Genetic and Environmental Components of Leadership

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"Are Leaders Born or Made?"

- Frequent question—long history
  - Galton (1869) found that individuals who had attained "eminence" in their field was rare, but was more prevalent among family members
  - Problem: Families share common environment and genes
  - People have well developed opinions on this issue

Potential Traits Posited to be Related to Leadership

- Cognitive Dimensions: Lord, et al. (1986) meta-analysis of relationship between intelligence and leadership emergence (.50)
- Personality: Many dimensions suggested (e.g. aggressiveness, cooperativeness, achievement, etc.)
  - Evidence that personality factors are indeed related to different facets of leadership (Schneider, et al., 1999; Judge, Bono, Illies, & Gerhardt, 2002; Chang & Drasgow, 2001)

Evidence that such traits are also heritable

- Cognitive functioning: Well established finding that the heritabilities are around .50
- Personality: Jan, Livesley, & Vernon (1996) showed that the "Big Five" factors were also heritable:
  - Neuroticism—41%
  - Extroversion--53%
  - Openness—61%
  - Agreeableness—41%
  - Conscientiousness—44%
- Lohelin (1992) gave similar estimates

Little direct evidence for the heritability of Leadership

- Johnson, Vernon, McCarthy, Molson, Harris, & Jang (1998)
  - Used Monozygotic (n=183) and Dizygotic (n=64) same sex twin pairs
  - Used a self-report measure—Multifactor Leadership Questionnaire (80-items)
    - Measure of 9 different concepts: Attributed charisma, idealized influence, inspirational motivation, intellectual stimulation, etc.

Johnson, et al. Results

- While limited evidence for significant heritabilities for the nine scales, a general factor--"Transactional Leadership"—showed a heritability of 48%
- Another general factor—"Transformational Leadership"—showed a heritability of 59%

Present Study

- To investigate the role of genetic influences in explaining these traits and leadership
- In addition, to examine the roles played by cognitive and personality factors in explaining leadership

Sample

- Surveys sent out to 1116 males
- Total sample of 650 (response rate of 58%)—426 with complete data
  - Monozygotic (MZ) pairs: 119 (n=238)
  - Dizygotic (DZ) pairs: 94 (n=188)
  - Predominately white (98%)
  - Mean age = 36.8 (s.d. = 1.54)

Sample description

- 34.3% working in production, construction, operating, maintenance, material handling jobs
- 26.6% working in professional, paraprofessional, or technical occupations
- No differences observed between twin types on these variable.

Measures

- Bio-History Measure of Leadership
  - List the work-related professional associations in which they served as a leader
  - Indicate whether you have "taken charge of a special project" and/or "planned or coordinated a special event"
  - Positions at work held that would be considered managerial or supervisory in nature
  - Scale ranged from 0 to 11 (m=3.72, s.d.=2.84)
  - Reliability = .63
- Correlated with other variables according to expectations

Other Measures

- Personality Measures:
  - Telegen's "Differential Personality Questionnaire": Social Potency, Achievement, Social closeness
- Cognitive Functioning: Vocabulary test collected on one-third of sample

Analyses

- Assumptions with twin research:
  - Equal Environments Assumption
  - Assume additive genetic effects
  - V = Vg + Vs + Vn
  - Vs=variance due to the shared environments experienced by twins reared together in the same families
  - Vn=variance due to experiences of twins due to exogenous or external factors
  - The covariance between the MZ twins reflects variance due to shared environment and heredity only (Vg + Vs)
  - The covariance for DZ twins reflects .5 heredity + Vs

Preliminary Model

- h2= 2(intraclass MZ –intraclass DZ)

Intraclass	MZ	DZ	h2
Leadershp	.48	.21	.55
SP	.58	.19	.79
Ach	.47	.11	.72
Vocab	.77	.49	.56

Preliminary evidence for the heritabilities of leadership using these measures

Structural equation modeling

- Can give estimates of how much variance to apportion to different sources:
  - Genetic (additive)
  - Shared Environmental factors*
  - Non-shared environmental factors**

*Can calculate this by Vs=intraclassMZ –h2

**Calculated by “what’s left over”; also includes error

”Fit Statistics”

- Low Chi-square value
- Low RMSEA
- Lowest AIC value

Model Estimates

	Genetics	Shared Envir	Non-shared Envir
Leadership	.47	.00	.53
SP	.55	.00	.45
Ach	.43	.00	.57
Vocab	.43	.28	.29

Fit Statistics

	AIC	RMSEA
Leadership	-4.883	.00
SP	-1.704	.07
Achiv	-2.70	.05
Vocab	.932	.15

Very good fit according to these statistics, except for Vocab

Results (continued)

- Intra-class correlations indicate significant heritabilities for the Leadership and other measures
- Model testing procedures indicate significant heritabilities for Leadership and other measures.
- Roughly 35% to 50% of the variation in measured leadership is associated with genetic factors.
- Shared Environment plays minor role

Other Analyses

- Measure of personality were correlated against leadership measure: Social Potency (.35) and Achievement (.23)
- Cognitive variable also related to leadership (.17)
- These personality and cognitive factors also demonstrated significant heritabilities

Other Analyses

- Analyses showed that the same genetic factors explained both leadership and the personality factors- common genetic factors—but not for cognitive factor
  - Genetic correlation of 1.0 implies that all genetic influences on one variable also influence another variable
    - Cognitive-leadership genetic correlation=.07
    - Social Potency-leadership genetic correlation= .61
    - Achievement-leadership genetic correlation=.77

Discussion

- Assumptions: Early environments for MZ and DZ are roughly equal
- Problems with self-report measures—verification needed
- No identification of specific gene structures
- Didn't look at more complex models (e.g. interactions, dominance, etc.)
- Need replication with older sample
- Many developmental implications that need exploration