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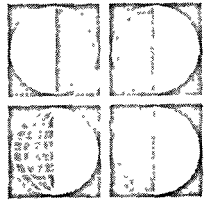
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Differential Rates of Secular Increase of Five Major Primary Abilities



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ABSTRACT: A number of studies have shown that mean intelligence levels have been increasing at a rate of around 3 IQ points per decade during the last half-century. This paper presents data for cohorts of 9–11 year olds in Northern Ireland tested in 1978 and 1988 and shows that the rates of increase differ markedly for different primary abilities. Verbal comprehension has shown virtually no increase, while there have been large increases in spatial relations and perceptual speed. Moderate increases have taken place in the numerical and reasoning primaries. The results are interpreted as supporting a nutrition theory of the secular increases in intelligence.

In the last few years there have been a number of reports showing that mean levels of intelligence have increased substantially in the economically developed nations over the course of the last half-century. Studies have reported increases in the United States (Flynn, 1984), Japan and Britain (Lynn and Hampson, 1986; Lynn et al., 1987; Lynn et al., 1988), in several countries of Continental Europe, and in Australia, New Zealand and Canada (Flynn, 1987).

Most of these studies have reported secular increases for a single IQ. However, when the data are examined, there is some indication that the nonverbal abilities have increased more than the verbal abilities. When the Wechsler tests are used, the performance IQ has shown a greater increase than the verbal IQ in the United States and several other countries (Flynn, 1987). In Britain we have found that the verbal Scottish test used in the 1932 and 1947 surveys has shown an increase of only 1.1 IQ points per decade over the period 1932–86 (Lynn et al., 1988) as compared with

an increase of 2.5 IQ points per decade obtained with the Cattell nonverbal test over approximately the same period (Lynn, Hampson and Mullineux, 1987).

The reasons for these secular increases in intelligence are not yet understood. Some light may be thrown on this problem by the apparent tendency of the nonverbal abilities to show greater increases than the verbal. There are two most probable explanations for the secular increases in intelligence. The first is that they are due to improvements in cognitive stimulation arising from the greater availability of toys, radio and TV, and improvements in education, as proposed by Teasdale and Owen (1987).

By this theory, greater increases would be expected in the verbal abilities than in the nonverbal abilities, because the verbal abilities are generally considered to be more responsive to cognitive stimulation. Thus, there are greater socioeconomic status differences in the verbal than in the nonverbal abilities in the United States (Jensen and Rey-

nolds, 1982), Britain (Nisbet and Entwistle, 1967), and France (Dumaret, 1985). The most probable explanation for the greater socioeconomic status differences in the verbal abilities is that these are to some extent taught in families, more so than the nonverbal abilities. Middle class families tend to be more effective in teaching the abilities and hence raise the verbal abilities more than the nonverbal abilities.

For this reason, an improved cognitive stimulation theory of the secular increases in intelligence would lead to the expectation that the verbal abilities would have shown greater increases than the nonverbal. Yet, as noted, the existing evidence suggests the contrary and therefore presents a difficulty for the theory.

The second possible theory of the intelligence increases is that they may be due to improvements in nutrition. There have certainly been improvements in nutrition over the course of the last half-century which are apparent from the secular increases that have taken place in a number of economically developed nations in height (Brandt, 1978). These improvements in nutrition have also led to increases in brain size (Ounsted et al., 1985; Davies et al., 1985) and possibly also to enhanced neurological development of the brain, e.g., in the growth of dendrites, glial cells, and myelination of the neurons. It is possible that neurological improvements of these kinds could be the principal factor responsible for the secular increases in intelligence.

There is some evidence that suboptimal nutrition has greater adverse effects on the nonverbal abilities than on the verbal. There have been two studies in which identical twins with differing birth weights, brought about by insufficient nutrition from the placenta to one twin,

have been given the Wechsler Test at the age of around 10 years. In both cases the lighter twin at birth was impaired on the performance (nonverbal) IQ, but there was no difference on the verbal IQ (Willerman and Churchill, 1937; Hendrichsen et al., 1986). These results suggest that the suboptimal nutrition of the lighter twin had adverse effects only on the nonverbal abilities. If this is true, secular improvements in nutrition would be expected to lead to greater increases in the nonverbal abilities. The existing data provide some suggestive evidence that this is the case, as noted above, and therefore tend to favor a nutritional improvement theory of the secular rise of intelligence.

In this paper, further data on rates of secular increase are reported for five major primary abilities and the implications of the results considered for theories of the factors responsible for the increases.

MATERIALS AND METHODS

The Primary Mental Abilities Test (Thurstone, 1963) measures and provides separate IQ's for the verbal comprehension, numerical ability, spatial relations, reasoning, and perceptual speed primary abilities. In 1978 this test was administered to all the fifth- and sixth-grade children (9-11 year olds) in four schools in a small town in Northern Ireland. In 1988 the test was administered to the children in the same grades in the same schools. It is therefore possible to determine the changes in mean IQ's for the five abilities separately.

