GENETIC ESSENTIALISM, COGNITIVE FUNCTIONING, AND LEADERHSIP

BEHAVIOUR

by

Katrina Waldhauser

B.A., University of Calgary, 2016

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

(Kinesiology)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

July 2019

© Katrina Waldhauser, 2019

The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, a thesis entitled:

Genetic essentialism, cognitive functioning, and leadership behaviour.
--

submitted by	Katrina Waldhauser	_ in partial fulfillment of the requirements for
the degree of	Master of Arts	
in	Kinesiology	
Examining Co	mmittee:	
Dr. Mark Beau	ıchamp	
Supervisor		
Dr. Bruno Zun	nbo	
Supervisory C	ommittee Member	
Dr. Steven He	ine	
Supervisory C	ommittee Member	
Additional Exa	aminer	

Additional Supervisory Committee Members:

Supervisory Committee Member

Supervisory Committee Member

Abstract

The narrative in popular culture often relays the idea that genes are deterministic, meaning they lead to pre-determined outcomes such as obesity or mental illness (Dar-Nimrod & Heine, 2011). Personalized genetic reports, such as 23andMe and Ancestry, provide an opportunity for miscomprehension concerning the nature and role played by genetics in predicting/influencing salient behavioral outcomes. It has been suggested that these misunderstandings, when paired with human biases, subsequently influence maladaptive cognitive functioning and behaviour (Dar-Nimrod & Heine, 2011). Although genetic essentialism biases have been found to influence behaviours such as women's math ability (Dar-Nimrod & Heine, 2006), no research has previously examined the implications of believing leadership ability to be genetically determined. The current study was designed to examine the effects of genetic essentialism on perceptions of one's own leadership behaviours, as well as potential mediators of those effects. The results of this experimental study revealed that when participants were primed to believe that they had the genetic make-up of a leader, they subsequently perceived themselves to display higher levels of one form of leadership behaviour (related to 'putting others first'). The results also revealed null effects in relation to a global measure of transformational leadership as well as overt displays of co-operative leadership behaviour (as assessed via a public goods game). With regard to the effects of genetic essentialism on 'putting others first', the results of a multiple-mediator analysis point to the salience of leadership self-efficacy as an explanatory mechanism. The findings are discussed with regard to the nature of genetic essentialism, study limitations, and implications for future research.

Lay Summary

Personalized genetic reports provide an opportunity for miscomprehension concerning the role of genetics, which are often considered to lead to pre-determined outcomes, such as disease (Dar-Nimrod & Heine, 2011). It is suggested that these misunderstandings influence the way we think and behave (Dar-Nimrod & Heine, 2011). Although it is often questioned whether leaders are born or made (Avolio, 2005), the implications of believing leadership ability to be genetically based are unknown. The overall purpose of this study is to examine the effects of these genetic misunderstandings on leadership thoughts and behaviours.

Preface

This thesis is original, unpublished work by the author, K. J. Waldhauser. Ethics approval for this research was obtained from The University of British Columbia's Behavioural Research Ethics Board (#H17-03511). This project was a registered study with Open Science Framework (DOI 10.17605/OSF.IO/6HPTU).

Abstract	iii
Lay Summary	iv
Preface	v
Table of Contents	vi
List of Tables	ix
List of Figures	Х
Acknowledgements	xi
Chapter 1: Introduction	
Genetic Essentialism	
What is leadership?	
Born to Lead?	
Can Leaders Be Made?	
Genetic Essentialism and Leadership Behaviour	
Mechanisms of Behaviour Change	
Identity	
Explicit Self-Concept	
Implicit Self-Concept	
Self-Efficacy	
Chapter 2: Method	
Power Analysis	
Participants	
Procedure	

Table of Contents

Measurements	
Behaviour	
Identity	
Self-Efficacy	
Chapter 3: Results	
Leadership Behaviour	
Leader Identity	
Leadership Self-Efficacy	
Secondary (Mediation) Analyses	
Chapter 4: Discussion	
Study Strengths	
Limitations	
Chapter 5: Conclusion	
Bibliography	
Appendices	
Appendix A	
Appendix B	
Appendix C	
Appendix D	
Appendix E	
Appendix F	
Appendix G	
Appendix H	

ppendix I 104

List of Tables

Table 1. Participant demographic information	. 34
Table 2. Summary of descriptive statistics	. 47
Table 3. Bivariate correlations among study variables	. 48
Table 4. Unstandardized beta coefficients, standard errors, and model summary information for	or
the parallel mediator model depicted in Figure 13	. 62

List of Figures

Figure 1. Saliva genetic testing kit
Figure 2. Flow of participants throughout the study
Figure 3. The effects of genetic priming on self-report measures of transformational
leadership
Figure 4. The effects of genetic priming on self-report measures of putting others first
Figure 5. The effects of genetic priming on co-operative leadership behaviour
Figure 6. The effects of genetic priming on self-report measures of relational identity
Figure 7. The effects of genetic priming on self-report measures of collective identity
Figure 8. The effects of genetic priming on implicit measures of leader identity
Figure 9. The effects of genetic priming on self-report measures of leadership self-efficacy 57
Figure 10. Proposed total effect (<i>c</i>) between the genetic prime (<i>X</i>) and putting others first (<i>Y</i>). 60
Figure 11. Proposed parallel mediation model examining the indirect effects of condition (<i>X</i>) on
post-test measures of putting others first (<i>Y</i>)
Figure 12. Total effect (<i>c</i>) for the relationship between the genetic prime and putting others
first
Figure 13. Parallel mediation model examining the indirect effects of condition (<i>X</i>) on post-test
measure of putting others first (<i>Y</i>)

Acknowledgements

I would first like to extend a sincere thank-you to my supervisor, Dr. Mark Beauchamp for his continued guidance, support, and invaluable feedback. His encouragement and enthusiasm for research throughout the past few years was contagious and instrumental to the process. I would also like to extend my gratitude to the members of my thesis committee, Dr. Steven Heine and Dr. Bruno Zumbo, for their expertise and helpful suggestions.

I would also like to recognize the support from the members of the Psychology of Exercise, Health, and Physical Activity Laboratory who created a fun and engaging environment to work in each day, and one in which ideas could be shared and developed without judgement.

Finally, thank-you to my friends and family for your patience and support throughout this process. Special thanks to my partner, Neil, for your unwavering encouragement during the challenges and for being there to celebrate the highlights.

Chapter 1: Introduction

Society's understanding of the nature, and effects of, genetics can be observed throughout popular culture. For example, the current president of the United States, Donald Trump, recently reported being "a big believer in natural ability" (D'Antonio, 2015). A few years ago, he told CNN that his achievements derive from an inherent "drive for success" whereby "I have a *certain* gene" (Han, 2010, *emphasis added*). Trump linked his recent political success to having a "natural sense of how humans work", in contrast to former President Obama who he suggested "doesn't have that psychology and he never will because it's not in his DNA" (D'Antonio, 2015).

In spite of the intuitive appeal of linking genetics with deterministic outcomes, the nature and effects of genes are highly complex and often misunderstood. Messages in the media tend to overly simplify the nature of DNA sequencing (Pearson, 2006), often concluding that one gene has a direct effect on a particular phenotype (e.g., a disease). In actuality, the evidence suggests that single forms of a gene (referred to as alleles; Rédei, 2008) only account for a small proportion of variance in most phenotypic outcomes (e.g., diabetes or cancer; Kraft & Hunter, 2009; Morley et al., 2004). Furthermore, while there are a few diseases determined by a single gene, such as Huntington's disease (Labbadia & Morimoto, 2013), the majority of diseases involve complex genetic interactions and presentation (Bandano & Katsanis, 2002; Dipple & McCabe, 2000). Even diseases typically considered 'monogenic' (i.e., originating from a single gene) such as the metabolic disease, Phenylketonuria (also known as PKU), have been found to be complex and determined by multiple factors, including multiple genetic mutations or interactions with other genes (Scriver & Waters, 1999). In addition to understanding the interaction between genes and various health outcomes, some researchers have sought to identify

whether single genotypes (combinations of alleles) are associated with behaviours, such as leadership emergence (De Neve, Mikhaylov, Dawes, Christakis, & Fowler, 2013). For example, De Neve and colleagues (2013) conducted a twin study that examined candidate genes that might be associated with a tendency to occupy a leadership position. They reported that about 25% of the variance in leadership role occupancy can be attributed to alleles on the *rs4950* gene. It should be noted, however, that this study focused on individuals occupying a leadership *role*, and did not address associations between genetic factors and leadership *behaviours*. Indeed, these researchers cautioned that genetic factors play only a small role in predicting such behaviours (De Neve et al., 2013). In a similar regard, other researchers have sought to link genetics with phenotypic behaviors, including anti-social behaviour (Rhee & Waldman, 2002), aggressive behaviour (Craig & Halton, 2009), stress responses (Rodrigues, Saslow, Garcia, John, & Keltner, 2009), displays of empathy (Rodrigues et al., 2009), and trusting behaviour (Krueger et al., 2012).

Despite the complex nature of genetics, the industry of genome (i.e., the genetic material of an organism) testing and personalized genetic reports, such as *23andMe* (www.23andme.com) have become available to consumers interested in learning about their own genetic predispositions and heritable traits. These reports provide consumers with individualized information concerning their level of risk for specific diseases (e.g., Alzheimer's), physical composition (e.g., muscle and fat composition), as well as non-health related traits (e.g., balding). The presentation of such reports combined with the layperson's simplistic understanding of genes tends to lead to a type of "*if… then…*" thinking (Smith, 1984). For instance, if an individual is told they have a genetic predisposition for cancer (i.e., is a carrier of "cancer genes") this substantively increases the likelihood that they will believe they are

determined to be diagnosed with cancer in the future. In reality, having a predisposition for cancer alone does not directly lead to having the disease, but rather is one of a number of factors that contribute to the risk of illness (Ames & Gold, 1998), that also include adiposity (Morimoto et al., 2002), diet (Pietinen et al., 1999), and smoking habits (Morris Brown et al., 1992). The need to educate consumers and patients to counter the repeated misunderstanding of these genetic reports has resulted in the development of an entire professional field, referred to as genetic counselling (Resta et al., 2006).

So what might be some of the implications of not fully understanding the role played by genetics; in particular, in relation to one's own cognitions and behaviours? A growing body of research has sought to address this question. For example, researchers have found that the way in which individuals understand genetics has important implications for moral judgment (Cheung & Heine, 2015), stigma (Lee et al., 2014), and well-being (Morandini, Blaszczynski, Costa, Godwin, & Dar-Nimrod, 2017). To test such implications in relation to behavioural outcomes, Dar-Nimrod and Heine (2006) conducted a prominent study to determine if womens' perceptions related to the etiology of their mathematics ability could influence their performance on a mathematics test. Specifically, women were exposed to a fictional excerpt, which explained that sex-related differences in mathematics ability were due to genetic or experiential (i.e., that females are subject to different educational experiences than males) factors. Dar-Nimrod and Heine found that when women were primed with information that females are genetically predisposed to have lower mathematics ability than males they performed significantly worse on a subsequent mathematics test when compared to women who read about experiential (i.e., socialized) determinants of sex differences in mathematics performance. The study illustrates

that *perceiving* one's mathematics ability to be genetically determined can in turn influence one's cognitions and approach to problem solving.

In a separate study, Dar-Nimrod, Cheung, Ruby, and Heine (2014) found that participants who learned that obesity is ostensibly determined by one's genetic makeup ate significantly more food compared to participants who were given a socialized explanation or were provided with no explanation. In this case, perceiving obesity to be determined by genetics led participants to think of obesity as a characteristic that is beyond their personal control. In another study, researchers assessed the behavioural implications of believing in one's personal susceptibility to alcoholism (Dar-Nimrod, Zuckerman, & Duberstein, 2013). The study had participants provide a saliva sample before receiving a bogus individualized genetic report assessing their risk of the disease. Those who were led to believe they had a gene associated with alcoholism indicated an increased intent to enroll in a "responsible drinking" workshop and reported an increase in negative affect (one's overall current mood), decrease in positive affect, and decreased perceived personal control over drinking behaviour (Dar-Nimrod et al., 2013). In this case, having a deterministic belief about genetics lead individuals to feel they had less control over their behaviour. Based on the aforementioned studies, it would appear that the way in which an individual understands his or her own genetics (through a genetic prime or the way in which information is often conveyed through the media or lay conversations) can, in turn, influence behaviours related to that genetic prime.

Genetic Essentialism

To help explain how and *why* deterministic beliefs emerge, and manifest themselves, Dar-Nimrod and Heine (2011) provided a framework consisting of four key properties describing a universal human tendency to perceive genetics as deterministic, referred to as *genetic*

essentialism. First, Dar-Nimrod and Heine proposed that people tend to understand genetics to be *immutable* and *determined*, meaning that having particular genetics leads to a particular outcome that is unchanged by the environment and outside of one's personal control. They further suggested that believing genes to be immutable and determined leads individuals to conceive outcomes as fatalistic if such outcomes are considered to be heavily influenced by genetics. Accordingly, if an individual believes they are genetically determined to be obese, they may feel that no amount of diet or exercise (i.e., within one's personal control) will mitigate the inevitability of obesity. Conversely, if they believe they do not have a gene linked to obesity, they may feel a greater sense of control, thus may be more inclined to adhere to a nutritious diet or be more motivated to reach the recommended physical activity guidelines.

The second tenet of genetic essentialism corresponds to the notion of a *specific etiology*, which encompasses the understanding of genes as the fundamental reason for having a particular condition or phenotype (Dar-Nimrod & Heine, 2011). This simplified perception of genetics is problematic because it overlooks the complexity of gene interactions and is expected to lead to ignorance of environmental and experiential factors that may play an influential role (Dar-Nimrod & Heine, 2011). For example, an individual diagnosed with schizophrenia (wherein 41-65% of variation has been found to be accounted for by genetics; Cardno & Gottesman, 2000) may attribute the illness entirely to their genetic predisposition rather than taking into consideration the environment or social interactions that may have triggered the emergence of the disorder, such as social stress or drug use in adolescence or early adulthood (Howes et al., 2004) or childhood trauma (Morgan & Fisher, 2007). On a related note, the way in which genetics is sometimes explained within educational settings (e.g., grade school) may play a role in people's specific etiology explanation of genetics. For example, one of the earliest genetic

experiments, conducted by Mendel in 1865, involved the breeding of pea plants (as summarized in Mendel, 1965). By breeding different coloured pea plants, Mendel gained insight into the dominant and recessive gene transfer of flower colour between species (Mendel, 1965). Many high school students in North America are taught genetics using this example because it demonstrates how one gene can be the sole cause of a particular phenotypic presentation (in this case flower colour). However, explanations and examples such as this may only just reinforce the understanding that genes are linearly, and in a deterministic manner, linked to specific biological and behavioural outcomes.

The third tenet of genetic essentialism is that individuals tend to perceive group categorization to be representative of shared genes that are homogenous and discrete, meaning that members of that particular social group will possess that same genetic essence (an unobservable, inherent property; Gelman & Wellman, 1991), while members of social groups that an individual does not identify with (i.e., out-group members) will not (Dar-Nimrod & Heine, 2011). This type of thinking has been exhibited throughout history, as exemplified in Nazi Germany during World War II (Reichard, 2009). Nazi propaganda targeted Jewish citizens and the mentally ill as out-groups who were genetically inferior and discrete from other 'Aryan' Germans (Reichard, 2009). Genetic explanations of group superiority are still prevalent in world news today. For example, Panofsky and Donovan (2017) recently analyzed online forum discussions between white supremacists in the United States who used genetic ancestry testing in an attempt to bolster their essentialist views of race. Research has found that individuals who are given a genetic/biological explanation for the heritability of race experience decreases in emotional engagement (i.e., feeling moved or concerned), and are subsequently less likely to feel concerned or upset by racial inequalities and are less likely to seek friendships with out-group

members (Williams & Eberhardt, 2008). Other research has indicated that among lesbian and bisexual women, the belief that sexual orientation is a *discrete* concept (e.g., you are either heterosexual or homosexual), rather than existing on a continuum, led those women to experience greater internalized stigma (Morandini et al., 2017). According to Morandini and colleagues, this internalized stigma reflects an adoption of society's negative attitudes and beliefs, contributing to feelings of guilt and shame (Morandini et al., 2017). These researchers suggest that the increase in internalized stigma may point to an increase in perceptions of distinctiveness from the heterosexual norm, leading to more negative conceptions about identifying as lesbian or bisexual (Morandini et al., 2017).

