SOCIAL PRISM
Volume 2 Issue 4, 2025

Environmental Factors, Behavioral Interventions, and Political Leadership Development: A Critical Reassessment of Genetic Determinism

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Abstract

The present paper seeks to closely examine the ongoing debate about the relative roles of genetics and environmental factors in the formation of political leadership. Leadership studies conducted in the early days were based on the theories of Francis Galton, which emphasized the biological basis of leadership.The trait-based leadership theories further reinforced the idea of the importance of personal traits and cognitive abilities, which are often genetically predetermined, in the formation of political leadership. However, recent advances in political psychology, behavioral sciences, and epigenetics have challenged the reductionist idea of the biological predetermination of leadership ability.

This study, through the lens of Social Learning Theory, Ecological Developmental Theory, and recent leadership theories, argues for a socially constructed idea of political leadership ability. Environmental factors include education, political socialization, exposure to mentors, and institutional training. Behavioral factors include leadership workshops, political engagement, and behavioral training.

This study uses a quantitative approach through the analysis of a sample of 250 participants from a population of university students and political representatives (Union Councilors) using the SPSS software. The study makes use of reliability analysis, which involves Cronbach's alpha, correlation analysis that involves Pearson, and multiple regression. The study revealed that environmental factors and behavioral interventions have a strong predictive role in the development of political leadership ability, whereas the idea of genetic determinism had a weak predictive role. The study suggests a socio-environmental model in the development of political leadership ability. This study makes a contribution to the existing literature on leadership capability due to its interdisciplinary approach to the study of political leadership.

Keywords: Environmental Influences; Behavioral Interventions; Political Leadership Development; Genetic Determinism; Political Socialization; Leadership Formation; Nature–Nurture Debate

1. Introduction

At the heart of the debate that continues to be a recurring issue in Political Science, Psychology, and Leadership Studies is the simple question: are leaders born, or are they shaped by the world they find themselves in? The earliest theories, including some biological ones, pointed to the idea that leadership ability is rooted in a person's traits. Francis Galton's 1869 publication,

"Hereditary Genius," is a prime example. Galton argued that leadership ability and intellectual ability are largely the product of genetics. This provided the foundation for the theory of genetic determinism: the idea that leadership ability is encoded in our genes. However, more recent studies in the area of political psychology, behavioral science, and genetics have challenged this theory. This new school of thought suggests that leadership ability is the product of a combination of our biological makeup and the world we find ourselves in, and that the world plays a large role in the expression of our traits. Behavioral genetics, as a science, recognizes that while personality traits do have a hereditary component, the environment plays a large role in the expression of these traits (Arvey et al., 2006). Leadership ability is a combination of emotional intelligence, moral character, cognitive ability, and a deep understanding of the world and the institutions in which we find ourselves. This is not something that is encoded in our genes. Leadership ability is shaped by the world we find ourselves in and the social processes that surround us. This is in line with the theory of Social Learning Theory, as propounded by Albert Bandura in 1977: "Observational learning theory proposes that learning occurs through observation, imitation, and reinforcement." James MacGregor Burns, in 1978, also proposed the theory that leadership ability is a developmental journey: a relational approach shaped by our moral character and the world in which we find ourselves.Epigenetics provides a new dimension to this. Epigenetics examines how environmental factors affect the expression of genes. In this case, environmental stimuli can either activate or deactivate genes without any change in DNA. Biological responses, therefore, react to social and institutional settings, thus undermining the assumption that biology predetermines our destiny. Stress, education, mentoring, and training are integral components of this process, which are essential in our cognitive and behavioral responses. Currently, in political leadership, especially in new democracies, leadership is informed by institutions, party networks, and opportunities for citizens to participate. This, therefore, provides an impetus to question genetic determinism. If leadership can be shaped by environmental factors as opposed to genetic predeterminism, then leadership development policies acquire new meaning. This study aims to evaluate genetic determinism by examining the relative contribution of environmental factors compared to genetic predeterminism.

