99, p < .01$).

Turning next to the Japanese means on the space relations scale, it will be seen that the overall Japanese mean is 119.6. The American mean, adjusted as in the preceding paragraph, is 105.6, so that the Japanese superiority on space relations amounts to 14.0 IQ points. This difference from the American mean is statistically significant ($t = 12.42, P < .01$).

The Japanese clearly achieve higher mean scores on space relations (overall adjustment mean = 114.0) than they do on abstract reasoning (overall adjustment mean = 104.5). The difference between these two means is statistically significant ($t = 5.99, P < .01$).

The results of this study therefore indicate two conclusions. Firstly, Japanese adolescents score a little higher than Caucasian adolescents in the United States and Britain for Spearman's g , as measured by the DAT abstract reasoning test. Secondly, Japanese adolescents are quite markedly superior on spatial ability, as measured on the DAT space relations test. The results evidently confirm the hypothesis that the most striking feature of the intelligence of the Japanese lies in their strong visuo-

spatial abilities.

Discussion

The most interesting question concerns the causes of this distinctive pattern of abilities in the Japanese. As noted in the introduction, the strong visuospatial abilities of the Japanese appear to be accompanied by relatively weak verbal abilities. The reason that Stevenson et al (1985) found no difference between Japanese and American children in their study comparing Japanese children in the city of Sendai with American children in Minneapolis is that the tests they used were largely verbal, with a small portion of general reasoning and visuospatial tests. When the test results are examined individually it is apparent that the Japanese did well on the visuospatial tests but poorly on the verbal tests.

It is noteworthy that the Japanese pattern of abilities is also present among ethnic orientals in the United States. The literature has been fully reviewed by Vernon (1982), who concludes that on verbal tests American ethnic orientals obtain a mean IQ of about 97, while on non-verbal and spatial tests they obtain a mean IQ of 110. The persistence of this pattern in such widely differing environments may suggest some genetic basis to this pattern of abilities which is sufficiently strong to transcend cultural differences.

REFERENCES

- Bennett, G. K., H. G. Seashore, and A. G. Wesman
 1973 *Manual for the Differential Aptitude Tests*. New York: The Psychological Corporation.
- Bradshaw, J. L., and N. C. Nettleton
 1983 *Human Laterality*. Prentice-Hall, Englewood. Cliffs, New Jersey.
- Burt, C. L.
 1949 The structure of the mind: a review of the results of factor analysis. *Brit. J. Educ. Psychol.* 19: 100-111.
- Eysenck, H. J.
 1982 *A Model for Intelligence*. Springer-Verlag, Berlin.
- Flynn, J. R.
 1984 The mean IQ of Americans: Massive gains 1932 to 1978. *Psychol. Bulletin*, 95: 29-51.

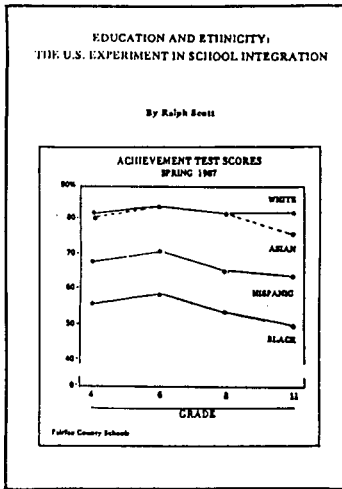
- Hilger, S. M. I., W. G. Klett and C. G. Watson
1976 Performance of Ainu and Japanese six year olds on the Good-enough-Harris drawing test. *Percept. Mot. Skills* 42: 435-438.
- Hodgkiss, J.
1978 Differential Aptitude Tests: British Manual. Windsor, United Kingdom: NFER Publishing Co.
- Jensen, A. R.
1980 Bias in Mental Testing. London: Methuen.
- Jensen, A. R. and C. R. Reynolds
1982 Race, social class and ability patterns on the WISC-R. *Person. Indiv. Diff.*, 3: 423-438.
- Lynn, R.
1977 The intelligence of the Japanese. *Bulletin Brit. Psychol. Soc.*, 30: 69-72.
1987 The intelligence of the Mongoloids: a psychometric, evolutionary and neurological theory. *Person. Indiv. Diff.* (to appear).
- Lynn, R. and S. Hampson
1986 The rise of national intelligence: evidence from Britain, Japan and the United States. *Person. Indiv. Diff.* 7: 23-32.
- Misawa, G., M. Motegi, K. Fujita and K. Hattori
1984 A comparative study of intellectual abilities of Japanese and American children on the Columbia Mental Maturity Scale. *Person. Indiv. Diff.* 5: 173-182.
- Spearman, C.
1904 General intelligence: objectively determined and measured. *Amer. J. Psychol.* 15: 201-292.
- Stevenson, H. W., J. W. Stigler, S. Lee, G. W. Lucker,
S. Kitamura and C. Hsu
1985 Cognitive performance of Japanese, Chinese and American Children. *Child. Devel.* 56: 718-734.
- Vernon, P. E.
1950 The Structure of Human Abilities. London: Methuen.
1982 The Abilities and Achievements of Orientals in North America. New York: Academic Press.