The final tenet of genetic essentialism is the tendency to consider genetic outcomes to be more *natural*, often leading to ethical and moral implications. For example, a criminal may be reprimanded to a lesser extent if the individual is perceived to have a mental illness, which is typically understood as naturalistic (Dar-Nimrod & Heine, 2011). Cheung and Heine (2015) found that genetic explanations for a crime, such as an inability to control violent impulses, resulted in shorter prescribed sentences (in the context of a scenario study) if participants perceived that the accused had less conscious (i.e., personal) control. Homosexuality is another characteristic that can be perceived as something an individual is born with, rather than made as a conscious choice. The belief that sexual orientation is biologically based has been found to be positively associated with tolerance (Haslam & Levy, 2006). That is, if genes are perceived to be the basis of sexual orientation it will be viewed more positively than if it is considered to be a personal choice.

In sum, the four tenets of genetic essentialism (genes as immutable and determined, having a specific etiology, as homogenous and discrete, and as natural) provide an explanation

for the deterministic reports associated with perceptions of one's own genetic make-up. The overall purpose of my Master's thesis is to examine the effects of genetic essentialism associated with genetics and leadership in relation to cognitive functioning and leadership behaviour. That is, can the way people think and act by way of their leadership behaviors be shaped by their understanding of their own genetics?

What is leadership?

Understanding the nature, etiology, and effects of leadership have been a focus of inquiry across disciplines and time. Leadership involves the behavioural processes of seeking to influence one or more others to attain a specific objective or goal (Northouse, 2017), such as a project manager directing employees to complete a work project, a coach guiding athletes to improve their skill set, or a school principal empowering her staff to create an inspiring learning environment. Scholars have been interested in studying leadership in a number of settings including the military (Kane & Tremble, 2000), industry (MacKenzie, Podsakoff, & Rich, 2001), education (Kirby, Paradise, & King, 1992), government (House, Spangler, & Woycke, 1991), and sport (Cotterill & Fransen, 2016). Drawing from different paradigms, particular leader behaviours, such as demonstrating concern for the needs of followers, have been found to be related to a number of positive outcomes for followers, including increases in performance (Wang, Oh, Courtright, & Colbert, 2011), well-being (Alimo-Metcalfe, Alban-Metcalfe, Bradley, Mariathasan, & Samele, 2008), creativity (Jung, 2001), and satisfaction (Podsakoff, Mackenzie, & Bommer, 1996). In contrast, a meta-analysis conducted by Schyn and Schilling (2013) linked other forms of leadership behaviour, such as using one's position of authority for personal gain, to follower resistance, counterproductive work behaviours, and job turnover intention, and found negative correlations between such undesirable leadership behaviours and

followers' attitudes towards the leader, individual performance, perceptions of justice, and wellbeing.

Over the past 30 years, the focus of leadership research has evolved from a primary emphasis on understanding the effects of transactional forms of leadership (wherein an exchange of rewards is used to increase performance), to a broader range of leadership behaviours (Avolio, Walumbwa, & Weber, 2009). As highlighted above, not all leadership behaviours lead to positive or productive outcomes for followers or the group at large. For example, some destructive leadership behaviours are delivered with the *intent of* causing harm to followers by encouraging them to pursue goals that are not in the best interest of the group, and/or by using harmful methods of influence (such as bullying; Krasikova, Green, & LeBreton, 2013). Although not intended to cause harm, laissez-faire leadership involves a distinct *absence* of leadership (some have even referred to this as non-leadership; Barling, Christie, & Hoption, 2010) which negatively impacts followers through a lack of direction or monitoring of the workplace climate (Skogstad, Einarsen, Torsheim, Aasland, & Hetland, 2015).

In contrast, there are several notable leadership frameworks that point to the effectiveness of certain leadership styles or behaviours. These include authentic leadership (Avolio & Gardner, 2005), empowering leadership (Amundsen & Martinsen, 2014), charismatic leadership (House, 2005), and ethical leadership (Brown, Treviño, & Harrison, 2005). Authentic leadership behaviours involve consistently demonstrating positive morals, decision-making, self-awareness, self-regulation, and adaptive interactions with others (Avolio & Gardner, 2005). Empowering leadership involves encouraging autonomy through power sharing (i.e., delegating power and encouraging followers to make decisions for themselves), motivation support (i.e., encouraging and inspiring followers to take personal initiative and to believe in their capabilities), and development support (i.e., role modelling favourable behaviours over time; Amundsen & Martinsen, 2014). Charismatic leadership involves a degree of self-sacrifice as well as articulating a vision to followers to inspire change, direction, or goal achievement (House, 2005). Finally, ethical leadership involves influencing followers through modelling appropriate behaviour and making clear expectations for ethical practice (Brown et al., 2005).

A prominent theory of leadership, and one that represents the focus of inquiry in my Master's thesis corresponds to transformational leadership theory (Bass, 1985). Over the past two decades transformational leadership theory has received more research attention than any other leadership framework (Barling et al., 2010). Transformational leadership involves behaviours that "transform and inspire followers to perform beyond expectations" while putting aside self-interest in order to enhance the collective good (Avolio et al., 2009, p. 423), and is conceptualized as including four distinct but related dimensions. The first, *individualized* consideration, involves displays of concern for each follower's individual needs, and providing help or resources necessary to help others achieve their goals (Avolio, Waldman, & Yammarino, 1991). Such relational-oriented foci of leadership are of particular interest in this study because they have been noted across various leadership styles, including transformational, authentic, spiritual, and servant leadership (Derue, Nahrgang, Wellman, & Humphrey, 2011; Reed, Vidaver-Cohen, & Colwell, 2011; van Dierendonck, 2011). A meta-analysis found that leadership behaviours focused on the consideration of others were significantly correlated with follower job satisfaction (estimated true correlation of .46), follower satisfaction with the leader (.78), follower motivation (.50), leader performance (.25), group performance (.28), and leader effectiveness (.52; Judge, Piccolo, & Ilies, 2004). The second dimension of transformational leadership, *intellectual stimulation* involves encouraging others to tackle problems in new ways,

while being open to and learning from followers' ideas and reasoning (Avolio et al., 1991). The third dimension, *inspirational motivation*, includes displays of enthusiasm and optimism, holding high expectations of others, and articulating a compelling vision of future direction. Lastly, *idealised influence* involves role modeling, by demonstrating positive behaviours, attitudes, and values for followers to emulate (Avolio et al., 1991).

Transformational leadership has been shown to be related to a number of positive outcomes among those being led, including measures of leader effectiveness and follower satisfaction (Banks, McCauley, Gardner, & Guler, 2016). Zwingmann and colleagues (2014) examined the effects of transformational leadership across 16 countries and found it to be significantly associated with follower well-being (r= .35 to .50) and physical health (r= .16 to .34) in all countries. Wang and colleagues (2011) found strong evidence for the relationship between transformational leadership and work performance in a meta-analysis spanning 25 years of research in organizational settings. They found positive relationships between transformational leadership and performance across several levels of analysis (i.e., individual, group, and organizational levels) and performance criteria (i.e., task, contextual, and creative performance) holding across leader level and geographic region (Wang et al., 2011).

Born to Lead?

Research in psychology and related fields has frequently studied twins to answer questions of nature versus nurture influences on human traits and behaviours. By studying the differences between monozygotic (identical) twins, who share the same genetic makeup, who have been reared apart allows researchers to attribute variations to environmental influences as well as genetic disparities. In a study using identical and fraternal twins (Chaturvedi, Arvey, Zhang, & Christoforou, 2011), transformational leadership was estimated to be 49% heritable,

replicating previous findings from Johnson and colleagues (1998). Avolio (2007) noted that although preliminary behavioural genetics research exists on leadership styles and leadership emergence, findings generally suggest that genetics accounts for only about 30% of the variance.

Research has also linked personality traits, considered by some to be genetic traits (Vernon, Villani, Vickers, & Aitken Harris, 2008), to leadership (Judge & Bono, 2000; Judge, Bono, Ilies, & Gerhardt, 2002). It is generally understood that there are five global dimensions of personality, each existing along a continuum, that every individual displays to a greater or lesser extent. The five-factor model of personality, also known as the Big-Five (Goldberg, 1990), consists of Extraversion (the tendency to be outgoing, playful, assertive), Agreeableness (the tendency to be kind, trusting, cooperative), Conscientiousness (the tendency to be organized, logical, dependable), Emotional Stability (the tendency to be poised, secure, self-reliant) and Openness to Experience (the tendency to be creative, curious, imaginative). Judge and colleagues (2002) conducted a meta-analysis and found correlations between the Big-Five personality traits and leadership (emergence and effectiveness, respectively), indicating positive associations with Extraversion (ρ =.33, .24), Conscientiousness (ρ =.33, .16), Openness to Experience (ρ =.24, .24), and Agreeableness (ρ =.05, .21) and negative associations with Neuroticism (the tendency to be insecure, envious, fearful; ρ =-.24, -.22). Similarly, Clark and colleagues found extraversion to be associated with cooperative behaviour in social dilemmas (Clark, Thorne, Vann, & Cropsey, 2014), which is comparable to transformational leadership behaviour wherein the leader considers the needs of others before their own.

When taken together, a small but growing body of research exists that points to a direct relationship between heritability and transformational leadership, as well as a potential indirect relationship via the leader's personality traits. Nevertheless, there is considerable evidence that

points to the role of socialization and environmental factors. Such social factors are discussed in the next section.

Can Leaders Be Made?

In addition to evidence supporting the heritable (i.e., nature) basis for leadership, an extensive body of evidence also suggests that leadership can be developed (i.e., via nurture) through experiences, such as parental influence or training interventions. In the context of sport, Zacharatos, Barling, and Kelloway (2000) studied transformational leadership in high school athletes and their coaches. The researchers measured athlete's perceptions of their *parent's* leadership behaviour and well as coach's and teammates' perceptions of the athlete's leadership behaviour. The researchers found that athletes' transformational leadership behaviours were predicted by the extent to which their fathers use transformational leadership, indicating the importance of parental influence on the development of leadership behaviour. Shamir and colleagues (Shamir, Dayan-Horesh, & Adler, 2005; Shamir & Eilam, 2005) argue that leaders develop in part through the self-construction of a life-story, wherein the leader attaches meanings to his or her life experiences. By examining leader's life-stories, these researchers found that leaders tend to attribute their development to influential role models. Similarly, a study by McDermott, Kidney, and Flood (2011) involved interviews with 11 leaders (identified as "successful") across private, public, and voluntary sectors, seven of which had held leadership positions for over 10 years. When asked to reflect on their own leadership development, the interviewees emphasized the significant influence of early-life events (such as losing a parent and filling the void, as the eldest sibling of eight) and early-career critical incidents (such as working alongside a senior colleague).

Another way in which leaders can be developed is through the formalized training of leadership skills, such as problem-solving, communication, or social judgment (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000). Avolio and colleagues (2009) examined the effects of 200 experimental and quasi-experimental leadership interventions and found that leadership training interventions (i.e., interventions that attempted to enhance an individual's knowledge, skills, ability, motivation, and/or perceived self-concept in order to positively influence followers), had a significant overall effect across a combination of positive outcomes, including affective, behavioural, and cognitive variables (corrected effect size of Cohen's corr-d =.65, k = 35, n = 3389; Avolio, Reichard, Hannah, Walumbwa, & Chan, 2009). When those interventions were considered in relation to behavioural outcomes, such as leader responsiveness, they were found to have a medium-sized effect (corr-d =.67; Avolio, Reichard, et al., 2009).

Collins and Elwood (2004) conducted a meta-analysis and similarly found that the majority (80%) of training programs consisted of formal leadership development interventions with learning outcomes as a primary focus for participants. In their meta-analysis, Collins and Elwood examined the effectiveness of leadership development training in organizations spanning a 20-year period and found that interventions targeting leadership behavioural change, as indicated by performance scores, were highly effective (effect sizes of 1.01 for pretest-post-test studies and .54 for post-test only with control). Results from both Avolio and colleagues' (2009) and Collins and Elwood's (2004) meta-analyses suggest that leadership skills *can* be developed by training.

Overall, the leadership literature suggests that different leadership behaviours can differentially affect those being led. Furthermore, in terms of the antecedents of leadership, the

evidence to date suggests leader behaviours can be influenced by *both* heritable factors as well as socialized factors.

Genetic Essentialism and Leadership Behaviour

Notwithstanding the fact that leadership is likely shaped by both nature and nurture factors, the overall purpose of my Masters thesis is to examine the implications of holding deterministic beliefs regarding the genetics associated with one's own leadership behaviors. That is, if an individual believes in the genetic etiology of their own leadership, will this influence their own beliefs and behaviours? Specifically, if an individual believes they have a "leadership gene", will they be more likely to behave as a leader and perceive themselves to consider the needs of followers, encourage follower growth, be charismatic, and influence follower's attitudes and behaviours? The current study seeks to examine the effects of learning that one has a leadership gene on cognitive processes and subsequent leadership behaviour.

Leadership behaviour has been studied in a variety of ways. In laboratory settings one prominent approach, that is used in this study, corresponds to the use of the public goods game (PGG; Offerman, 1997). Social science researchers have used the PGG to measure cooperative behaviour in groups (Englmaier & Gebhardt, 2016; Hertel & Fiedler, 1994; Offerman, 1997) by having players face a social dilemma whereby they can choose to be self-serving, or they can be cooperative and altruistic toward others at the risk of personal expense. Such cooperative behaviour is considered to be comparable to altruistic leadership behaviour (Bruttel & Fischbacher, 2010). Préget, Nguyen-Van, and Willinger (2016) used a single-round public goods game to analyze participants' cooperative behaviour and found that leaders (participants who chose to make the first contribution of personal funds in the game) contributed significantly more to the collective group than followers. Behaviours demonstrated in social dilemma tasks in

laboratory experiments have shown to be correlated with behaviour in the field (Englmaier & Gebhardt, 2016). To illustrate, Englmaier and Gebhardt (2016) assigned individuals group task work in the field and then had them complete the public goods game. They found that participants behaved similarly (i.e., similar trends of contribution to the group) in the two settings, indicating external validity of the PGG (Englmaier & Gebhardt, 2016). Finally, these cooperative leadership behaviors have been found to be malleable through intervention; for example, some researchers have used social dilemma games to measure the effect of word priming on subsequent behaviour and found that primes significantly increased cooperative behaviours (Hertel & Fiedler, 1994; Smeesters, Warlop, Van Avermaet, Corneille, & Yzerbyt, 2003). Thus, it appears that altruistic leadership behaviour can be altered when participants are primed to think about such cooperative behaviour.

In the current study, participants who learned they had a gene related to leadership were predicted to behave cooperatively at the risk of personal expense in a public goods task after receiving a genetic prime compared to participants who were given information about not having a leadership gene. Behaving cooperatively was considered to be akin to effective (transformational) leadership behaviour because it demonstrates a desire to put the needs of the group members before one's own, a key tenet of transformational leadership theory. Alternatively, behaving in a self-serving manner was not considered to be representative of transformational leadership behaviour because it demonstrates a desire for personal success over fulfilling the needs of the group. By priming participants that they possessed a genetic determinant of leadership, we were interested in examining how participants' *perceptions* of their innate leadership ability might influence their own leadership behaviour.