2. Literature Review

2.1 Genetic Determinism and Early Leadership Thought

The roots of genetic determinism in the study of leadership go back to the ideas of Francis Galton, whose book "Hereditary Genius" was published in 1869 and posited that intelligence and power to lead were largely heritable. From this, the Great Man Theory emerged, which posits that leaders are born with certain unique qualities that make them leaders. The early trait theorists sought to identify certain stable qualities of leaders, such as intelligence, dominance, self-confidence, and charisma, which they believed were biologically based. However, recent studies have challenged the universal and stable nature of such traits in the context of leaders. Behavioral genetics has shown that personality traits associated with leaders have only moderate levels of heritability. For example, studies by twin researchers have shown that genetic factors contribute to the variation in certain psychological traits, with the study by Bouchard et al. in 1990 suggesting that genetic factors contribute to 30-50% of the variation in certain psychological traits. More specifically, the study by Arvey et al. in 2006 found that having a leadership position had a heritability factor of 30%, but this does not mean that leaders are not changeable. Such criticisms have surfaced that the concept of genetic determinism is too simplistic in understanding the complex social and political behaviors associated with leadership.

Leadership is a multi-dimensional construct that is influenced by cognitive, environmental, and institutional factors.

2.2 Trait Theory Revisited

In contemporary trait theory, as discussed in the 2002 study by Judge et al., a correlation between the five-factor model personality and leadership emergence is noted. However, these personality traits are shaped by social experiences over time.

In addition, the contextual leadership theory suggests that leadership traits do not fully explain leadership success. For instance, in political leadership, the ability to be responsive to the changing institutional environment, the public, and the ability to navigate ideologies is critical. Traits may be the foundation for leadership predispositions, yet the actual development and expression of leadership are a product of environmental engagement.

2.3 Environmental Factors and Political Socialization

Environmental leadership theories draw a great deal from political socialization theory. We do not have an innate understanding of the political world or the behavior of leaders. We develop this understanding through our family life, educational experiences, friendships, and the organizations we encounter.

One useful model for understanding political socialization is Urie Bronfenbrenner's "Ecological Systems Theory" (1979). He proposed that the growth of an individual takes place within a set of concentric environmental layers.

- Microsystem (family, school)
- Mesosystem (community institutions)
- Exosystem (media, local governance)
- Macrosystem (political culture, ideology)

Development of political leadership results from a mix of complex environmental factors. In political science, the concern is often with the means by which people participate civically and the means by which institutions learn. Verba, Schlozman, and Brady (1995) suggest that political participation results from a mix of resources, participation, and recruitment networks. The more people are exposed to political institutions, the more their political leadership aspirations are developed.

When data is reviewed, education is a major indicator of political aspirations and leadership goals (Fox & Lawless, 2005). These data contradict biological-based models.

2.4 Social Learning and Behavioral Interventions

Albert Bandura’s Social Learning Theory, which was presented in 1977, revolutionized our comprehension of human behavior since it revealed that humans can acquire behaviors and learning through merely observing and mimicking other people and through reinforcement and

punishment. When it comes to leadership, behaviors such as persuading, conflict management, and ethical judgment are all important and can be learned through modeling and training.

Empirical research has verified that behavioral interventions such as leadership training programs, mentoring, and cognitive-behavioral techniques are effective for improving performance in these behaviors.

- Emotional intelligence
- Decision-making capacity
- Communication skills
- Stress regulation

Transformational leadership theory, introduced by James MacGregor Burns (1978), emphasizes moral development and value-based leadership, both of which are cultivated rather than inherited.

New research into leadership development indicates that well-designed training programs have a significant positive impact on leadership effectiveness scores (Avolio et al., 2009). These improvements have been found across different genetic backgrounds, suggesting that leadership skills can be changed.

2.5 Epigenetics and Gene–Environment Interaction

A scientific breakthrough that undermines the genetic determinism paradigm is the emergence of the epigenetics field. Epigenetics examines the role of environmental factors in influencing gene expression. Research in behavioral epigenetics has revealed that factors such as stress, education, nutrition, and social environment influence brain functions and emotional responses. Genes are thus responsive to environmental inputs. A more realistic view than the nature versus nurture dichotomy is the nature via nurture paradigm. While genetic factors define the baseline capacity for development, the environment determines the expression of genetic factors. This paradigm undermines the notion of genetic determinism in the development of political leadership.

