

Prof. Rex Li's Writings

Category: Education

Sub-category: Gifted Education

Code: Edu 01 – 004

Title:

The Genetic Evidence of Intelligence

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Summary/ Abstract: The issue of heritability of intelligence starts from Galton and Darwin. Then there were twin studies to map out specific genes and traits since 1950s.

Today we speculate about heritability estimates and genetic component. The latest findings in epigenetics may throw light on the issue.

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Deep Reading on Genetic Evidence of Intelligence (Dai p. 47 – 53)

(1) The Issue of Heritability of Intelligence

The issue: Heritability of Intelligence

They Study: Twin study (identical vs fraternal) on Intelligence (a trait) to tease out genetic vs environmental factors.

Evidence of Genetically Based Biological Differences. The argument that early manifestation of exceptional competence or later outstanding achievement involves natural endowment has been closely associated with behavioral genetics, particularly with respect to the *heritability* of intelligence or general cognitive ability, psychometrically defined and measured (Plomin, 1997). The basic technique of this approach is to use various twin designs (identical twins versus fraternal twins or siblings, identical twins reared apart, etc.) to tease apart variances of a given behavioral and psychological trait that can be accounted for by genetic differences versus by environmental factors (Plomin, DeFries, Craig, & McGuffin, 2003; Scarr, 1997). More recently, efforts have also been made to

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(2) Findings of Twin Study – Map out Specific Genes and Traits

There is genetic component (gc) of intelligence:

(a) gc explains $\frac{1}{2}$ of variations

(b) Heritability estimates: get larger in adult vs child.

(Prof. Li: Interesting: It should become smaller when one grows older as learning / experience play bigger role.)

(c) Environmental factors have genetic components.

& McGuffin, 2003; Scarr, 1997). More recently, efforts have also been made to map out specific genes that might be responsible for major psychological traits. There are several findings that support a distinct genetic basis for intellectual and academic competence: (a) Genetic differences explain at least half the variation in cognitive ability measures; (b) heritability estimates (an index of the proportion of variance on a trait explainable by genetic factors) for intelligence are larger in adolescence and adulthood than in childhood, suggesting a pervasive genetic influence throughout life span (Plomin & Spinath, 2004); and (c) many factors traditionally considered environmental influences (e.g., some features of home environment, the type of friends a person has) have been found to have a genetic component; that is, through passive, evocative, and active correlations, individuals with specific genetic dispositions are likely to be selected in, or actively select, certain environments (Scarr, 1992; cf. Dickens & Flynn, 2001). If variations in

(p. 50)

(3) Cases of Exceptionality as Evidence of Genetic Factor

If the environments are “normalized” for most individuals (except for cases of physical and mental deprivation, social barriers for specific social groups, and cultural impoverishment during a specific historical period), cases of exceptional talent intelligence or severe mental retardation likely reflect individual variations (i.e., enduring individual differences) rather than environmental variations. Of

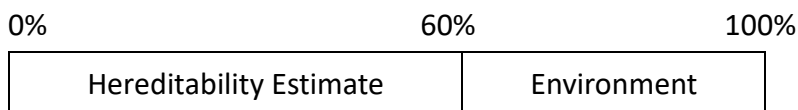
(p. 50)

(4) The Complication of SES & IQ

- 1) In upper-SES, IQ variation can be explained by genetics.
- 2) In lower-SES, IQ variation can be explained by environment. (heritable estimate = 0)
- 3) SES may itself have a genetic component.
- 4) Environmental compensation
- 5) Environment / education augment, not reduce, heritability estimate (he)

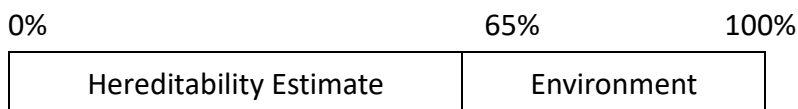
(Prof. Li: meaning here is that education does not reduce he, it enhances it. See graphic presentation below)

Before education intervention:



After education intervention:

→ push he



textualized.” For example, whether heritability of a trait is evenly distributed in a population is an open question. A recent study looked at variations in socioeconomic status (SES) as a moderator of the heritability of IQ (Turkheimer et al., 2003). For the upper-SES group, they found that the variation in IQ can be explained mainly by genetic differences. However, for the low-SES group, almost all variation in IQ can be attributed to environmental differences; the heritability estimate for the latter group was in fact zero. It is uncertain, of course, whether SES itself contains a genetic component (thus, using SES as a moderator might have inadvertently discounted genetic contributions), and whether dividing groups according to SES created truncated distributions of IQ. Nevertheless, the finding suggests that the variation in IQ scores on the lower end of SES may have different etiologies from score variations at the higher end of SES and implicate a distinct effect of environmental compensation (e.g., parental and social interventions despite low SES). Conversely, there are theoretical grounds for the prediction that when environmental support and educational resources become abundant, it would augment, rather than reduce, heritability estimates for the observed variation in intellectual competences (see Bronfenbrenner & Ceci, 1994; Ceci & Papierno, 2005; Gustafsson & Undheim, 1996).

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(5) New Conceptual Terms

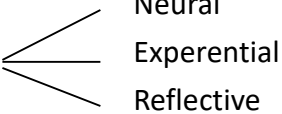
- 1) Behavioral genetics
- 2) Heritability estimates (he)
- 3) Genetic component
- 4) Moderator of heritability of IQ
- 5) Truncated distribution of IQ

(6) Summary p. 47 – 53

47 Being and doing / becoming
Galton vs Darwin (heritable vs hardwork)

48 Theses: giftedness is possessed
Antithesis: giftedness is achieved

R: Of course he meant synthesis:

49 Perkins 3 intelligence theories 
The race metaphor (different starting point + rate)

50 Reformulation of thesis

- Natural endowment
- Genetic basis
- Neuro anatomical
- Neuro Chemical
- Clinical

50 – 51 Deep reading – see former pages

51 Criticism against hereditary school

- 1) “decontextualized”
- 2) Not yet locating a gene for high intelligence.
- 3) Crude and artificial separation of environment and hereditary estimate
- 4) Only potential source, no process

52 – 3 Neuroanatomical Evidence

R: A lot of research since 2000, comparing smart brains with normal brains in MRI, EEG, ERP, etc.

- 1) The smart brains work more efficiently.
- 2) Different patterns of EEG / ERP.
- 3) R: Author cautions
“whether the observed neural correlate of high functioning indicate a neural causation”
- 4) Developmental neuro science: gifted and non-gifted children are different in prolonged cortical development (age 11 vs age 6)
“unique maturation process that was probably genetically controlled.”
Caution: “because of enriched environment”
- 5) Perfect pitch – structural asymmetry in brain
- 6) Mathematically-gifted in right hemisphere

53 Clinical cases

- 1) Chess – visual spatial – not related to social
- 2) Dyslexia – highly heritable with distinct brain morphology
- 3) Einstein – delayed language and very high spatial imagery.
- 4) Gershwind – “the pathology of superiority.”