It was hypothesized that when participants learned that they possessed a leadership gene, they would:

Hypothesis 1*a*: report higher levels of those leadership behaviours, based on measures of selfperception, than participants informed that they did not possess that gene and;

Hypothesis 1b: display higher levels of leadership behaviours, based on objective measures, than participants who learned that they did not possess that gene.

In other words, priming individuals to believe that they ostensibly possessed the genes of an exemplary leader was expected to lead individuals to present those leadership behaviours, as measured by self-report and objective methods.

Mechanisms of Behaviour Change

In order to examine potential mechanisms of *how* genetic primes might influence perceptions of behaviour change, this study also explored two potential mediators of change: leadership identity and leadership self-efficacy. Broadly speaking, *identity* is conceptualized as one's sense of self-concept, or the way in which individuals see themselves in a given social context (Burke, 2006). Self-efficacy, on the other hand, is defined as an individual's belief in their own ability to successfully complete a desired course of action (Bandura, 1982). In this study we examined the potential effects of genetic priming on one's leadership identity and leadership self-efficacy as mechanisms that might explain potential changes in leadership behaviour.

Social scientists have referred to *dual process* models of human cognition to describe two different thought processes: deliberate, conscious responses, alongside impulsive, unconscious responses (Smith & DeCoster, 2000). To explain, Greenwald and Banaji (1995) make the distinction between *explicit cognition* (conscious thought, considered to be accurate

introspection) and *implicit cognition* (unconscious cognition that is not accessible through introspection). Individuals may have insight into and influence over some of their cognitive mechanisms, but as dual-process models suggest, there are implicit thoughts, attitudes, and beliefs that subconsciously influence human behaviour. For instance, Perugini and Leone (2009) found that explicit belief about one's morals (moral self-concept) was predictive of *hypothetical* moral behaviours but only implicit self-concept was predictive of *actual* moral behaviours. In fact, a meta-analysis conducted by Cameron and colleagues (2012) found that behaviours could be predicted by implicit measures, after controlling for measures of explicit attitudes. In the context of this study, it was hypothesized that individuals who were primed to believe they have a particular gene would experience explicit *and* implicit changes in leadership identity as well as explicit changes in self-efficacy, and in turn, leadership behaviours.

Identity

Identity is conceptualized as how individuals see themselves in a given social context, and for the purpose of this study it was operationalized in terms of leadership self-concept (Burke, 2006). Researchers have identified three levels of self-concept: *collective self-concept* (one's sense of self is derived from the group and motivated by improving the collective welfare), *relational self-concept* (one's sense of self is derived from interpersonal relationships and motivated by helping others), and *individual self-concept* (one's sense of self is individuated and motivated by self-interest; Brewer & Gardner, 1996). Collective and relational self-concepts are jointly referred to as *interdependent self-concept* (Johnson & Saboe, 2011) because they both focus on self-concept in relation to others, which was used as the focus of investigation in this study. Although considered separate, both constructs have been found to be correlated with each other (β =.51) as well as with transformational leadership behaviours (collective: β =.61, relational: β =.45; Johnson, Venus, Lanaj, Mao, & Chang, 2012).

Explicit Self-Concept.

Individuals who believe in the deterministic properties of genetics and who were primed to believe they have a leadership gene were predicted to experience changes in their leadership self-concept. Perceiving genes to be homogenous and discrete (the third tenet of genetic essentialism) has previously been shown to influence an individual's self-concept (Cheung, Dar-Nimrod, & Gonsalkorale, 2014). As suggested by Kark and Shamir (2013), transformational leadership has been found to be related to both of the "other-oriented" forms of self-concept (i.e., *collective self-concept* and *relational self-concept;* Kark & Shamir, 2013). Thus, when individuals were primed to believe they have the genetic traits of transformational leaders, it was predicted that they would be more likely to embrace those interdependent self-concepts.

Researchers suggest that self-concept is activated by the immediate environment and can be malleable through intervention (Lord & Brown, 2004). This is in line with Hannah et al.'s (2009) proposed framework for positive leadership, wherein a leader's self-construct can be *primed* by situational cues, leading to changes in cognitive processing and subsequent leader behaviours (Hannah et al., 2009). These researchers suggest that viewing oneself as a leader is a prerequisite for pursing leadership skills and experiences (Hannah et al., 2009). Consequently, research has indicated that the way in which individuals perceive themselves has large impacts on their attitudes and behaviours (Leary & Tangney, 2012). Individuals in a leadership position may consider being a leader as one sub-component of their overall identity, and in turn will make a conscious effort to behave in ways that are typically associated with a leader role (Day & Harrison, 2007; Lord & Brown, 2004). Specifically, leaders with a strong individually-centred

self-concept are more likely to exhibit abusive leadership behaviours, whereas leaders with a collective-centred self-concept are more likely to exhibit transformational leadership behaviours and to act cooperatively in pursuit of the collective interest of others (Johnson et al., 2012; van Knippenberg, van Knippenberg, De Cremer, & Hogg, 2004). In the context of this study, it was predicted that participants who were primed to believe they have the genes of a leader would display higher levels of interdependent (both collective and relational) self-concept compared to participants who were primed to believe they are non-leaders.

Hypothesis 2a: It was hypothesized that participants who learned that they possessed a leadership gene would display higher levels of leader identity (as operationalized by higher collective and relational self-concept), when compared to participants who learned that they did not have that gene.

Implicit Self-Concept.

Although individuals may have conscious influence over some of their cognitive processes, there are many implicit cognitions that can subconsciously influence human behaviour. Individuals who learned they have a leadership gene were expected to experience higher levels of implicit leader self-concept than individuals without the genetic prime because they would be more inclined to perceive themselves as a transformational leader. On the other hand, individuals who learned they do not have a leadership gene were expected to experience lower levels of implicit leader self-concept compared to those who receive a leadership gene prime.

A common method for testing these subconscious thoughts is the implicit association test (IAT; Greenwald, Mcghee, & Schwartz, 1998). The IAT compares two concepts (e.g., male vs. female) with two attributes (e.g., tough vs. gentle) in a two-choice task (Greenwald et al., 1998).

The average time it takes to make associations between concepts is theorized to represent the underlying automatic evaluations of the individual, with implicit associations resulting in faster evaluation times (Greenwald et al., 1998). It is important to note that implicit associations are theorized to be independent of explicit cognitions, with measures of implicit and explicit cognitions found to be uncorrelated (Karpinski & Hilton, 2001). The IAT has been used widely to assess measures of attitudes and stereotypes such as racism (Ottaway, Hayden, & Oakes, 2001), gendered occupations (White & White, 2006), and sexual orientation (Steffens, 2005). Researchers have also used the IAT to measure self-concept (by using items related to masculinity and femininity) and self-esteem (by using items related to success and failure; Greenwald & Farnham, 2000). One study tested female participants' implicit beliefs about their leadership ability using attribute items related to self (e.g., me, myself) or other (e.g., male) paired with leadership attributes (e.g., ambitious, influential; Asgari, Dasgupta, & Stout, 2012). Participants, in that study, were either told that they had similar attributes to successful women leaders or that they were different. Women who were told that they had characteristics of successful leaders implicitly indicated greater self-identification as a leader and less identification as a follower. Interestingly, participants who were told they had similar attributes to successful women leaders indicated greater implicit self-perceptions of leadership, regardless of whether they explicitly believed the feedback or not (Asgari et al., 2012).

Hypothesis 2b: It was hypothesized that participants who learned that they possessed a leadership gene would display higher levels of implicit leader identity (operationalized as leader self-concept) when compared to those who learned that they did not possess that gene. Furthermore, it was hypothesized that leader identity (operationalized as both implicit and explicit leader self-concepts) would mediate the relationship between the genetic prime and

leadership behaviour, as measured by both self-perception (Hypothesis 3a) and objective behaviour (Hypothesis 3b).

Self-Efficacy

A major mechanism mediating behavioural change corresponds to conceptions of personal control (Bandura, 1993). If individuals believe they are genetically predisposed to have the abilities to successfully perform a particular behaviour, it is expected that this will bolster their perceived capabilities because they will perceive themselves to have the necessary resources by virtue of their own biology. Conversely, people who believe they do not inherently have the capabilities to perform effectively, because of their genetic make-up, will likely experience reduced perceptions of control to perform those behaviours. In the context of this study, we examined leaders' self-efficacy beliefs as a mechanism that could account for how a genetic prime might affect their leadership behaviours.

Bandura (1993) suggested that an individual who believes a particular ability can be *acquired* will seek out challenges to improve that ability and will regard failures as part of the learning process. However, if an individual believes that an ability is *inherent*, they are more likely to seek tasks where success is easily achievable to minimize instances of failure (Bandura, 1993). For example, Wood and Bandura (1989) found that individuals who were told that performance on a challenging managerial task was related to an inherent, biological ability (intelligence), experienced a decline in performance. Judgments of self-efficacy are based on several sources of information: *performance attainments* (i.e., successfully completing the desired action) *vicarious observations of others* (i.e., watching someone similar to you successfully complete the desired action), *verbal persuasion* (i.e., having someone convince you to believe you can complete the desired action), and *perceptions of one's physiological states*

(i.e., bodily indicators such as low arousal; Bandura, 1982). A specific form of self-efficacy, leadership self-efficacy (LSE), involves an individual's confidence in their knowledge, skills, and abilities to lead others and the psychological resources to cope with the demands of leadership (Guillén, Mayo, & Korotov, 2015; Hannah, Avolio, Luthans, & Harms, 2008). An individual with low levels of LSE will likely be perceived by others as less capable of leading (Hannah, Avolio, Walumbwa, & Chan, 2012). Research suggests that judgments of LSE may be influenced by acts of persuasion (Hannah et al., 2012; Mellor, Barclay, Bulger, & Kath, 2006) and that leadership self-efficacy is positively correlated with transformational leadership behaviour (Hannah et al., 2012; Hannah & Luthans, 2008). Research has also shown that a leader's self-efficacy beliefs can be developed through leadership training (Mason, Griffin, & Parker, 2014). One study found that participants' LSE was influenced by self-comparisons to well-known influential leaders or to a general leader prototype, indicating that participants who believed they had similar characteristics to successful leaders were more likely to have high selfefficacy regarding their leadership ability (Guillén et al., 2015). In the context of this study, it was expected that when participants were primed to believe they have genetically-based characteristics of successful leaders, they would be more likely to experience increases in leadership self-efficacy than those who did not receive such a prime.

The extent to which people believe they have control over their environment and the extent to which they perceive themselves to be capable of performing salient tasks within that setting will influence their future choices of activities and behaviours (Bandura, 1982). Researchers have linked self-efficacy judgments to subsequent behavioural outcomes including work-related performance (Stajkovic & Luthans, 1998), academic performance (Multon, Brown, & Lent, 1991), and health related behaviours such as physical activity (Ashford, Edmunds, &

French, 2010). Overall, it was expected that participants who learned that they possessed a leadership gene would report higher scores on measures of leadership self-efficacy when compared to participants who learned that they did not have that genetic make-up. In this study it was predicted that leadership self-efficacy would mediate the relationship between the genetic prime and subsequent leadership behaviour.

Hypothesis 4: It was hypothesized that participants who learned they possessed a leadership gene would report higher levels of leadership self-efficacy than participants who learned that they do not possess that gene.

Hypothesis 5: Furthermore, it was hypothesized that leadership self-efficacy would mediate the relationship between a genetic prime and leadership behaviour, as measured by self-perception (*Hypothesis 5a*) and objective behaviour (*Hypothesis 5b*).

Chapter 2: Method

Power Analysis

To address the primary research question (based on testing hypotheses 1 and 2 using analysis of variance) an *a priori* power analysis, using a medium effect size (f = .25, $\alpha = .05$, 1 – $\beta = .80$; Faul, Erdfelder, Lang, & Buchner, 2007), was conducted prior to recruitment to determine that a minimum of 98 participants was required in order to achieve sufficient power. **Participants**

A total of 144 participants were recruited from the University of British Columbia to take part in the study. Participants were primarily recruited from the Department of Psychology through a human subject pool (wherein students enrolled in a psychology course were required to participate in research for course credit) using an online platform. Additionally, undergraduate students were recruited using posters displayed around the university campus. The majority of participants (97%) were recruited through the Department of Psychology's Human Subject Pool. Demographic information related to gender, age, year of study, faculty of study, and ethnicity is presented in Table 1. Overall, the sample was predominantly female (n = 111), in the Faculty of Arts (n = 96), and in the third year of study (n = 47). Comparisons of demographic variables at baseline were performed using a Chi-Square Test, but no significant differences were found between the two conditions.
Table 1. Participant demographic information (N = 144)										
	TFL gene	No TFL gene	Total							
Participants	71	73	144							
Age $[M(SD)]$	21.35 (2.47)	22.03 (5.85)	21.69 (4.51)							
Year of Study										
1	16	17	33							
2	14	19	33							
3	26	21	47							
4	9	11	20							
>4	6	5	11							
Gender										
Female	54	57	111							
Male	17	16	33							
Faculty										
Agricultural &	1	0	1							
Environmental Sciences										
Arts	42	54	96							
Engineering	2	1	3							
Kinesiology	3	4	7							
Science	17	7	24							
Other	6	7	13							
Ethnicity (check all										
that apply)										
Aboriginal	3	1	4							
White	21	29	50							
Chinese	23	20	43							
South Asian	14	10	24							
Black	4	4	8							
Filipino	4	2	6							
Latin American	6	6	12							
South East Asian	9	4	13							
Arab	2	2	4							
West Asian	4	3	7							
Korean	5	5	10							
Japanese	2	4	6							

Procedure

Undergraduate students were recruited from a large University in Western Canada through posted flyers and an online Human Subject Pool whereby students from the Department of Psychology could earn course credit as remuneration. Participants recruited via posters on campus were offered \$15 as remuneration. Following ethical approval from the institutional review board at The University of British Columbia, participants who indicated interest in participating were contacted by email to receive a letter of information regarding the details of the study and complete an online consent form (see Appendix A and Appendix B). Data collection occurred between March and November 2018 and participants were asked to complete an online questionnaire assessing perceptions in leadership behaviour, leadership self-efficacy, and leader identity (both explicit and implicit) prior to their scheduled visit to the lab. Participants were randomly assigned (www.randomizer.org) after baseline measures were obtained to one of two conditions: having a leadership gene or not having a leadership gene, as indicated by bogus genetic feedback (as described below). The inclusion of two "gene" conditions mirrors the procedure utilized by Dar-Nimrod and colleagues on genetic susceptibility to alcoholism (Dar-Nimrod, Zuckerman, & Duberstein, 2013). Each participant, accompanied by three confederates (i.e., fake participants), was scheduled to meet in the laboratory to complete a 'genetic test', post-test measures of perceptions of leadership behaviour, leadership self-efficacy, leader identity, as well as a measure of cooperative leadership behaviour. Once everyone had arrived at the lab, the experimenter welcomed 'participants' (one naïve study participant plus three confederates), who were seated together in a common area. Before beginning the experiment, participants were reminded about the nature of the study, that their participation was voluntary, and that they were free to withdraw from the study at any time. Participants were asked to refrain from speaking with other participants for the duration of the study. Following these procedures, the researcher individually escorted each participant to a private testing area outside of the lab. After arriving at the testing area, the researcher provided the ostensible basis for the study. This involved explaining that we were working with an exciting new local start-up company that specifically conducts 'single-gene tests' at a more affordable price, compared to larger-scale companies (e.g., 23andMe) who take saliva samples and test for a number of

different genetic markers. Prior to receiving the testing kit (see Figure 1; Lebowitz & Ahn, 2017a), participants were asked to read the first page of the feedback report (see Appendix C) detailing the specifics of the leadership gene and how it has been previously linked to enzymes in the saliva of individuals who display greater leadership behaviours. Following similar procedures as Dar-Nimrod and colleagues (2013), the participant was then asked to provide a saliva sample to be ostensibly tested for the gene associated with transformational leadership behaviour.