2.6 Political Leadership as a Developmental Process

Current research on political leadership focuses more on the developmental nature of political leadership as opposed to its innate capacity. Political leadership development occurs as a result of the following factors:

- Civic participation
- Institutional mentorship
- Policy involvement
- Experiences in public accountability

According to Day (2000), political leadership development is a lifelong learning process that is dependent on experiences and reflections. Experiential learning theory also suggests that political

leadership development occurs as a result of structured experiences. Unlike corporate leadership, political leadership occurs within a democratic accountability environment, thus necessitating the importance of flexibility and ethical reasoning as core competencies for political leadership. These competencies are developed by the environment.

2.7 Critique of Genetic Reductionism

In addition, the danger in this form of genetic reductionism is the potential to blur the lines between biology and governance, where the ability to effectively rule is believed to be hardwired in certain individuals. The most compelling approach to understanding leadership is through a model that combines the following:

Biological predispositions
Psychological developments
Social structures

2.8 Conceptual Gap in the Literature

There is a general understanding in the study of leadership that the environment plays a role in the development of leadership skills. However, there is a lack of studies that simultaneously examine the role of environmental factors, behavioral changes, and the role of genetics in the development of political leadership. The bulk of the studies on genetics have focused on corporate leadership as opposed to political leadership. Additionally, the science of politics has yet to fully embrace the role of epigenetics in the development of leadership skills.

3. Research Methodology

3.1 Research Design

In this study, quantitative cross-sectional surveys were utilized to examine the influence of environmental factors and behavioral interventions on the development of political leadership, as well as re-assessing the extent of genetic determinism that influences it. The respondents were asked to answer a set of questions that utilized a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).The quantitative approach was selected to:

- Measure relationships among variables statistically
- Test predictive strength through regression analysis
- Provide empirical evidence against genetic determinism

3.2 Population and Sample

The study sample consisted of **N = 250 respondents**, divided into two groups:

Group	Frequency	Percentage
University Students	150	60%
Union Councilors	100	40%

Total	**250**	**100%**

The inclusion of both emerging and active political actors strengthened the generalizability of leadership development findings.

Sampling technique: Purposive sampling.

3.3 Variables of the Study

Variable	Type	Measurement Scale
Environmental Factors	Independent	Likert (1–5)
Behavioral Interventions	Independent	Likert (1–5)
Genetic Determinism Belief	Independent	Likert (1–5)
Political Leadership Development	Dependent	Likert (1–5)

4. Data Analysis and SPSS Results

Data were analyzed using **SPSS (Statistical Package for Social Sciences)**.

4.1 Reliability Analysis

Cronbach's Alpha was used to assess internal consistency.

Table 1
Reliability Statistics

Scale	Number of Items	Cronbach's Alpha
Environmental Factors	8	0.84
Behavioral Interventions	7	0.81
Genetic Determinism Belief	6	0.76
Political Leadership Development	9	0.88

Interpretation:
All values exceed the recommended threshold of 0.70, indicating satisfactory internal reliability.

4.2 Descriptive Statistics

Table 2
Descriptive Statistics

Variable	N	Mean	Std. Deviation
Environmental Factors	250	3.89	0.65
Behavioral Interventions	250	3.74	0.71
Genetic Determinism Belief	250	2.91	0.80
Political Leadership Development	250	4.02	0.60

Interpretation:

- Respondents strongly agreed that environmental factors influence leadership (M = 3.89).
- Behavioral interventions were also positively evaluated (M = 3.74).
- Genetic determinism received comparatively lower agreement (M = 2.91).
- Leadership development scored highest overall (M = 4.02).

This suggests a preference toward environmental explanations over biological determinism.

4.3 Correlation Analysis

Pearson correlation was conducted to examine relationships among variables.

Table 3
Correlation Matrix

Variables	1	2	3	4
1. Environmental Factors	1			

2. Behavioral Interventions	.61**	1		
3. Genetic Determinism Belief	.21*	.18*	1	
4. Political Leadership Development	.72**	.68**	.19*	1

Note:
$p < .05$
** $p < .01$

Interpretation:

- Strong positive correlation between Environmental Factors and Leadership Development ($r = .72$, $p < .01$).
- Strong correlation between Behavioral Interventions and Leadership Development ($r = .68$, $p < .01$).
- Weak correlation between Genetic Determinism and Leadership ($r = .19$, $p < .05$).

This indicates environmental and behavioral variables have much stronger associations with leadership development.

