The Genetics of Talent Development

Putting the Gift Back into Giftedness

Introduction: The Nature-Nurture Controversy

- Nature:
  - Galton's (1869) *Hereditary Genius*
  - Galton's (1874) *English Men of Science*
- Nurture:
  - Behaviorist Learning (e.g., Watson)
  - Expertise Acquisition (e.g., Ericsson)
    - Deliberate Practice
    - The 10-year Rule

Integration: Behavioral Genetics

- Environmental Effects
  - Shared (e.g., parental child-rearing practices)
  - Nonshared (e.g., birth order)
- Genetic Effects
  - Additive versus Nonadditive (emergenic)
  - Static versus Dynamic (epigenetic)
- Genetic → Environmental Effects
  - e.g., “deliberate practice”

Definition: Potential Talent

- Any genetic trait or set of traits that
- accelerates expertise acquisition and/or
- enhances expert performance
- in a talent domain (e.g., creativity)
- Traits may be
  - cognitive (e.g. IQ) or dispositional (e.g., introversion),
  - specific (e.g., perfect pitch) or general (e.g., *g*)

Two-Part Genetic Model

- Emergenic Individual Differences
- Epigenetic Development

Emergenic Individual Differences: The Model

$$P_i = \prod_{j=1}^{k} C_{ij}^{w_j}$$

Emergenic Individual Differences: The Model

- P_i is the potential talent for the *i*th individual
- C_{ij} is the *i*th individual's score on component trait *j* (*i* = 1, 2, 3, ... *N*)
- w_j is the weight given to the *j*th component trait ($w_j > 0$)
- Π is the multiplication operator (cf. Σ)

Emergenic Individual Differences: The Model

$$P_i = \prod_{j=1}^{k} C_{ij}^{w_j}$$

Emergenic Individual Differences: The Implications

- the domain specificity of talent
- the heterogeneity of component profiles within a talent domain

Hypothetical Profiles for Children with Equal High Talent ($n = 5$, $k = 3$)

Child (i)	C_{i1}	C_{i2}	C_{i3}	P_i
1	5	5	4	100
2	50	2	1	100
3	2	2	25	100
4	1	20	5	100
5	100	1	1	100

Hypothetical Profiles for Children with Zero Talent (n = 5, k = 3)

Child (*i*)	C_{i1}	C_{i2}	C_{i3}	P_i
1	0	0	0	0
2	5	0	50	0
3	20	20	0	0
4	100	0	0	0
5	0	5	5	0

Emergenic Individual Differences: The Implications

- the domain specificity of talent
- the heterogeneity of component profiles within a talent domain
- the skewed frequency distribution of talent magnitude
- the attenuated predictability of talent
- the low familial inheritability of talent
- the variable complexity of talent domains

Emergenic Individual Differences: Monte Carlo Simulation

- Component scores based on 5-point (0-4) scale, randomly generated under a binomial distribution (p = .5)
- N = 10,000
- Trait components' weights set equal to unity for both models (i.e., $w_j = 1$ for all j)

Univariate	+	+	+	x	x	x
Statistics	*k = 1*	*k = 5*	*k = 10*	*k = 1*	*k = 5*	*k = 10*
M/k	2.01	2.00	2.00	2.01	6.43	106.93
SD/k	1.00	0.45	0.32	1.00	9.06	320.06
Skewness	0.02	-0.02	0.02	0.02	3.04	10.69
Kurtosis	-0.50	-0.13	-0.07	-0.50	14.41	207.32
% $P_i = 0$	5.84	0.00	0.00	5.84	26.79	46.94
Max *z* Score	1.99	3.56	3.76	1.99	10.60	32.47

Regres-sion	+	+	+	x	x	x
Statistics	*k = 1*	*k = 5*	*k = 10*	*k = 1*	*k = 5*	*k = 10*
Mean β	1.00	0.44	0.31	1.00	0.35	0.17
Equation R^2	1.00	1.00	1.00	1.00	0.61	0.29
Maximum *t* Residual	0.00	0.00	0.00	0.00	12.67	38.75