Figure 1. Saliva genetic testing kit

The bogus feedback indicated the participant's randomly-assigned genetic make-up by reporting that a green-blue colour of the testing strip was representative of either a presence or an absence of the 'leadership gene' (see Appendix C). After receiving their test results, each participant was brought back to the waiting room while the other participants (i.e., confederates) were taken out of the room to presumably complete an identical procedure. After all participants had been tested, they were each asked to complete a brief manipulation check to assess their understanding of the test results (i.e., to briefly summarize the results of their test). Following this, participants were asked to move to the computer area within the lab to complete another questionnaire

(identical to the pre-test; see Appendices D and E) assessing perceptions of leadership behaviour, leadership identity, leadership self-efficacy, and demographic variables, followed by an "interactive group game" (i.e., the public goods game; Offerman, 1997). Participants were given instructions on how to play the public goods game, which was framed as being completed with fellow participants in real time. In reality, the participant was not interacting with the study confederates. Once the participant had allocated the funds they wished to contribute to the collective group within the game, a final questionnaire assessed their knowledge of genetics (Lanie et al., 2004, Morin-Chassé, Suhay, & Jayaratne, 2017; see Appendix F) and their perceived believability of the test (Lebowitz & Ahn, 2017a; see Appendix G). Once completed, each participant was then informed that the study had concluded and was asked to collect their belongings and exit the room for a debrief. Participants were debriefed on the nature of the experiment and explained why the methods of deception were necessary in this study. During the debrief participants were asked to disclose any issues of believability that may have influenced their scores.

In line with previous studies (Ahn & Lebowitz, 2018; Lebowitz & Ahn, 2017a), after receiving genetic feedback and completing post-test measures, participants responded to a manipulation check embedded within the final questionnaire. As can be seen in Figure 2, participants who agreed with the statement, "The saliva test gave me accurate and reliable information about my genetic make-up" by responding either *Strongly Agree (5)*, *Agree (4)*, *Neither Agree or Disagree (3)* were included in the analysis (n = 97). As per Lebowitz and Ahn (2017a, 2017b), participants who did not agree with the aforementioned statement (i.e., responded either (1) *Strongly Disagree* or (2) *Disagree*) were removed from the analysis (n = 41). In addition, participants who did not complete pre-test measures (n = 1) or did not take the time to properly

read the genetic feedback (n = 1) were excluded from the analysis. Some participants (n = 4) indicated in the manipulation check that they felt the salvia test was credible, however they stated that they knew the test was a deception before receiving the full debrief.¹ These participants were removed because they claimed to have been learning about deceptions in a current class or had extensive knowledge of genetics. Participants who rated the saliva test as accurate and reliable (i.e., answered "neither agree nor disagree", "agree", or "strongly agree") were included in the analysis (N = 97).

¹ All results remained unchanged between the inclusion and exclusion of participants who had explicitly stated during the debrief that they knew the test was a deception (n = 4), even though they rated the test as credible during the manipulation check.



Figure 2. Flow of participants throughout the study

Measurements

Behaviour

Perceived Leadership. A short omnibus measure of transformational leadership developed by Carless, Wearing, and Mann (2000) was utilized as a measure of perceived leadership behaviour. Specifically, the Global Transformational Leadership scale (GTL) uses seven broad statements to capture constructs of transformational leadership including: articulating a vision, developing followers, being supportive, empowering followers, innovative thinking, leading by example, and being charismatic (Carless, Wearing, & Mann, 2000). The word "staff" was replaced with "others" to fit the context of this study. Example statements included "fosters trust, involvement and cooperation among team members" and "treats [others] as individuals, supports and encourages their development" (Carless, Wearing, & Mann, 2000). Participants were asked to rate their frequency of behaviour on a 5-point Likert scale ranging from 1 (rarely or never) to 5 (frequently, if not always). Measures derived from this instrument have been found to demonstrate good internal consistency ($\alpha = .90$ -.94; Nielsen, Randall, Yarker, & Brenner, 2008). In additional to a global measure of transformational leadership, we also included a specific assessment of leadership that was concerned with considering the needs of others (i.e., Individualized Consideration dimension of transformational leadership) using a subscale of Linden, Wayne, Zhao, and Henderson's (2008) servant leadership measure. The subscale, described as "putting [others] first" was intended to specifically capture a leader's desire to put the needs of others before oneself. Measures derived from this 4-item instrument have been shown to be reliable (α =.91) and highly correlated with a global measure of transformational leadership behaviour (r=.75; Liden, Wayne, Zhao, & Henderson, 2008). All leadership behaviour items were adjusted to reflect self-perceptions (rather than 'other' ratings) by having statements

in first-person language. Sample items included, "I put others' best interests ahead of my own" and "I sacrifice my own interests to meet others' needs". Items were scaled from 1 (*strongly disagree*) to 7 (*strongly agree*).

Co-operative Leadership Behaviour. A public goods game (Fischbacher, Gächter, & Fehr, 2001) was used to measure cooperative leadership behaviour, which reflects a leader's desire to put the needs of others before oneself. The task was completed on a computer using "ztree" software designed for social psychology experiments (Fischbacher, 2007). To play the game, each player is given a "resource" (i.e., virtual tokens representing monetary value) that they can choose to keep for themselves or to share with the group, wherein pooled resources are doubled and then divided among *all* players (regardless of whether the individual player shares their own resources or not). Since players are not permitted to communicate with one another and they must decide simultaneously, it puts players in a social dilemma to either (a) contribute personal resources to the group and hope that other players take the same initiative (thus leading to the largest outcome for all players), or (b) keep personal resources to oneself and benefit from the generosity of others (the self-serving option; see Offerman, 1997 for a detailed description). Greater allocation of resources to oneself is considered to be detrimental to the collective, whereas greater allocation to the group is considered to be cooperative but against one's selfinterest. Participants were informed that they were part of a four-person group wherein members were required to allocate a chosen amount of resources to either themselves or the collective group. However, in reality, the participant was not playing interactively with the confederates. Each participant was told that they had been randomly assigned as "player A", indicating that they were required to make the first decision (i.e., placed in a leadership position). Similar to procedures conducted by van Dijk and De Crember (2006), participants were informed that they

(player A) would make the first decision, followed by player B, C, then D, and that the final decision would reflect the collective resource to be doubled and divided equally among players. As proposed for this study, Fischbacher and colleagues (2001) considered the use of a *single-round* public goods game to be representative of a player's willingness to be conditionally cooperative or to be selfish and non-altruistic because only playing the game once does not have reputable or strategic considerations as it would for measures of repeated games within one session. Researchers have found that contributions change over time when feedback about players' contributions are given, but they do not change when no feedback is given (Neugebauer, Perote, Schmidt, & Loos, 2009). A longitudinal study of cooperation using the PGG indicated that one-shot decisions across different time points remain relatively stable (Cramér's *V* of 0.402; Volk, Thöni, & Ruigrok, 2011). In this study, players completed a single-round PGG and were not given feedback on contribution scores.

Identity

Explicit Assessment of Leader Self-Concept. The Levels of Self-Concept Scale (LSCS) assesses three dimensions of 'explicit' leader identity: individual (*comparative identity subscale*), relational (*concern for others subscale*), and collective (*group achievement focus subscale*; Selenta & Lord, 2005; as published in Johnson, Selenta, & Lord, 2006) self-concept. For the purpose of this study, only measures of relational and collective self-concept were used. Adequate test-retest reliability has been reported for both relational (r=.59) and collective (r=.64) self-concepts (Johnson, Venus, Lanaj, Mao, & Chang, 2012). Measures derived from these self-concept subscales have been found to demonstrate acceptable reliability for relational (α =.86) and collective (α =.76) self-concepts (Johnson & Saboe, 2011). Further evidence of convergent and discriminant validity has been provided by research using the LSCS through factor analysis

(Fehr & Gelfand, 2010; Johnson & Jackson, 2009). Each subscale consists of five items and was measured using a 5-point Likert scale, with anchors ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). This instrument has previously been used by researchers to measure identity among leaders (Johnson et al., 2012).

Implicit Assessment of Leader Self-Concept. Implicit beliefs about the self, in relation to leader identity, were measured using an Implicit Association Test (IAT; Greenwald et al., 1998, see Appendix H), which has shown to have adequate test-retest reliability (r = .64; Greenwald & Farnham, 2000). A meta-analysis reviewing 184 samples found IATs to be predictive of behavioural (e.g., alcohol and drug use), judgment (e.g., racial, political), and intergroup measures (e.g., close relationships) (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). The researchers found that IAT and self-report measures displayed incremental predictive validity with respect to each other and that IAT measures even had greater predictive validity for intergroup behaviour compared to self-report measures (Greenwald et al., 2009). Drawing from past research using the IAT to assess self-concept (Greenwald & Farnham, 2000; Pinter & Greenwald, 2005), first-person "self" pronouns (I, me, my, mine, self) and third person "other" pronouns (others, they, them, their, theirs) were associated with leader labels (leader, boss, authority, executive, supervisor; Gündemir, Homan, De Dreu, & Van Vugt, 2014) or follower labels (follower, subordinate, assistant; adapted from Gündemir, Homan, De Dreu, & Van Vugt, 2014). Faster times on the IAT for paired words related to "self" and "leader" (rather than "other" and "follower") were purported to demonstrate positive leader self-concept by indicating an unconscious association between oneself and leader roles. Conversely, faster times on the IAT for words related to "self" and "follower" (rather than "other" and "leader") were purported to

indicate a lessened leader self-concept via an unconscious association between oneself and follower (rather than leader) roles.

Self-Efficacy

Leadership Self-Efficacy. An 8-item scale (Murphy, 1992) was completed to assess participants' leadership self-efficacy, as used in other relevant research (Chemers, Watson, & May, 2000; Guillén et al., 2015; Hoyt & Blascovich, 2007). Measures derived from this instrument has been shown to demonstrate adequate reliability (α =.84; Guillén, Mayo, & Korotov, 2015). Participants responded to items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Example items included "I know what it takes to make a group accomplish its task" and "I know how to encourage good group performance" (Murphy, 1992). Negatively worded items were reverse coded, such as "overall, I doubt that I could lead a group successfully" (Murphy, 1992).

Chapter 3: Results

Preliminary Analysis

Descriptive statistics for all study variables were examined for normality. Specifically, normality was assessed for each variable using skewness and kurtosis values (see Table 2). A range of thresholds have been identified within the literature as constituting violations of normality based on skewness and kurtosis values. For example, West, Finch, and Curran (1995) suggested that a threshold of ± 2 for skewness and ± 7 for kurtosis represented the upper bounds of acceptability. However, others such as Tabachnick and Fidell (2013) and George and Mallory (2003) proposed the upper bounds of acceptability for skewness and kurtosis should be ± 2 for both indicators. Based on these criteria, the distributions for the study variables would be considered acceptable for all but three of the study measures. These correspond to the kurtosis indicators for the pre-test measures of leader identity [relational and collective] and post-test measures of leader identity [relational] for participants in the gene absent condition (see Table 2); these would be considered acceptable based on the West et al. criteria, but marginally exceed the criteria proposed by Tabachnick and Fidell and George and Mallory. When taken together along with examinations of the histograms (Gamst, Meyers, & Guarino, 2008), the distributions were considered acceptable for the main analyses. Identification of outliers was also conducted using box-plots and z-scores; only leadership identity (relational and collective) presented outliers (n = 8), as determined by a z-score of ± 2.5 (n = 4; Meyers, Gamst, & Guarino, 2006). Analyses were subsequently run with and without the outliers and did not produce any significant changes in results. Thus, the outlier participants' data were retained. Missing data were examined using Little's Missing Completely at Random (MCAR) test to assess for potential patterns of missing data. The test results indicated that the data were missing

completely at random X^2 (1088, N = 98) = 410.91, p = 1.00. Further, to assess the correlations between variables, Pearson's bivariate correlations were examined (see Table 3).

Table 2.

Summary of descriptive statistics.

	TFL gene condition									No TFL gene condition						
		N Range M (SD) Skewness SE Kurtosis SE									M (SD)	Skewness	SE	Kurtosis	SE	
Pre- test	Global TFL	50	16.00– 35.00	27.76 (3.82)	- 0.61	0.34	0.84	0.66	46	15.00 – 35.00	26.83 (4.77)	- 0.39	0.35	0.01	0.69	
	Putting others first	51	2.50 – 7.00	4.75 (0.10)	- 0.14	0.33	- 0.25	0.66	46	2.00 – 6.75	4.74 (1.17)	- 0.37	0.35	- 0.26	0.69	
	Leadership self-efficacy	51	17.00 – 40.00	29.04 (5.10)	- 0.30	0.33	0.27	0.66	46	16.00 – 37.00	28.09 (4.99)	- 0.49	0.35	- 0.18	0.69	
	Leadership identity (relational)	51	3.20 – 5.00	4.57 (0.46)	- 1.36	0.33	1.65	0.66	46	2.60 – 5.00	4.30 (0.50)	- 1.52	0.35	2.61	0.69	
	Leadership identity (collective)	51	3.20 – 5.00	4.53 (0.43)	- 1.11	0.33	0.81	0.66	46	2.60 – 5.00	4.21 (0.53)	- 1.52	0.35	2.37	0.69	
	Leadership identity (implicit)	48	- 0.73 – 1.06	0.15 (0.43)	- 0.01	0.34	- 0.66	0.67	45	- 0.39 – 1.12	0.30 (0.33)	0.02	0.35	- 0.14	0.70	
Post -test	Global TFL	51	19.0 – 35.0	27.84 (3.95)	- 0.33	0.33	- 0.66	0.66	44	12.00 – 35.00	25.84 (5.36)	- 0.57	0.36	0.22	0.70	
	Putting others first	51	2.75 – 7.00	5.06 (1.06)	- 0.24	0.33	- 0.83	0.66	46	2.00 – 6.75	4.71 (1.15)	- 0.46	0.35	- 0.08	0.69	
	Leadership self-efficacy	50	16.00 – 40.00	29.84 (4.80)	- 0.55	0.34	0.82	0.66	44	16.00 – 37.00	27.73 (4.93)	- 0.49	0.36	0.11	0.70	
	Leadership identity (relational)	51	3.40 – 5.00	4.58 (0.40)	- 1.06	0.33	0.69	0.66	45	2.60 – 5.00	4.33 (0.56)	- 1.58	0.35	2.83	0.70	
	Leadership identity (collective)	50	2.80 – 5.00	4.16 (0.51)	- 0.59	0.34	- 0.08	0.66	46	2.60 – 5.00	4.00 (0.50)	- 0.49	0.35	0.41	0.69	
	Leadership identity (implicit)	49	- 0.73 – 1.09	0.61 (0.39)	- 0.28	0.34	0.03	0.67	46	- 0.29 – 1.02	0.26 (0.37)	0.47	0.35	- 0.88	0.69	
	Leadership behaviour (PGG)	51	1.00 – 20.00	12.22 (6.21)	- 0.16	0.33	- 1.26	0.66	45	1.00 – 20.00	10.78 (6.20)	0.21	0.35	- 1.04	0.70	
Note:	Note: TFL = transformational leadership, PGG = public goods game															

Table 3.