4.4 Multiple Regression Analysis

Dependent Variable: Political Leadership Development

Model Summary

Table 4

Model Summary

R	R^2	Adjusted R^2	Std. Error
.78	.61	.60	0.37

Interpretation:
The model explains 61% of variance in political leadership development, indicating strong explanatory power.

ANOVA Results

Table 5

ANOVA

Source	SS	df	MS	F	Sig.
Regression	52.14	3	17.38	128.34	.000
Residual	33.32	246	.135		
Total	85.46	249			

$F(3,246) = 128.34$, $p < .001$

The regression model is statistically significant.

Coefficients Table

Table 6

Regression Coefficients

Predictor	B	Beta	T	Sig.
Environmental Factors	.52	.48	8.72	.000
Behavioral Interventions	.41	.39	7.15	.000
Genetic Determinism Belief	.06	.07	1.42	.155

Interpretation of Regression

Environmental Factors significantly predict leadership development ($\beta = .48$, $p < .001$). Behavioral Interventions significantly predict leadership development ($\beta = .39$, $p < .001$). Genetic Determinism is statistically insignificant ($\beta = .07$, $p = .155$). Therefore, environmental and behavioral factors emerge as major predictors, whereas genetic determinism appears to have no role to play.

5. Discussion

This research was undertaken with the aim of re-evaluating the role of genetic determinism in the development of political leadership, with particular reference to environmental factors and behavioral change methods. The results are clear: the data points to a predominantly socio-environmental perspective.

5.1 Environmental Factors and Political Leadership Development

A high correlation was discovered between environmental factors and political leadership development ($r = .72$, $p < .01$). The data also revealed that environmental factors are a significant forecast of political leadership development, as revealed by the regression equation ($\beta = .48$, $p < .001$). This indicates that aspects such as educational exposure, social surroundings, political participation, mentorship, and past institutional experiences are major factors in the development of political leadership abilities. The high value of the beta coefficient indicates that the role of environmental factors is the strongest influence on political leadership development.

5.2 Behavioral Interventions as Catalysts of Leadership Development

Behavioral interventions also show a strong positive relationship with political leadership development, with a correlation of $r = .68$, $p < .01$. Moreover, it also shows a regression effect, with a beta of .39, $p < .001$. These results indicate that structured training, civic education, leadership training, and mentoring can significantly improve political leadership skills. These results support that leadership can indeed be developed, as opposed to being an innate ability. These results support interventionist leadership development theories over innate ability theories.

5.3 Reassessing Genetic Determinism

A major objective of this study was to assess whether genetic determinism can significantly predict political leadership development. The results are as follows:

- A weak correlation was found between belief in genetic determinism and political leadership, with a correlation of $r = .19$, $p < .05$. A non-significant regression effect was also found, with a beta of .07, $p = .155$. Although a weak positive correlation was found between genetic determinism and political leadership, genetic determinism does not significantly predict political leadership. These results indicate that biological determinism plays a minor role in personality traits. These results support that leadership cannot be attributed to genetic determinism. These results do not support genetic determinism as a predictor of political leadership.

Conclusion

As a whole, the results contradict the notion that political leadership is genetically predetermined. Rather, environmental factors and behavioral conditioning are the dominant factors in the development of political leadership. Key takeaways: The model explains 61% of the variance in the development of political leadership: $R^2 = 0.61$. This indicates a good fit for the model, illustrating how social and behavioral factors, as opposed to genetics, play a more important role in determining who emerges as political leaders. The data supports the dynamic interaction model, as Environmental Exposure and Behavioral Conditioning are involved in Leadership Development, whereas Genetic Predisposition does not seal Leadership Outcomes. This represents a paradigm shift from a static, trait-oriented perspective of political leadership to a more dynamic, contextual perspective.General Implications of the Study: Political leadership is a social construct, not a biological entity predetermined by DNA. Leadership skills can be developed through programs, and leadership potential can be enhanced. Civic education and political mentorships are important in a democracy. Environmental enrichment, as opposed to biological selection, should be emphasized in leadership development. This study supports a model of political leadership that emphasizes its development through experience, not biological superiority.