RESULTS

The number of boys and girls in the two grades and their mean ages in months for 1978 and 1988 are given in

TABLE 1
NUMBERS AND MEAN AGES (MONTHS)
FOR BOYS AND GIRLS IN 1978 AND 1988

GRADE AND SEX	1978		1988	
	N	Age	N	Age
5th grade				
Boys	76	119.7	73	119.2
Girls	80	119.6	79	119.2
6th grade				
Boys	79	131.6	78	131.3
Girls	82	131.6	80	131.2

TABLE 2
INCREASES IN MEAN IQ'S OF 9-11-YEAR-OLDS, 1978-1988

TEST	1978		1988		IQ RISE
	Mean	SD	Mean	SD	
Verbal	109.50	18.20	109.82	18.24	0.24
Numerical	104.57	13.17	107.15	13.98	2.58 ^c
Spatial relations	97.59	16.84	103.77	16.11	6.18 ^a
Reasoning	106.18	15.52	107.48	16.23	1.30 ^a
Perceptual speed	98.60	12.81	107.48	16.48	8.88 ^a

Table 1. It is apparent that age and sex distribution of the subjects are closely similar for the two years. The intelligence test results are shown in Table 2. It will be seen that there are striking differences in the rates of secular increase of the five abilities. Verbal comprehension has shown virtually no increase at all, whereas there are large increases of 6.18 and 8.88 IQ points respectively in the spatial relations and perceptual speed abilities. The numerical and reasoning abilities show intermediate rates of increase. If the five abilities are averaged, there was a mean IQ of 103.30 in 1978 and of 107.14 in 1988, giving an increase of 3.84 IQ points. This figure is

broadly similar to the results obtained in previous studies, but it is apparent that the rise in global IQ conceals substantial differences in the rates of increases of the primaries considered separately.

DISCUSSION

The results confirm in sharper focus the tendencies of previous studies to show greater secular increases in the nonverbal abilities than in the verbal. The principal interest in the data lies in the bearing of the results for theories of the secular increases in intelligence. In the introduction to this paper, reasons were set out for expecting that an improved cognitive stimulation theory

would predict greater increases in the verbal abilities than in the nonverbal. Yet the results show no significant increase in verbal ability and a relatively small increase in numerical ability which is directly taught in schools and to some degree informally in families through such things as dice and card games. The really large increases are in the spatial relations and perceptual speed abilities which are very little taught either in schools or in families.

It is proposed that these differential rates of increase count against a cognitive stimulation theory of the rises in IQ's and favor a nutrition theory. As noted in the introduction, suboptimal nutrition appears to impair the performance IQ of the Wechsler but not the verbal IQ. The Wechsler performance IQ contains tests of spatial relations (the block design and object assembly tests) and also of perceptual speed (coding), so the larger rises of spatial relations and perceptual speed abilities may be attributable to secular improvements in nutrition. Possibly the causal sequence may be that improvements in nutrition have brought about larger head size and larger brains and that these in turn have contributed to improved intelligence. The head size of children has increased by approximately one standard deviation over the last half-century (Ounsted et al., 1985; Davies et al., 1985), and head size is correlated with IQ at a magnitude of approximately 0.3 (Van Valen, 1974). Alternatively, it may be that secular improvements in nutrition have generated enhanced neurological development of the brain, e.g., in the growth of dendrites and glial cells, and that this has led to the improvement of intelligence. The secular increase in head size could be just a further correlated effect of the improvements in nutrition.

There are three other points of interest in the results. First, many of the results on the secular rise of intelligence cover long time spans from pre-World War Two to a recent date, e.g., 1932-86 (Lynn et al., 1988). The present results show that intelligence is still rising over a recent decade at the same rate of increase. There is apparently as yet no diminishing returns effect.

Second, Flynn (1987) has expressed doubts as to whether the rise in IQ can reflect genuine rises in cognitive ability and argues that if increases in cognitive ability of one standard deviation over the last half-century had taken place people would have noticed it. The differential rates of increase suggest a solution to this problem. Probably we judge people's intelligence largely from their verbal ability and rather little from their spatial or perceptual speed abilities. As the verbal abilities have shown very little secular increase, we are not particularly struck by the rises that have taken place.

Third, it is commonly supposed that the nonverbal abilities decline with aging more than do the verbal abilities (e.g., Horn, 1988). Insofar as this conclusion is based on cross-sectional studies, a considerable element in this apparent effect is probably that the nonverbal abilities have shown greater secular increases than the verbal. Thus, the relatively poor nonverbal abilities of older people may well be largely due to the fact that the older generations never had strong nonverbal abilities, not to a decline in these abilities with aging.

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