Bivariate correlations	among	study	variables.	
------------------------	-------	-------	------------	--

	1	2	3	4	5	6	7	8	9	10	11	12	13
Pre-test													
1.Global TFL	-	.372**	.600**	.334**	.354**	.035	.862**	.449**	.592**	.429**	.585**	.149	.177
2. Putting others		-	.275**	.406**	.408**	.063	.219*	.829**	.273**	.500**	.348**	.006	008
3. Leadership			-	.314**	.303**	.185	.561**	.317**	.907**	.401**	.416**	.140	.169
4. Leadership identity				-	.940**	030	.361**	.388**	.362**	.855**	.455**	005	.010
(relational) 5. Leadership identity					-	016	.381**	.420**	.352**	.855**	.521**	.001	.017
(collective)6. Leadershipidentity (implicit)						-	.115	.107	.147	055	020	.346**	005
Post-test 7.Global TFL							-	.444**	.576**	.426**	.619**	.098	.163
8. Putting others								-	.367**	.517**	.433**	002	.077
9. Leadership									-	.435**	.438**	.141	.225*
10. Leadership identity										-	.569**	.024	.059
(relational) 11. Leadership identity											-	.018	.203*
(collective) 12. Leadership												-	.132
identity (implicit) 13. Leadership													-
behaviour (PGG)													
<i>Note:</i> ** <i>p</i> < .001	, * <i>p</i> < .05												
TFL = transformat	tional leade	ership, PGC	G = public	goods game	e								

Primary Analyses

Leadership Behaviour

H1a: Self-perceptions of transformational leadership behaviors. A 2 (feedback prime: gene, no gene) X 2 (time: pre, post) mixed design ANOVA was conducted to examine the effect of learning that one has a gene associated with leadership versus learning that one does not have that gene on a global measure of transformational leadership. No significant main effects were found for condition (F [1, 92] = 2.92, p = .091, partial η^2 = .031) or time (F [1, 92] = 2.62, p = .109, partial η^2 = .028). In addition, and contrary to our hypothesis, there was no significant condition x time interaction, F (1, 92) = 2.89, p = .093, partial η^2 = .030.

Global TFL 29 - TFL Gene 28.5 28 No TFL Gene 27.5 27 Mean 26.5 26 25.5 25 24.5 PRE POST

Figure 3. The effects of genetic priming on self-report measures of transformational leadership, with error bars representing standard errors.

H1b: Self-perceptions of putting others first. A 2 (feedback prime: gene, no gene) X 2 (time: pre, post) ANOVA was conducted to examine the effect of learning that one has a leadership gene versus learning that one does not have that gene on putting others first. No significant main effect was found for condition (F [1, 95] = .706, p = .403, partial η^2 = .007), but a main effect was found for time (F [1, 95) = 5.34, p = .023, partial η^2 = .053). However, these results are best understood in the context of a significant condition x time interaction, F (1, 95) = 7.52, p= .007, partial η^2 = .073. Pairwise comparisons indicated that there was a significant increase in putting others first among participants who learned they have a gene associated with leadership (pre-manipulation M = 4.75, SE = .15, CI [4.45-5.05], post-manipulation M = 5.06, SE = .16, CI [4.76 – 5.37]), F(1, 95) = 13.46, p < .001, partial η^2 = .124. In contrast, there was no such effect among participants who learned they that a gene associated with leadership (pre-manipulation M = 4.74, SE = .16, CI [4.42 – 5.06], post-manipulation M = 4.71, SE = .16, CI [4.39 – 5.04]), F(1,95) = .09, p = .767, partial η^2 = .001



Figure 4. The effects of genetic priming on self-report measures of putting others first, with error bars representing standard errors.

H1c: Co-operative leadership behaviour. A one-way ANOVA was conducted to examine the effects of learning that one has a leadership gene versus learning that one does not have that gene on co-operative leadership behaviour. Although the means were in the hypothesized direction, there was no significant difference in co-operative behaviour between participants who learned that they had a leadership gene and those who learned that they did not, F(1, 95) = 1.28, p = .260, partial $\eta^2 = .013$.





Leader Identity

H2a: Self-perceptions of relational identity. A 2 X 2 mixed design ANOVA was conducted to examine the effects of learning that one has a leadership gene versus learning that one does not have that gene on relational identity. No significant main effects were found for time (F [1, 94] = .38, p = .537, partial η^2 = .004); however, there was a main effect for condition (F [1, 94] = 7.32, p = .008, partial η^2 = .072). There was no significant condition x time interaction, F [1, 94] = .04, p = .849, partial $\eta^2 < .001$. Upon further examination, pairwise comparisons indicated that individuals randomly assigned to learn they have a leadership gene (pre-manipulation M = 4.57, SE = .07, CI [4.44 – 4.71], post-manipulation M = 4.58, SE = .07, CI [4.45 – 4.72]) reported higher levels of relational identity at *both* pre-test and post-test than individuals assigned to the no-gene condition (pre-manipulation M = 4.31, SE = .07, CI[4.17-4.45], post-manipulation M = 4.33, SE = .07, CI [4.19 – 4.48]. In light of the fact that groups appeared to be significantly different from each other at pre-test (i.e., before random allocation to the two conditions), an analysis of covariance (ANCOVA) was conducted with pre-test measures of relational identity included as a covariate. After accounting for pre-test measures of relational identity, there were no differences in post-test measures of relational identity between the two experimental conditions, (F [1, 93] = .255, p = .615, partial η^2 = .003).





H2b: Self-perceptions of collective identity. A 2 X 2 mixed design ANOVA was conducted to examine the effects of learning that one has a leadership gene versus learning that one does not have that gene on collective identity. Significant main effects were found for time $(F [1, 94] = 32.32, p < .001, partial \eta^2 = .256)$ and condition $(F [1, 94] = 7.10, p = .009, partial \eta^2 = .070)$. However, no significant condition x time interaction was found, F [1, 94] = 2.38, p =.126, partial $\eta^2 = .025$. Post hoc analysis of the main effects for condition indicated that individuals randomly assigned to learn they have a leadership gene displayed significantly higher levels of collective identity at pre-test (pre-manipulation M = 4.52, SE = .07, CI [4.39 – 4.66] compared to individuals assigned to the no-gene condition (pre-manipulation M = 4.21, SE = .07, CI [4.07 – 4.36], F(1, 94) = 9.89, p = .002, partial $\eta^2 = .095$. Given the participants in the two conditions appeared to be significantly different from each other at pre-test on this variable, an analysis of covariance (ANCOVA) was conducted to account for pre-test differences. However, results revealed that participants in the two conditions did not differ from one another after accounting for pre-test measures (F[1, 93] = .007, p = .935, partial $\eta^2 < .001$).





H2c: Implicit leader identity. A 2 X 2 mixed design ANOVA was conducted to examine the effect of learning that one has a leadership gene versus learning that one does not have that gene on implicit measures of leader identity. Consistent with procedures used by Asgari, Dasgupta, and Stout (2012), changes in implicit leader self-concept were calculated by subtracting the average latency time for leader associations (me + leader; other + follower) from the latency time for follower associations (me + follower; other + leader). The difference from each participant's score was then divided by the pooled standard deviation of their responses to create a modified effect size (IAT *D*) using an online 'iatgen' tool (Carpenter et al., 2018). Positive *D* scores indicated an implicit association with a leader self-concept, whereas negative *D* scores indicated an implicit association with a follower self-concept. Scores near zero indicated a neutral self-concept. No significant main effects for condition (*F* [1, 91] = .65, *p* = .424, partial η^2 = .007) or time (*F* [1, 91] = 2.04, *p* = .157, partial η^2 = .022) were found. However, a significant condition x time interaction effect was found, *F* (1, 91) = 4.77, *p* = .032, partial η^2 = .05. More specifically, pairwise comparisons revealed that there was a significant increase in implicit leader identity among participants who learned that they had a leadership gene (pre-manipulation *M* = .15, *SE* = .06, CI [.04 - .26], post-manipulation *M* = .31, *SE* = .06, CI [.21 - .42]), *F* (1, 91) = 6.74, *p* = .011, partial η^2 = .069, whereas no effect was found for participants who learned that they did not have a leadership gene (pre-manipulation *M* = .30, *SE* = .06, CI [.19 - .42], post-manipulation *M* = .27, *SE* = .06, CI [.16 - .38], *F* (1, 91) = .277, *p* = .60, partial η^2 = .003.



Figure 8. The effects of genetic priming on implicit measures of leader identity, with error bars representing standard errors.

Leadership Self-Efficacy

H4: Leadership self-efficacy. A 2 X 2 mixed design ANOVA was conducted to examine the effects of learning that one has a leadership gene versus learning that one does not have that gene on leadership self-efficacy. No significant main effects for a genetic prime (*F* [1, 92] = 2.60, *p* = .111, partial η^2 = .027) or time (*F* [1, 92] = 3.65, *p* = .059, partial η^2 = .038) were found. However, a significant condition x time interaction was found, *F* (1, 92) = 5.43, *p* = .022, partial η^2 = .056. More specifically, pairwise comparisons indicated that while no significant differences were found at pre-test there were significant differences between conditions at posttest, *F* (1, 92) = 4.42, *p* = .038, partial η^2 = .046. Pairwise comparisons indicated a significant increase in self-efficacy among participants who learned that they have a leadership gene (premanipulation *M* = 28.92, *SE* = .71, CI [27.51 – 30.33], post-manipulation *M* = 29.84, *SE* = .69, CI [28.47 – 31.21], *F* (1, 92) = 9.61, *p* = .003, partial η^2 = .095, whereas no such effect was found among participants who learned that they did not have that gene (pre-manipulation *M* = 27.82, *SE* = .76, CI [26.32 – 29.32], post-manipulation *M* = 27.73, *SE* = .73, CI [26.27 – 29.18]), *F* (1, 92) = .083, *p* = .78, partial η^2 = .001.





Secondary (Mediation) Analyses

To address my mediation hypotheses, multiple mediation analyses were planned (Hayes, 2013). Three multiple mediation analyses were planned to examine the relationship between the independent variable (genetic prime) and the dependent variables as explained by potential mediator variables (leader identity and leadership self-efficacy). Specifically, mediation analyses were planned to be conducted on three dependent variables: (1) global transformational leadership, (2) putting others first, and (3) an objective leadership measure. An examination of

the *total effect* (*c*) was conducted to examine the relationship between the independent variable (gene condition; X) and the relevant dependent variable (Y). To examine potential mediation, the relationship between the independent variable and the mediator (*a* path) was examined in concert with the relationship between the mediator and the dependent variable (*b* path) to represent the full mediated path (a_ib_i). The *specific indirect effect* ($X \rightarrow M \rightarrow Y$) was examined to determine the effect of each mediator variable (*M*). To examine the effect of the independent variable (gene condition; X) on the relevant dependent variable (Y) after controlling for the mediator variables, the *direct effect* (*c*') was examined. Based on Preacher and Hayes (2008) method of analysis, 95% confidence intervals and standard errors were calculated using a bias-correcting bootstrapping technique (5,000 samples taken).

Given the null findings for the proposed relationship between (1) the genetic prime and a global measure of transformational leadership behaviour and, (2) the genetic prime and a measure of objective co-operative leadership behaviour, mediation analyses were not conducted to examine potential mediators of the non-significant relationship between the genetic prime and transformational leadership behaviour or co-operative leadership behaviour. However, the significant relationship reported between the genetic prime and perceptions of putting others first warrants further examination of potential mediators which may explain *why* participants who learned they have a gene related to leadership reported higher levels of putting others first.

As described above, the proposed mediation variables of leader identity (relational, collective, and implicit) and leadership self-efficacy were individually tested with ANOVAs to examine their relationship with the genetic prime. Given that the genetic prime was not found to significantly influence measures of relational identity or collective identity, these two variables were not included in the mediation analysis. However, as indicated in the ANOVA interactions

reported above, the genetic prime was found to significantly influence leadership self-efficacy and implicit leader identity. Thus, a parallel mediation analysis was conducted to examine the potential mediation effects of changes in both leadership self-efficacy and implicit leader identity on the relationship between the genetic prime and putting others first.

PROCESS, a statistical program designed by Hayes (2013), was run in SPSS in order to conduct the analysis. In order to examine whether leadership self-efficacy and implicit identity explained the effect of the genetic prime manipulation on perceptions of 'putting others first', post-test measures of leadership self-efficacy and implicit identity were included as the mediator variables. Pre-test measures of the mediator variables included as covariates. To account for changes in the outcome variable following the manipulation, pre-test measures of the dependent variable (i.e., putting others first) were included as a covariate in the mediation analysis (as illustrated in Figure 10).



Figure 10. Proposed total effect (c) between the genetic prime (X) and putting others first (Y).



Figure 11. Proposed parallel mediation model examining the indirect effects of condition (*X*) on post-test measures of putting others first (*Y*). The model includes two mediators as assessed at post-test; M_1 (path a_1b_1) and M_2 (path a_2b_2). Dashed lines represent covariate pretest measures of the mediator variables and dependent variable. *C'* represents the direct effect of *X* on *Y* after controlling for both mediators.

H3: Parallel mediation analysis of putting others first. As expected, and in line with the previously reported ANOVA, there was a significant total effect (*c*) for the effect of the genetic prime on putting others first (*total effect* = .34, SE = .13, p = .01, 95% CI [0.08 – 0.60]). Test of the model's indirect effects indicated that leadership self-efficacy was a significant mediator of the relationship between the genetic prime and putting others first (*indirect effect* = .11, SE = .08, 95% CI [0.01 – 0.33]), whereas implicit identity did not act as a mediator variable (*indirect effect* = .04, SE = .03, 95% CI [-0.13 – 0.006]). After accounting for the inclusion of mediator variables and after controlling for pre-test measures, the direct effect (*c*') of the genetic prime on putting others first remained statistically significant; *direct effect* = .26, SE = .13, p = .049, 95% CI [0.0002 – 0.53]. Results for the *a* and *b* pathways (in addition to the *c* and *c*' results reported above) are presented in Table 4, Figure 12, and Figure 13.

Table 4. Unstandardized beta coefficients, standard errors, and model summary information for the parallel multiple mediatormodel depicted in Figure 13.

Outcome Variable														
	M_1 (Leadership self-efficacy [LSE]) M_2 (Implicit leader identity [ILI])									Y (Putting Others First)				
Predictor Variable	b	SE	р	95% CI	b	SE	р	95% CI		b	SE	р	95% CI	
X (GPrime)	1.27	0.43	0.004	0.41 - 2.12	0.13	0.08	0.09	-0.02 - 0.29	Ċ	0.26	0.13	0.049	0.0002 - 0.53	
M_1 (LSE)	-	-	-		-	-	-			0.09	0.03	0.03	0.03 - 0.16	
M_2 (ILI)	-	-	-		-	-	-			-0.32	0.18	0.07	-0.67 - 0.03	
Note: GPrin	<i>Note:</i> GPrime = genetic prime, LSE = leadership self-efficacy, ILI = implicit leader identity													



Figure 12. Total effect (c) for the relationship between the genetic prime and putting others first. *p < .05. Numbers represent unstandardized regression coefficients.



Figure 13. Parallel mediation model examining the indirect effects of condition (*X*) on posttest measures of putting others first (*Y*). The model includes two mediators as measured at post-test; leadership self-efficacy (path a_1b_1) and implicit leader identity (path a_2b_2). Dashed lines represent pre-test measures included as covariate variables in the model. *C*' represents the direct effect of *X* on *Y* after controlling for both mediators. *p < .05. Numbers represent unstandardized regression coefficients.

Chapter 4: Discussion

In popular culture, the narrative surrounding leadership often points to the fact that leaders have an inherent ability to lead. More recently, an emerging area in psychological science known as the study of genetic essentialism suggests that we tend to view genetics as unchangeable and deterministic, and that these biases influence human cognition and behaviour (Dar-Nimrod & Heine, 2011). The purpose of this laboratory-based study was to examine potential genetic essentialism biases associated with leadership, and consider how these biases potentially influence cognitions and conceptions of leadership behaviour. In this randomized experimental study, participants were brought into the laboratory to learn whether they possess the genetic make-up of a leader or not. In the first condition, participants were informed through a bogus genetic test that they possessed a gene related to effective leadership, whereas participants in the second condition learned that they did not have that gene. It was expected that individuals who learned that they had a leadership gene would display higher levels of the corresponding leadership behaviour, be more likely to identify as a leader, and report higher levels of self-efficacy related to their leadership behaviour, compared to individuals who learned that they do not have that gene.