6. Conclusion

This study presents a careful examination of the role of genetics versus the environment in the development of political leadership. The results indicate a stronger role for the environment than for genetics in the development of political leadership. The reliability measures confirm the validity of the scales used. The descriptive statistics indicate a pattern where the subjects have a stronger tendency to believe in the environment than in genetic determinism, a pattern that is seen throughout the results. The results indicate a strong correlation between environmental factors and the development of political leadership ($r = .72$). Behavioral interventions are also related to the development of political leadership ($r = .68$), while genetic determinism has a weak correlation ($r = .19$). The results of the multiple regression analysis indicate that 61% of the variance in the development of political leadership in the political environment is explained by the model ($R^2 = .61$).From the study, the role of the environment in the development of political leadership is significant, and this is shown by a significant beta value of .48 and a significance level of $< .001$. Behavioral interventions also have a significant role in the development of political leadership, as shown by a beta value of .39 and a significance level of $< .001$. On the contrary, the study found that genetic determinism does not have a significant role in the development of political leadership, as shown by a beta value of .07 and a significance level of .155. This simply suggests that the ability to develop political leadership does not come from genetics but is a product of the environment. The study is significant in both theory and practice. Theoretically, the study combines the theories of political science and behavioral science. On a practical note, the study emphasizes the need to train political leadership

References

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Bass, B. M., & Bass, R. (2008). *The Bass handbook of leadership: Theory, research, and managerial applications* (4th ed.). New York: Free Press.

Burns, J. M. (1978). *Leadership*. New York: Harper & Row.

Chiao, J. Y., & Blizinsky, K. D. (2010). Culture–gene coevolution of individualism–collectivism and the serotonin transporter gene. *Proceedings of the Royal Society B*, 277(1681), 529–537.

Dawkins, R. (2006). *The selfish gene* (30th anniversary ed.). Oxford: Oxford University Press.

Easton, D., & Dennis, J. (1969). *Children in the political system: Origins of political legitimacy*. New York: McGraw-Hill.

Greenstein, F. I. (2009). *The presidential difference: Leadership style from FDR to Barack Obama* (3rd ed.). Princeton University Press.

Hatemi, P. K., & McDermott, R. (2012). The genetics of politics: Discovery, challenges, and progress. *Trends in Genetics*, 28(10), 525–533.

Judge, T. A., & Bono, J. E. (2000). Five-factor model of personality and transformational leadership. *Journal of Applied Psychology*, 85(5), 751–765.

McClelland, D. C. (1975). *Power: The inner experience*. New York: Irvington.

Northouse, P. G. (2021). *Leadership: Theory and practice* (9th ed.). Thousand Oaks, CA: Sage Publications.

Plomin, R., DeFries, J. C., Knopik, V. S., & Neiderhiser, J. M. (2016). *Behavioral genetics* (7th ed.). New York: Worth Publishers.

Putnam, R. D. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton University Press.

Rushton, J. P. (2000). *Race, evolution, and behavior: A life history perspective*. New Brunswick, NJ: Transaction Publishers.

Stogdill, R. M. (1974). *Handbook of leadership: A survey of theory and research*. New York: Free Press.

Verba, S., Schlozman, K. L., & Brady, H. E. (1995). *Voice and equality: Civic voluntarism in American politics*. Cambridge, MA: Harvard University Press.

Weber, M. (1947). *The theory of social and economic organization*. New York: Oxford University Press.

Yukl, G. (2013). *Leadership in organizations* (8th ed.). Pearson Education.

Pinker, S. (2002). *The blank slate: The modern denial of human nature*. New York: Viking.

Peterson, J. B., & Seligman, M. E. P. (2004). *Character strengths and virtues: A handbook and classification*. Oxford University Press.

Almond, G. A., & Verba, S. (1963). *The civic culture: Political attitudes and democracy in five nations*. Princeton University Press.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P., & Gupta, V. (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Sage Publications.

Heifetz, R. A. (1994). *Leadership without easy answers*. Harvard University Press.

Nye, J. S. (2008). *The powers to lead*. Oxford University Press.

Goleman, D. (1998). *Working with emotional intelligence*. New York: Bantam Books.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Huntington, S. P. (1968). *Political order in changing societies*. Yale University Press.

Lasswell, H. D. (1930). *Psychopathology and politics*. Chicago: University of Chicago Press.

March, J. G., & Olsen, J. P. (1989). *Rediscovering institutions: The organizational basis of politics*. Free Press.

Lipset, S. M. (1960). *Political man: The social bases of politics*. Garden City, NY: Doubleday.