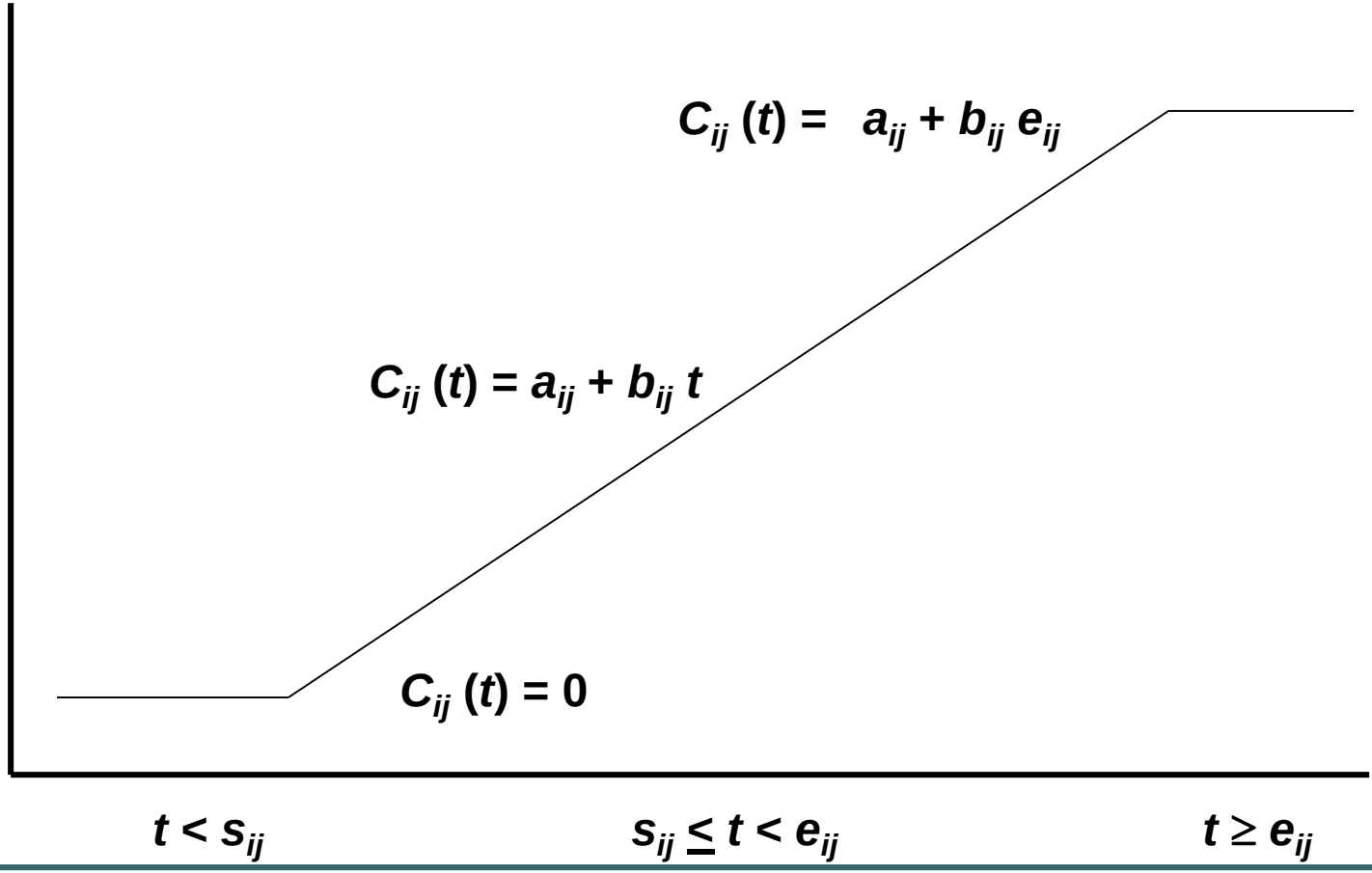
Epigenetic Development: The Model

$$P_i(t) = \prod_{j=1}^{k} C_{ij}(t)^{w_j}$$

e.g.

$C_{ij}(t)$ = 0, if $t < s_{ij}$,
= $a_{ij} + b_{ij}\, t$, if $s_{ij} \leq t < e_{ij}$, and
= $a_{ij} + b_{ij}\, e_{ij}$, if $t \geq e_{ij}$.

Epigenetic Development: The Model



Epigenetic Development: The Implications

- **the occurrence of early- and late-bloomers**
- **the potential absence of early talent indicators**
- **the age-dependent cross-sectional distribution of talent**
- **the possibility of talent loss** (absolute vs. relative)
- **the possible age-dependence of a youth's optimal talent domain**
- **the increased obstacles to the prediction of talent**

Conceptual Elaboration

- the ratio scaling of the talent component traits (cf. thresholds)
- the postulate of uncorrelated components, and
- the integration of the *k* component traits using a multiplicative rather than an additive function

Conceptual Integration

- Fourfold Typology of Genetic Gifts
- Additive versus Multiplicative Models
- Simple versus Complex Domains

Fourfold Typology of Genetic Gifts

	Additive	***Additive***	***Multiplicative***	***Multiplicative***
Results	***Simple***	***Complex***	***Simple***	***Complex***
Trait profiles	Uniform	Diverse	Uniform	Diverse
Distribution	Normal	Normal	Skewed	Extremely skewed
Proportion ungifted	Small	Extremely small	Large	Extremely large
Familial inheritance	Highest	High	Low	Lowest
Growth trajectories	Few	Numerous	Few	Numerous
Growth onset	Early	Earliest	Later	Latest
Ease of Identification	Highest	High	Low	Lowest
Instruction / training strategies	Few	Numerous	Few	Numerous

Caveats

- Focus solely on nature
- Nurture no less critical, and probably more so
- Combining nature and nurture would render the phenomenon not simpler, but even more complex owing to nature-nurture interactions