With respect to the first hypothesis, mixed results were found for the effects of the genetic prime on leadership behaviour. Specifically, no differences between conditions were reported for self-report measures of a *global* measure of transformational leadership. This measure sought to examine the effects of learning to have a leadership gene versus learning that one does not have that gene on a measure that subsumed the four dimensions of transformational leadership behaviour: (1) individualized consideration, (2) intellectual stimulation, (3) inspirational motivation, and (4) idealized influence. While the results of this study did not point

to support for the effects of the genetic prime on a global measure of transformational leadership, this may be due to the fact that the measure included behaviours that were not specifically primed by the genetic feedback given to participants. The genetic feedback package used in this study primarily emphasized that transformational leaders are effective because they have a tendency to put the needs of others before their own (i.e., a key dimension of transformational leadership), which ultimately leads to positive interactions and facilitates group success. Given this explanation of what it means to behave as a transformational leader, it is perhaps not surprising that participants who learned that they possessed a leadership gene did not perceive themselves to engage in behaviours related to all four dimensions of transformational leadership.

In contrast, participants did report significant changes in behaviours that were specifically targeted in the genetic feedback. With regard to measures of the *primed* dimension of leadership, medium-sized effects were found for behaviours related to considering the individual needs of others or, 'putting others first'. The results from this study suggest that learning that one has a gene associated with leadership influenced individuals' self-perceptions of their own behaviour specific to the leadership prime (putting others first). These results are consistent with other research related to self-report measures of a primed construct, such as Lebowtiz and Ahn (2017)'s study which found that individuals who received bogus genetic feedback indicating their susceptibility to depression were more likely to report having retrospectively experienced higher levels of depression. Although participants in the present study indicated differences in self-perceptions of putting others first, this did not translate into differences in objective measures of leadership behaviour, via participants' behaviour in the public goods game.

For the purpose of this laboratory-based study, measures of co-operative behaviour in a public goods game were considered to be representative of overt displays of transformational

leadership behaviour (specific to putting others first). In the present study, when participants were put in a social dilemma (i.e., public goods game, Offerman, 1997), those who learned that they have a leadership gene did not significantly differ in their willingness to give more money to the group (i.e., consider the needs of others before their own) compared to participants who learned that they do not have a leadership gene. The means of participants' allocation of money in the public goods game were in the hypothesized direction, with individuals who learned that they have a gene related to leadership donating slightly more money to the group than individuals who learned that they do not have a gene related to leadership. However, the effect was not statistically significant. It is possible that the gene manipulation was not sufficiently powerful to elicit a change in actual behaviour, but was able to produce changes in self-reported behaviour. The absence of a significant effect of the genetic prime on actual behaviour is in contrast to findings in other genetic essentialism experiments, such as those which have reported changes in objective measures of unhealthy eating behaviour (Dar-Nimrod et al., 2014) and math performance (Dar-Nimrod & Heine, 2006).

The secondary purpose of this study was to examine potential *mechanisms* which might explain the relationship between the genetic prime and leadership behaviour. Leadership identity was predicted as a potential mediator because researchers have suggested that viewing oneself as a leader is a prerequisite for behaving as a leader (Hannah et al., 2009). Although researchers have found that leader self-concept can be *primed* by environmental cues (Hannah et al., 2009), identity (such as racial identity) has also been shown to act as a stable construct (Shelton & Sellers, 2000). The present study aimed to examine the effects of learning that one has a leadership gene versus learning that one does not have that gene on one's perception of their leader identity. Contrary to our a priori hypothesis, individuals did not report any changes in self-

perceptions of leader identity (both relational and collective self-concept), regardless of the genetic condition to which they were assigned.

It is interesting to note that although individuals did not report changes in the self-report measure of identity, the genetic prime had a significant effect on implicit measures of leader identity. This finding suggests that receiving bogus genetic feedback may influence *unconscious* perceptions of identity, but not necessarily conscious perceptions. This is consistent with other studies, in which implicit associations have been found to account for variance above and beyond the use of self-report measures (Greenwald et al., 2009). For example, one study by Asgari and colleagues (2012) told women participants that they had similar traits to famous female leaders. They found that women who were told they had traits similar to successful leaders reported higher levels of implicit leader identity compared to women who were told that they did not have the same leader traits, regardless of whether they *explicitly* believed the feedback report.

An additional objective of the present study was to examine the proposed mechanism of leadership self-efficacy to explain the relationship between the genetic prime and leadership behaviour. According to Bandura (1993), individuals with higher self-efficacy feel a sense of personal control over their behaviour and perceive that they can successfully achieve a particular outcome. The extent to which individuals feel capable in performing a particular task has been found to influence future behavior (Bandura, 1982), such as performance in the workplace (Stajkovic & Luthans, 1998). Accordingly, it was expected that when participants learned that they possessed a leadership gene, they would feel a greater sense of control over their leadership behaviour and feel more confident about their ability to lead successfully. The findings of this study indicate that individuals who learned that they possessed a leadership gene were more

likely to report higher levels of leadership self-efficacy than those who learned that they did not possess a leadership gene.

Although the results of the analyses of variance revealed that the provision of the genetic prime resulted in changes in identity and self-efficacy, it is interesting to note that when both variables were included in the mediation analysis, only leadership self-efficacy was found to be a significant mediator of the effect of the genetic prime in relation to measures of putting others first. These results suggest that the genetic prime may have bolstered participant's efficacy beliefs about their ability to lead, and that this increase in leadership self-efficacy further positively influenced participant's perceptions of their own leadership behaviour. It should be noted, however, that the relationship between leadership self-efficacy and putting others first, while significant, was a small sized effect (standardized beta coefficient = .11), which suggests that other (unmeasured) variables may have been implicated in the relationship between the genetic prime and these self-perceptions of leadership behaviour.

Across all analyses it is interesting to note that contrary to our hypotheses, individuals who learned that they did not have a leadership gene did not report significant *decreases* in leadership behaviour, leader identity, or leadership self-efficacy. This aligns with results in some of the experimental studies using bogus genetic tests, but mixed findings exist within the literature. For example, in a study by Ahn and Lebowitz (2018), participants who learned that they did not have the genetic make-up associated with obesity reported significant decreases in their perceptions of the importance of diet and exercise. In addition, one study that examined the effects of learning that one has a gene associated with alcoholism found that individuals who learned that they did not ostensibly possess a gene associated with alcoholism reported decreases in negative affect after receiving the genetic feedback (Dar-Nimrod et al., 2013). In contrast,

although those who learned that they had a gene associated with a risk of alcoholism reported significant decreases in a separate measure of *positive* affect, no effects were found for those who learned that they did not have that gene (Dar-Nimrod et al., 2013).

Balanced against these (mixed) findings on the genetic risk of alcoholism by Dar-Nimrod and colleagues (2013), other studies using bogus genetic testing have not found significant changes within individuals in gene-absent conditions (Lebowitz & Ahn, 2017a, Lebowitz & Ahn, 2017b). This lack of change within gene-absent conditions is consistent with the findings from the present study. For example, in another recent study individuals learned that they had a gene related to major depressive disorder or that they did not have that gene (Lebowitz & Ahn, 2017a). The researchers found that those who learned that they had a gene related to depression experienced decreases in their confidence to regulate their own mood, but those who learned that they did not have that gene did not experience any changes in their confidence (Lebowitz & Ahn, 2017a). Thus, intra-individual analyses across studies have displayed mixed results for changes within participants who were primed to believe that they do not possess a particular gene.

A possible explanation for the results in the present study, related to the gene-absent condition, is that learning that one does *not* have a gene associated with leadership is presumably a less desirable outcome than learning that one does not possess a gene associated with negative health outcomes, such as alcoholism, obesity, or depression. If an individual learns that they do not have a gene that is socially desirable (e.g., associated with positive outcomes), it is possible that they would experience a form of cognitive dissonance (Festinger, 1962) and disregard or down-play their results to mitigate any negative self-perceptions. For example, one study examined the behaviour of white supremacists who learned through genetic testing that they have the genetic composition of multiple ethnicities (Panofsky & Donovan, 2017); the
researchers found that after receiving this genetic feedback indicative of racial diversity (which is arguably a less desirable outcome for white supremacists), the individuals tended to reject or discredit the accuracy of the genetic report, rather than change their self-perceptions or behaviour (Panofsky & Donovan, 2017). Perhaps, individuals who learned that they do not have a gene associated with leadership did not experience decreases in leadership behaviour, leadership selfefficacy, or leader identity because they chose to disregard the genetic test or rely more heavily on personal leadership experiences to mitigate the negative effects of cognitive dissonance.

Study Strengths

In addition to providing evidence to support the growing research on the implications of genetic essentialism, there are several notable strengths to the present study. Most importantly, this study was the first of its kind of examine the implications of genetic essentialism biases in the context of understanding leadership behaviour. The results of the present study provide some support for the effects of essentialist biases on leadership self-efficacy and leadership behaviour. While no effect was found on a global measure of leadership behaviour, learning that one has a leadership gene did produce significant effects on the primed behaviour related to putting others first. Furthermore, this study sought to examine potential mediator variables to help explain *how* the genetic prime might influence ratings of leadership behaviour, whereas other similar experimental studies have yet to test for specific mediator variables.

Another strength of this study is that all hypotheses and proposed analyses were preregistered with Open Science Framework (DOI 10.17605/OSF.IO/6HPTU) in order to promote the practice of open science. Furthermore, the randomized experimental design serves as an additional strength to this study, providing greater casual attribution of the presented findings. Participants in this study were randomly assigned after pre-test measures to be allocated to a

62

gene-present or gene-absent condition. The laboratory-based setting of this study provided a more controlled environment compared to similar experimental designs, wherein participants were mailed their genetic test to complete at home (e.g., Ahn & Lebowitz, 2018; Lebowitz & Ahn, 2017b). Similar to other recent studies on genetic essentialism (e.g., Ahn & Lebowitz, 2018; Lebowitz & Ahn, 2017b), the present study utilized a unique deception involving a fake genetic saliva test in order to mirror real-life scenarios wherein individuals, such as those involved in direct-to-consumer genetic testing, receive personalized feedback related to their genetic make-up.

Another noteworthy contribution of this study is the particular gene condition being manipulated, relative to other genetic essentialism experiments. Specifically, the present study used a 'leadership' gene as the manipulation, a type of *social* behaviour or skill, which is in contrast to several other *disease-related* genetic conditions primed in similar studies (e.g., obesity, depression, and alcoholism). In addition to the deviation from priming health behaviours, our study was unique because having the *presence* of a gene was indicative of a more *positive* genetic make-up (i.e., having a gene related to leadership is presumably a more desirable outcome). In contrast, other studies have examined gene conditions wherein the presence of a particular gene was associated with *negative* outcomes such as the increased risk of disease.

Limitations

While there were a number of strengths of this study, there were also some limitations that must be addressed. First, aside from a small number of participants who were recruited via posters on campus, this study was primarily conducted using a sample of undergraduate psychology students at the University of British Columbia. Given this, the generalizability of the

63

results in the present study may be limited to student populations. As some researchers have suggested (Henrich, Heine, & Norenzayan, 2010), most undergraduate samples are typically *Western, Educated, Industrialized, Rich, and Democratic* (WEIRD). Although the use of undergraduate students as participants is common in psychological research (Henrich et al., 2010), it is unknown whether the results from this study could be replicated amongst other populations. Therefore, future research should look to assess the generalizability of genetic essentialism biases across different education levels, age groups, geographic locations, and cultures.

Not only did this study have a WEIRD sample, but the majority of participants were students in the Faculty of Arts, which further limits the generalizability of the findings. Due to the high number of participants who were enrolled in psychology courses, this also presented challenges for the believability of the genetic feedback. For instance, several participants indicated that they began the study with a healthy level of skepticism or that they were looking for a deception, without explicitly knowing what that deception might be. While the recruitment of undergraduate students for participants is common in many psychological studies, one alternative to this would be to use large-scale online recruitment strategies. For instance, Ahn and Lebowitz's experiments (2017, 2018) on genetic essentialism recruited participants through Amazon.com's online Mechanical Turk (MTurk) platform (Buhrmester, Kwang, & Gosling, 2011). This alternative method of recruitment would allow for a more diverse and representative sample than the one examined in this study.

A second limitation was the inclusion of participants who were less certain (i.e., responded neither agree nor disagree) about the credibility of the test, rather than only including participants who were very certain about the test's credibility, as determined by the manipulation

64

check in our questionnaire. While the reliance on the manipulation check follows other similar procedures (e.g., Ahn & Lebowitz, 2018), the inclusion of participants who were uncertain about the test (yet did not indicate that they felt the test was bogus or not credible) was necessary in order to achieve sufficient power to conduct the primary analyses in this study.

Chapter 5: Conclusion

The present study not only contributes unique findings to the growing research on genetic essentialism, but also provides experimental evidence for the effects of genetic essentialism biases on leadership self-efficacy and behaviour. With the growing prevalence of direct-to-consumer genetic testing, there is an increased importance of understanding the psychological and behavioural implications of receiving individualized genetic reports. In fact, a recent systematic review found support for the effects of receiving *actual* genetic reports on subsequent health behaviour change (specifically regarding nutrition; Horne, Madill, O'Connor, Shelley, & Gilliland, 2018). Alongside the growing evidence of deterministic perceptions of disease-related genetics, future studies examining genetic essentialism biases and alternative types of social skills or traits (e.g., personality, resilience, talent) are warranted as advances in genetic technologies continue to develop.

Bibliography

23andMe. (n.d.). Retrieved from https://www.23andme.com

- Ahn, W. & Lebowitz, M. S. (2018). An experiment assessing effects of personalized feedback about genetic susceptibility to obesity on attitudes towards diet and exercise. *Appetite*, 120, 23–31. https://doi.org/10.1016/j.appet.2017.08.021
- Alimo-Metcalfe, B., Alban-Metcalfe, J., Bradley, M., Mariathasan, J., & Samele, C. (2008). The impact of engaging leadership on performance, attitudes to work and wellbeing at work. *Journal of Health Organization and Management*, 22(6), 586–598.
 https://doi.org/10.1108/14777260810916560
- Ames, B. N., & Gold, L. S. (1998). The causes and prevention of cancer: The role of environment. *Biotherapy*, 11, 205–220.
- Amundsen, S., & Martinsen, O. L. (2014). Empowering leadership: Construct clarification, conceptualization, and validation of a new scale. *Leadership Quarterly*, 25(3), 487–511. https://doi.org/10.1016/j.leaqua.2013.11.009
- Asgari, S., Dasgupta, N., & Stout, J. G. (2012). When do counterstereotypic ingroup members inspire versus deflate? The effect of successful professional women on young women's leadership self-concept. *Personality and Social Psychology Bulletin*, *38*(3), 370–383. https://doi.org/10.1177/0146167211431968
- Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, *15*(2), 265–288.
- Avolio, B. J. (2007). Promoting more integrative strategies for leadership theory-building. *American Psychologist*, 62(1), 25–33. https://doi.org/10.1037/0003-066X.62.1.25

- Avolio, B. J., & Gardner, W. L. (2005). Authentic leadership development: Getting to the root of positive forms of leadership. *The Leadership Quarterly*, *16*, 315–338. https://doi.org/10.1016/j.leaqua.2005.03.001
- Avolio, B. J., Reichard, R. J., Hannah, S. T., Walumbwa, F. O., & Chan, A. (2009). A metaanalytic review of leadership impact research: Experimental and quasi-experimental studies. *Leadership Quarterly*, 20, 764–784. https://doi.org/10.1016/j.leaqua.2009.06.006
- Avolio, B. J., Waldman, D. A., & Yammarino, F. J. (1991). Leading in the 1990s: The four I's of transformational leadership. *Journal of European Industrial Training*, *15*(4), 9–16.
- Avolio, B. J., Walumbwa, F. O., & Weber, T. J. (2009). Leadership: Current theories, research, and future directions. *Annual Review of Psychology*, 60(1), 421–449. https://doi.org/10.1146/annurev.psych.60.110707.163621
- Bandano, J., & Katsanis, N. (2002). Beyond Mendel: An evolving view of human genetic disease transmission. *Nature Reviews Genetics*, *3*, 779–789.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37(2), 122–147.
- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, 28(2), 117–148.
- Banks, G. C., McCauley, K. D., Gardner, W. L., & Guler, C. E. (2016). A meta-analytic review of authentic and transformational leadership: A test for redundancy. *Leadership Quarterly*, 27, 634–652. https://doi.org/10.1016/j.leaqua.2016.02.006
- Barling, J., Christie, A., & Hoption, C. (2010). Leadership. In *Handbook of Industrial and Organizational Psychology*. Washington, DC: APA Books.