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EDUCATION AND ETHNICITY:
The U.S. Experiment in School Education

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**PROMOTING EDUCATIONAL DISADVANTAGE: A NEW DILEMMA
FOR AMERICAN BLACKS**



CONTENTS

The U.S. Experiment in Enforced
School Integration.

Playing the Social Science Card.

School Achievement and
Desegregation: Is There a Linkage?

Sex and Race Achievement Profiles.

Mandated School Busing
and Student Learning.

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It is perplexing that circumstances have worsened for literally millions of minority youths during a period which has witnessed the burgeoning of special programs designed to help them. For more than three decades the entire structure of U.S. education has been dramatically reshaped. However, as U.S. schools become racially 'balanced,' educators were forced to deal with large ethnic achievement gaps at the high school level. It is not uncommon, for example, for a tenth grade student to have trouble reading a third grade textbook while sitting beside classmates capable of college work. Typically, ability grouping was abolished, and classrooms and instructional groupings were racially balanced. Other race-conscious intervention measures followed: informal quotas on student discipline, on grading practices and in composition of 'special' classrooms. Ethnic quotas on discipline and suspensions have forced teachers to tolerate behavior which is most efficaciously curbed during the formative years. Racial quotas for exceptional students have radically altered what is meant by the terms 'mentally retarded,' 'gifted' and 'learning disabled.' Uncritical promotions have led to unacceptably high failure rates in high school and universities. The sensitive racial topics considered throughout this book are intended to promote rethinking of basic educational strategies which have proven to be harmful for both black and white students alike.

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THE INDIAN GOVERNMENT PROGRAM FOR STERILIZATION: A CASE STUDY IN UTTAR PRADESH

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The authors evaluate the effectiveness of a program for voluntary sterilization in India. Major defects are identified, such as the failure to restrict economic inducements to younger applicants .

Two aspects are now given more emphasis in the implementation of plan programs in India. First, a wider geographical spread in program implementation is stressed, with the objective of bringing more regions and more people into the mainstream of development activities. Realization of the targets set at district, block and village levels is therefore given weightage in assessing the overall performance of a program. Second, result-oriented rather than expenditure-related performance is given importance in program evaluation. Clearly identifiable and directly measurable physical targets are set, and the officials involved in program implementation at all levels are made responsible and accountable for the realization of the targets. Thus, numerical achievements such as the number of people pulled up above the poverty line, the number of couples covered by birth control measures, the number of landless people given land, etc. have all become important in the career assessment of the officials involved in program implementation.

Officials from the revenue, planning and health departments posted at district, block and village levels have more intimate knowledge of the socio-economic and political realities at the grass root level than higher level authorities, and as such they are better equipped to act as agents of change. To obtain improved results, the government has thus found it convenient to make better use of these officials by making them more accountable for program implementation.

This emphasis on the achievement of numerical targets has qualitatively changed the implementation of plan programs at the grass root level. Success stories, as measured by the realization of set targets, are now more frequently reported. However, not enough follow up studies are available to permit an objective assessment of these reported success stories. Moreover,