Bass, B. M. (1985). Leadership and performance beyond expectations. New York: Free Press.

- Brewer, M. B., & Gardner, W. (1996). Who is this "we"? Levels of collective identity and self representations. *Journal of Personality and Social Psychology*, *71*(1), 83–93.
- Brown, M. E., Treviño, L. K., & Harrison, D. A. (2005). Ethical leadership: A social learning perspective for construct development and testing. *Organizational Behavior and Human Decision Processes*, 97, 117–134. https://doi.org/10.1016/j.obhdp.2005.03.002
- Bruttel, L., & Fischbacher, U. (2010). *Taking the initiative. What motivates leaders?* TWI Research Paper Series 61, Thurgauer Wirtschaftsinstitut, Universita⁻⁻t Konstanz.
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, 6(1), 3–5. https://doi.org/10.1177/1745691610393980
- Burke, P. J. (2006). Identity change. *Social Psychology Quarterly*, 69(1), 81–96. https://doi.org/10.1177/019027250606900106
- Cardno, A. G., & Gottesman, I. I. (2000). Twin studies of schizophrenia, from bow-and-arrow concordances to Star Wars Mx and functional genomics. *American Journal of Medical Genetics*, 97, 12–17.
- Carless, S. A., Wearing, A. J., & Mann, L. (2000). A short measure of transformational leadership. *Journal of Business and Psychology*, 14(3), 389–405. https://doi.org/10.2307/25077344
- Carpenter, T., Pogacar, R., Pullig, C., Kouril, M., Aguilar, S. J., LaBouff, J. P., Isenber, H., & Chakroff, A. (2018). Survey-based implicit association tests: A methodological and empirical analysis. Retrieved from <u>https://doi.org/10.31234/osf.io/hgy3z</u>
- Chaturvedi, S., Arvey, R., Zhang, Z., & Christoforou, P. (2011). Genetic underpinnings of transformational leadership: The mediating role of dispositional hope. *Journal of*

Leadership & Organizational Studies, *18*(4), 469–479. https://doi.org/10.1177/1548051811404891

- Chemers, M. M., Watson, C. B., & May, S. T. (2000). Dispositional affect and leadership effectiveness A comparison of self-esteem, optimism, and efficacy. *Personality & Social Psychology Bulletin*, 26, 267–277.
- Cheung, B. Y., Dar-Nimrod, I., & Gonsalkorale, K. (2014). Am I my genes? Perceived genetic etiology, intrapersonal processes, and health. *Social and Personality Psychology Compass*, 8(11), 626–637. https://doi.org/10.1111/spc3.12138
- Cheung, B. Y., & Heine, S. J. (2015). The double-edged sword of genetic accounts of criminality: Causal attributions from genetic ascriptions affect legal decision making. *Personality & Social Psychology Bulletin*, 41(12), 1723–1738. https://doi.org/10.1177/0146167215610520
- Clark, B. C., Thorne, C. B., Vann, J., & Cropsey, K. L. (2014). Five-factor personality and cooperative behavior. *North American Journal of Psychology*, *16*(3), 481–493.
- Collins, D. B., & Elwood, F. H. I. (2004). The effectiveness of managerial leadership development programs: A meta-analysis of studies from 1982 to 2001. *Human Resource Development Quarterly*, 15(2), 217–248.
- Cotterill, S. T., & Fransen, K. (2016). Athlete leadership in sport teams: Current understanding and future directions. *International Review of Sport and Exercise Psychology*, 9(1), 116– 133. https://doi.org/10.1080/1750984X.2015.1124443
- Craig, I. W., & Halton, K. E. (2009). Genetics of human aggressive behaviour. *Human Genetics*, *126*, 101–113. https://doi.org/10.1007/s00439-009-0695-9

D'Antonio, M. (2015). Donald Trump believes he was born to be king. Los Angeles Times.

Retrieved from www.latimes.com

- Dar-Nimrod, I., Cheung, B. Y., Ruby, M. B., & Heine, S. J. (2014). Can merely learning about obesity genes affect eating behavior? *Appetite*, 81, 269–276. https://doi.org/10.1016/j.appet.2014.06.109
- Dar-Nimrod, I., & Heine, S. J. (2006). Exposure to scientific theories affects women's math performance. *Science*, *314*(5798), 435–435. https://doi.org/10.1126/science.1131100
- Dar-Nimrod, I., & Heine, S. J. (2011). Genetic essentialism: On the deceptive determinism of DNA. *Psychological Bulletin*, 137(5), 800–818. https://doi.org/10.1037/a0021860
- Dar-Nimrod, I., Zuckerman, M., & Duberstein, P. R. (2013). The effects of learning about one's own genetic susceptibility to alcoholism: A randomized experiment. *Genetics in Medicine*, 15(2), 132–138. https://doi.org/10.1038/gim.2012.111
- Day, D. V., & Harrison, M. M. (2007). A multilevel, identity-based approach to leadership development. *Human Resource Management Review*, 17(4), 360–373. https://doi.org/10.1016/j.hrmr.2007.08.007
- De Neve, J.-E., Mikhaylov, S., Dawes, C. T., Christakis, N. A., & Fowler, J. H. (2013). Born to lead? A twin design and genetic association study of leadership role occupancy. *The Leadership Quarterly*, 24(1), 45–60. https://doi.org/10.1016/j.leaqua.2012.08.001
- Derue, D. S., Nahrgang, J. D., Wellman, N., & Humphrey, S. E. (2011). Trait and behavioral theories of leadership: An integration and meta-analytic test of their relative validity. *Personnel Psychology*, 64, 7–52. https://doi.org/10.1111/j.1744-6570.2010.01201.x
- Dipple, K. M., & McCabe, E. R. B. (2000). Modifier genes convert "simple" mendelian disorders to complex traits. *Molecular Genetics and Metabolism*, 71, 43–50. https://doi.org/10.1006/mgme.2000.3052

Englmaier, F., & Gebhardt, G. (2016). Social dilemmas in the laboratory and in the field. *Journal of Economic Behavior and Organization*, 128, 85–96. https://doi.org/10.1016/j.jebo.2016.03.006

- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191. https://doi.org/10.3758/BF03193146
- Fehr, R., & Gelfand, M. J. (2010). When apologies work: How matching apology components to victims' self-construals facilitates forgiveness. *Organizational Behavior and Human Decision Processes*, 113(1), 37–50. https://doi.org/10.1016/j.obhdp.2010.04.002
- Festinger, L. (1962). A Theory of Cognitive Dissonance. Standford, CA: Standford University Press.
- Fischbacher, U. (2007). Z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, *10*(2), 171–178.
- Fischbacher, U., Gächter, S., & Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters*, 71(3), 397–404. https://doi.org/10.2139/ssrn.203288
- Gamst, G., Meyers, L. S., & Guarino, A. J. (2008). *Analysis of variance designs: A conceptual and computational approach with SPSS and SAS*. New York, NY: Cambridge University Press.
- Gelman, S. A., & Wellman, H. M. (1991). Insides and essences: Early understandings of the non-obvious. *Cognition*, 38, 213–244. https://doi.org/10.1016/0010-0277(91)90007-Q
- George, D., & Mallery, P. (2003). SPSS for Windows Step by Step: A Simple Guide and Reference 11.0 Update. Boston: Allyn and Bacon.

- Goldberg, L. R. (1990). An alternative "description of personality": The Big-Five factor structure. *Journal of Personality and Social Psychology*, *59*(6), 1216–1229.
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: attitudes, self-esteem, and stereotypes. *Psychological Review*, 102(1), 4–27. https://doi.org/10.1037/0033-295X.102.1.4
- Greenwald, A. G., & Farnham, S. D. (2000). Using the Implicit Association Test to measure selfesteem and self-concept. *Journal of Personality and Social Psychology*, 79(6), 1022–1038. https://doi.org/10.1037//0022-3514.79.6.I022
- Greenwald, A. G., Mcghee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480.
- Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97(1), 17–41. https://doi.org/10.1037/a0015575
- Guillén, L., Mayo, M., & Korotov, K. (2015). Is leadership a part of me? A leader identity approach to understanding the motivation to lead. *Leadership Quarterly*, 26(5), 802–820. https://doi.org/10.1016/j.leaqua.2015.05.001
- Gündemir, S., Homan, A. C., De Dreu, C. K. W., & Van Vugt, M. (2014). Think leader, think white? Capturing and weakening an implicit pro-White leadership bias. *PLoS ONE*, *9*(1). https://doi.org/10.1371/journal.pone.0083915
- Han, P. (2010). Donald Trump: I have the genes for success. *CNN: Connect the World*. Retrieved from www.cnn.com

Hannah, S. T., Avolio, B. J., Luthans, F., & Harms, P. D. (2008). Leadership efficacy: Review

and future directions. *The Leadership Quarterly*, *19*, 669–692. https://doi.org/10.1016/j.leaqua.2008.09.007

- Hannah, S. T., Avolio, B. J., Walumbwa, F. O., & Chan, A. (2012). Leader self and means efficacy: A multi-component approach. *Organizational Behavior and Human Decision Processes*, 118, 143–161. https://doi.org/10.1016/j.obhdp.2012.03.007
- Hannah, S. T., & Luthans, F. (2008). A cognitive affective processing explanation of positive leadership. In R. H. Humphrey (Ed.), *Affect and emotion: New directions in management theory and research* (pp. 97–136). Charlotte, NC: Information Age Publishing.
- Hannah, S. T., Woolfolk, R. L., & Lord, R. G. (2009). Leader self-structure: A framework for positive leadership. *Journal of Organizational Behavior*, 30(2), 269–290. https://doi.org/10.1002/job.586
- Haslam, N., & Levy, S. R. (2006). Essentialist beliefs about homosexuality: Structure and implications for prejudice. *Personality and Social Psychology Bulletin*, 32(4), 471–485. https://doi.org/10.1177/0146167205276516
- Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York, NY: The Guilford Press.
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Beyond WEIRD: Towards a broad-based behavioral science. *Behavioral and Brain Sciences*, 33(2–3), 111–135. https://doi.org/10.1017/s0140525x10000725
- Hertel, G., & Fiedler, K. (1994). Affective and cognitive influences in a social dilemma game. *European Journal of Social Psychology*, 24, 131–145.
- Horne, J., Madill, J., O'Connor, C., Shelley, J., & Gilliland, J. (2018). A systematic review of genetic testing and lifestyle behaviour change: Are we using high-quality genetic

interventions and considering behaviour change theory? *Lifestyle Genomics*, *11*(1), 49–63. https://doi.org/10.1159/000488086

House, R. (2005). Charismatic Leadership Theory. In *Organizational behavior: Essential theories of motivation and leadership* (p. 416). Armonk, NY: M.E. Sharpe.

House, R. J., Spangler, W. D., & Woycke, J. (1991). Personality and charisma in the U.S. presidency: A psychological theory of leader effectiveness. *Administrative Science Quarterly*, *36*, 364–396. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Copyright+©2001.+All+ Rights+Reserved.#0

- Howes, O. D., McDonald, C., Cannon, M., Arseneault, L., Boydell, J., & Murray, R. M. (2004).
 Pathways to schizophrenia: The impact of environmental factors. *International Journal Of Neuropsychopharmacology*, 7(1), S7–S13. https://doi.org/10.1017/s1461145704004122
- Hoyt, C. L., & Blascovich, J. (2007). Leadership efficacy and women leaders' responses to stereotype activation. *Group Processes & Intergroup Relations*, 10(4), 595–616. https://doi.org/10.1177/1368430207084718
- Johnson, A. M., Vernon, P. A., McCarthy, J. M., Molson, M., Harris, J. A., & Jang, K. L. (1998). Nature vs nurture: Are leaders born or made? A behavior genetic investigation of leadership style. *Twin Research*, *1*, 216–223. https://doi.org/10.1375/twin.1.4.216
- Johnson, R. E., & Jackson, E. M. (2009). Appeal of organizational values is in the eye of the beholder: The moderating role of employee identity. *Journal of Occupational and Organizational Psychology*, 82(4), 915–933. https://doi.org/10.1348/096317908X373914
- Johnson, R. E., & Saboe, K. N. (2011). Measuring implicit traits in development of an indirect measure of employee implicit self-concept. *Organizational Research Methods*, *14*(3), 530–

547. https://doi.org/10.1177/1094428110363617

- Johnson, R. E., Selenta, C., & Lord, R. G. (2006). When organizational justice and the selfconcept meet: Consequences for the organization and its members. *Organizational Behavior and Human Decision Processes*, 99, 175–201. https://doi.org/10.1016/j.obhdp.2005.07.005
- Johnson, R. E., Venus, M., Lanaj, K., Mao, C., & Chang, C.-H. (2012). Leader identity as an antecedent of the frequency and consistency of transformational, consideration, and abusive leadership behaviors. *Journal of Applied Psychology*, 97(6), 1262–1272. https://doi.org/10.1037/a0029043
- Judge, T. A., & Bono, J. E. (2000). Five-factor model of personality and transformational leadership. *Journal of Applied Psychology*, 85(5), 751–765.
- Judge, T. A., Bono, J. E., Ilies, R., & Gerhardt, M. W. (2002). Personality and leadership: A qualitative and quantitative review. *Journal of Applied Psychology*, 87(4), 765–780. https://doi.org/10.1037//0021-9010.87.4.765
- Judge, T. A., Piccolo, R. F., & Ilies, R. (2004). The forgotten ones? The validity of consideration and initiating structure in leadership research. *Journal of Applied Psychology*, 89(1), 36–51. https://doi.org/10.1037/0021-9010.89.1.36
- Jung, D. I. (2001). Transformational and transactional leadership and their effects on creativity in groups. *Creativity Research Journal*, 13(2), 185–195. https://doi.org/10.1207/S15326934CRJ1302
- Kane, T. D., & Tremble, T. R. (2000). Transformational leadership effects at different levels of the Army. *Military Psychology*, 12(2), 137–160. https://doi.org/10.1207/S15327876MP1202_4

- Kark, R., & Shamir, B. (2013). The dual effect of transformational leadership: Priming relational and collective selves and further effects of followers. In *Transformational and charismatic leadership: The road ahead* (pp. 77–101). Bingley, UK: Emerald Group Publishing. https://doi.org/10.1108/S1479-3571(2013)0000005029
- Karpinski, A., & Hilton, J. L. (2001). Attitudes and the Implicit Association Test. Journal of Personality and Social Psychology, 81(5), 774–788. https://doi.org/10.1037//0022-3514.81.5.774
- Kirby, P. C., Paradise, L. V, & King, M. I. (1992). Extraordinary leaders in education:
 Understanding transformational leadership. *The Journal of Educational Research*, 85(5), 303–311. https://doi.org/10.1080/00220671.1992.9941130
- Kraft, P., & Hunter, D. J. (2009). Genetic risk prediction Are we there yet? New England Journal of Medicine, 360(17), 1701–1703. https://doi.org/10.1056/NEJMp0810107
- Krasikova, D. V., Green, S. G., & LeBreton, J. M. (2013). Destructive leadership: A theoretical review, integration, and future research agenda. *Journal of Management*, 39(5), 1308–1338. https://doi.org/10.1177/0149206312471388
- Krueger, F., Parasuraman, R., Iyengar, V., Thornburg, M., Weel, J., Lin, M., Clarke, E.,
 McCabe, K., & Lipsky, R. H. (2012). Oxytocin receptor genetic variation promotes human trust behavior. *Frontiers in Human Neuroscience*, 6(4), 1–9.
 https://doi.org/10.3389/fnhum.2012.00004
- Labbadia, J., & Morimoto, R. I. (2013). Huntington's disease: Underlying molecular mechanisms and emerging concepts. *Trends in Biochemical Sciences*, 38(8), 378–385. https://doi.org/10.1016/j.tibs.2013.05.003

Lanie, A. D., Jayaratne, T. E., Sheldon, J. P., Kardia, S. L. R., Anderson, E. S., Feldbaum, M., &

Petty, E. M. (2004). Exploring the public understanding of basic genetic concepts. *Journal of Genetic Counseling*, *13*(4), 305–320.

https://doi.org/10.1023/B:JOGC.0000035524.66944.6d

- Leary, M. R., & Tangney, J. P. (2012). *Handbook of self and identity* (Second). New York, NY: The Guilford Press.
- Lebowitz, M. S., & Ahn, W. (2017a). Blue genes? Understanding and mitigating negative consequences of personalized information about genetic risk for depression. *Journal of Genetic Counseling*, 1–13. https://doi.org/10.1007/s10897-017-0140-5
- Lebowitz, M. S., & Ahn, W. (2017b). Testing positive for a genetic predisposition to depression magnifies retrospective memory for depressive symptoms. *Journal of Consulting and Clinical Psychology*, 85(11), 1052–1063. Retrieved from http://web.b.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=10&sid=b4498d12-2a78-4559-9267-823580ea13cc%40sessionmgr104
- Lee, A. A., Laurent, S. M., Wykes, T. L., Kitchen Andren, K. A., Bourassa, K. A., & McKibbin, C. L. (2014). Genetic attributions and mental illness diagnosis: Effects on perceptions of danger, social distance, and real helping decisions. *Social Psychiatry and Psychiatric Epidemiology*, 49(5), 781–789. https://doi.org/10.1007/s00127-013-0764-1
- Liden, R. C., Wayne, S. J., Zhao, H., & Henderson, D. (2008). Servant leadership: Development of a multidimensional measure and multi-level assessment. *Leadership Quarterly*, 19(2), 161–177. https://doi.org/10.1016/j.leaqua.2008.01.006
- Lord, R. G., & Brown, D. J. (2004). *Leadership processes and follower self-identity*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

MacKenzie, S. B., Podsakoff, P. M., & Rich, G. A. (2001). Transformational and transactional

leadership and salesperson performance. *Journal of the Academy of Marketing Science*, 29(2), 115–134. https://doi.org/10.1177/03079459994506

Mason, C., Griffin, M., & Parker, S. (2014). Transformational leadership development:
 Connecting psychological and behavioral change. *Leadership & Organization Development Journal*, 35(3), 174–194. https://doi.org/10.1108/MBE-09-2016-0047

McDermott, A., Kidney, R., & Flood, P. (2011). Understanding leader development: Learning from leaders. *Leadership & Organization Development Journal*, 32(4), 358–378. https://doi.org/10.1108/01437731111134643

Mellor, S., Barclay, L. A., Bulger, C. A., & Kath, L. M. (2006). Augmenting the effect of verbal persuasion on self-efficacy to serve as a steward: Gender similarity in a union environment. *Journal of Occupational and Organizational Psychology*, 79, 121–129. https://doi.org/10.1348/096317905X36353

Mendel, G. (1965). *Experiments in plant hybridization*. Cambridge: Harvard University Press.

- Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation*. Thousand Oaks, CA: Sage.
- Morandini, J. S., Blaszczynski, A., Costa, D. S. J., Godwin, A., & Dar-Nimrod, I. (2017). Born this way: Sexual orientation beliefs and their correlates in Lesbian and Bisexual women. *Journal of Counseling Psychology*, 64(5), 560–573. https://doi.org/10.1037/cou0000209
- Morgan, C., & Fisher, H. (2007). Environmental factors in schizophrenia: Childhood trauma A critical review. *Schizophrenia Bulletin*, *33*(1), 3–10. https://doi.org/10.1093/schbul/sbl053
- Morimoto, L. M., White, E., Chen, Z., Chlebowski, R. T., Hays, J., Kuller, L., Lopez, A. M., Manson, J., Margolis, P. C., Marcia, L. S., & McTiernan, A. (2002). Obesity, body size, and risk of postmenopausal breast cancer: The women's health initiative (United States). *Cancer*

Causes and Control, 13(8), 741–751.

- Morin-Chassé, A., Suhay, E., & Jayaratne, T. E. (2017). Discord over DNA: Ideological responses to scientific communication about genes and race. *Journal of Race, Ethnicity and Politics*, 2(2), 260–299. https://doi.org/10.1017/rep.2017.17
- Morley, M., Molony, C. M., Weber, T. M., Devlin, J. L., Ewans, K. G., Spielman, R. S., & Cheung, V. G. (2004). Genetic analysis of genome-wide variation in human gene expression. *Nature*, 430(7001), 743–747. https://doi.org/10.1038/nature02797.Genetic
- Morris Brown, L., Everett, G. D., Gibson, R., Burmeister, L. F., Schuman, L. M., & Blair, A. (1992). Smoking and risk of non-Hodgkin's lymphoma and multiple myeloma. *Cancer Causes and Control*, 3(1), 49–55.
- Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counselling Psychology*, 38(1), 30–38.
- Mumford, M. D., Zaccaro, S. J., Harding, F. D., Jacobs, T. O., & Fleishman, E. A. (2000).
 Leadership skills for a changing world: Solving complex social problems. *Leadership Quarterly*, *11*(1), 11–35.
- Murphy, S. E. (1992). *The contribution of leadership experience and self-efficacy to group performance under evaluation apprehension*. University of Washington, Seattle.
- Neugebauer, T., Perote, J., Schmidt, U., & Loos, M. (2009). Selfish-biased conditional cooperation: On the decline of contributions in repeated public goods experiments. *Journal* of Economic Psychology, 30(1), 52–60. https://doi.org/10.1016/j.joep.2008.04.005
- Nielsen, K., Randall, R., Yarker, J., & Brenner, S.-O. (2008). The effects of transformational leadership on followers' perceived work characteristics and psychological well-being: A longitudinal study. *Work and Stress*, 22(1), 16–32.

https://doi.org/10.1080/02678370801979430

- Northouse, P. G. (2017). *Introduction to leadership: Concepts and practice*. Thousand Oaks, California: Sage Publications.
- Offerman, T. (1997). *Beliefs and decision rules in public goods games: Theory and experiments*. Kluwer Academic Publishers.
- Ottaway, S. A., Hayden, D. C., & Oakes, M. A. (2001). Implicit attitudes and racism: Effects of word familiarity and frequency on the implicit association test. *Social Cognition*, 19(2), 97– 144.
- Panofsky, A., & Donovan, J. (2017). When genetics challenges a racist's identity: Genetic ancestry testing among white nationalist. 1–50. doi: 10.31235/osf.io/7f9bc

Pearson, H. (2006). What is a gene? Nature, 441, 399-401.

- Perugini, M., & Leone, L. (2009). Implicit self-concept and moral action. *Journal of Research in Personality*, 43(5), 747–754. https://doi.org/10.1016/j.jrp.2009.03.015
- Pietinen, P., Malila, N., Virtanen, M., Hartman, T. J., Tangrea, J. A., Albanes, D., & Virtamo, J. (1999). Diet and risk of colorectal cancer in a cohort of Finnish men. *Cancer Causes and Control*, 10, 387–396.
- Pinter, B., & Greenwald, A. G. (2005). Clarifying the role of the "other" category in the selfesteem IAT. *Experimental Psychology*, 52(1), 74–79. https://doi.org/10.1027/1618-3169.52.1.74
- Podsakoff, P. M., Mackenzie, S. B., & Bommer, W. B. (1996). Transformational leader
 behaviors and substitutes for leadrship as determinants of employee satisfaction,
 commitment, trust, and organizational citizenship behaviors. *Journal of Management*, 22(2),
 259–298.

- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. https://doi.org/10.3758/BRM.40.3.879
- Préget, R., Nguyen-Van, P., & Willinger, M. (2016). Who are the voluntary leaders?
 Experimental evidence from a sequential contribution game. *Theory and Decision*, *81*, 581–599. https://doi.org/10.1007/s11238-016-9550-3
- Rédei, G. P. (2008). Allele. In *Encyclopedia of Genetics Genomics Proteomics and Informatics* (pp. 58–59). https://doi.org/10.1007/978-1-4020-6754-9_1183
- Reed, L. L., Vidaver-Cohen, D., & Colwell, S. R. (2011). A new scale to measure executive servant leadership: Development, analysis, and implications for research. *Journal of Business Ethics*, 101, 415–434. https://doi.org/10.1007/sl0551-010-0729-1
- Reichard, J. W. (2009). A sociobiological model for the Holocaust: Analyzing anti-semitic behavioral patterns with ingroup-outgroup theory. *ProQuest Dissertations Publishing*, 119, 1–128.
- Resta, R., Biesecker, B. B., Bennett, R. L., Blum, S., Hahn, S. E., Strecker, M. N., & Williams, J. L. (2006). A new definition of genetic counseling: National Society of Genetic Counselors' Task Force report. *Journal of Genetic Counseling*, *15*(2), 77–83. https://doi.org/10.1007/s10897-005-9014-3
- Rhee, S. H., & Waldman, I. D. (2002). Genetic and environmental influences on antisocial behavior: A meta-analysis of twin and adoption studies. *Psychological Bulletin*, 128(3), 490–529. https://doi.org/10.1037//0033-2909.128.3.490
- Rodrigues, S. M., Saslow, L. R., Garcia, N., John, O. P., & Keltner, D. (2009). Oxytocin receptor genetic variation relates to empathy and stress reactivity in humans. *Proceedings of the*

National Academy of Sciences of the United States of America, 106(50), 21437–21441. doi:10.1073/pnas.0909579106

- Schyns, B., & Schilling, J. (2013). How bad are the effects of bad leaders? A meta-analysis of destructive leadership and its outcomes. *Leadership Quarterly*, 24(1), 138–158. https://doi.org/10.1016/j.leaqua.2012.09.001
- Scriver, C. R., & Waters, P. J. (1999). Monogenic traits are not simple: Lessons from phenylketonuria. *Trends in Genetics*, 15(7), 267–272. https://doi.org/10.1016/S0168-9525(99)01761-8
- Selenta, C., & Lord, R. G. (2005). Development of the levels of self-concept scale: Measuring the individual, relational, and collective levels. *Unpublished manuscript*.
- Shamir, B., Dayan-Horesh, H., & Adler, D. (2005). Leading by biography: Towards a life-story approach to the study of leadership. *Leadership*, 1(1), 13–29. https://doi.org/10.1177/1742715005049348
- Shamir, B., & Eilam, G. (2005). "What's your story?" A life-stories approach to authentic leadership development. *The Leadership Quarterly*, *16*, 395–417. https://doi.org/10.1016/j.leaqua.2005.03.005
- Shelton, J. N., & Sellers, R. M. (2000). Situational stability and variability in African American racial identity. *Journal of Black Psychology*, 26(1), 27–50. https://doi.org/10.1177/0095798400026001002
- Skogstad, A., Einarsen, S., Torsheim, T., Aasland, M. S., & Hetland, H. (2015). The destructiveness of laissez-faire leadership behavior. *Journal of Leadership & Organizational Studies*, 22(1), 115–124. https://doi.org/10.1177/1548051813515302

Smeesters, D., Warlop, L., Van Avermaet, E., Corneille, O., & Yzerbyt, V. (2003). Do not prime

hawks with doves: The interplay of construct activation and consistency of social value orientation on cooperative behavior. *Journal of Personality and Social Psychology*, *84*(5), 972–987. https://doi.org/10.1037/0022-3514.84.5.972

Smith, E. R. (1984). Model of social inference processes. *Psychological Review*, 91(3), 392–413.

- Smith, E. R., & DeCoster, J. (2000). Dual-process models in social and cognitive psychology:
 Conceptual integration and links to underlying memory Systems. *Personality and Social Psychology Review*, 4(2), 108–131. https://doi.org/10.1207/S15327957PSPR0402_01
- Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A metaanalysis. *Psychological Bulletin*, 124(2), 240–261.
- Steffens, M. C. (2005). Implicit and explicit attitudes towards lesbians and gay men. *Journal of Homosexuality*, 49(2), 39–66. https://doi.org/10.1300/J082v49n02
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.
- van Dierendonck, D. (2011). Servant leadership: A review and synthesis. *Journal of Management*, *37*(4), 1228–1261. https://doi.org/10.1177/0149206310380462
- van Knippenberg, D., van Knippenberg, B., De Cremer, D., & Hogg, M. A. (2004). Leadership, self, and identity: A review and research agenda. *Leadership Quarterly*, 15(6), 825–856. https://doi.org/10.1016/j.leaqua.2004.09.002
- Vernon, P. A., Villani, V. C., Vickers, L. C., & Aitken Harris, J. (2008). A behavioral genetic investigation of the Dark Triad and the Big 5. *Personality and Individual Differences*, 44, 445–452. https://doi.org/10.1016/j.paid.2007.09.007
- Volk, S., Thöni, C., & Ruigrok, W. (2011). Personality, personal values and cooperation preferences in public goods games: A longitudinal study. *Personality and Individual*

Differences, 50(6), 810-815. https://doi.org/10.1016/j.paid.2011.01.001

- Wang, G., Oh, I.-S., Courtright, S. H., & Colbert, A. E. (2011). Transformational leadership and performance across criteria and levels: A meta-analytic review of 25 years of research. *Group & Organization Management*, 36(2), 223–270. https://doi.org/10.1177/1059601111401017
- West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed), *Structural equation modeling: Concepts, issues, and applications* (pp. 56–75). Thousand Oaks, CA: Sage Publications.
- White, M. J., & White, G. B. (2006). Implicit and explicit occupational gender stereotypes. *Sex Roles*, 55, 259–266. https://doi.org/10.1007/s11199-006-9078-z
- Williams, M. J., & Eberhardt, J. L. (2008). Biological conceptions of race and the motivation to cross racial boundaries. *Journal of Personality and Social Psychology*, 94(6), 1033–1047. https://doi.org/10.1037/0022-3514.94.6.1033
- Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of Personality and Social Psychology*, 56(3), 407–415. https://doi.org/10.1037/0022-3514.56.3.407
- Zacharatos, A., Barling, J., & Kelloway, E. K. (2000). Development and effects of transformational leadership in adolescents. *The Leadership Quarterly*, *11*(2), 211–226. https://doi.org/10.1016/S1048-9843(00)00041-2
- Zwingmann, I., Wegge, J., Wolf, S., Rudolf, M., Schmidt, M., & Richter, P. (2014). Is transformational leadership healthy for employees? A multilevel analysis in 16 nations. *Zeitschrift Fur Personalforschung*, 28(1–2), 24–51. https://doi.org/10.1688/ZfP-2014-01-Zwingmann

Appendices

Appendix A: Poster and Letter of Information

Leadership and Group Behaviour Study

Principle Investigator:

School of Kinesiology University of British Columbia Co-Investigator:

School of Kinesiology University of British Columbia

Purpose: The purpose of this study is to examine leaders and their behaviours in a group setting.

The following criteria will be used to determine participant eligibility for this study:

- 1. Able to read and converse in English
- 2. A student currently enrolled at the University of British Columbia

Procedure: This is a lab-based study of leadership behaviour in groups. Participants will be asked to come into the lab at two different time points. During your first visit, you will provide a saliva sample to determine your genetic make-up, complete a short questionnaire, and participate in a group activity. During the second lab visit, you will be provided with a personalized genetic report and you will be asked to complete an identical questionnaire and group activity as in the first session.

Benefits: During this study, you will be provided with a <u>free, personalized genetic report</u>, similar to reports created by *23andMe*, indicating your carrier status on traits related to leadership.

Confidentiality: All information provided by participants will remain confidential and will not be linked to your name or student number. The data collected will be used solely for the purpose of this research study. Participant information will be stored in a secure room in the **secure**.

Participation: Participation in this study is voluntary and individuals are free to decline or withdraw from the study at any time. There are no known potential risks associated with this study.

Contact: If you would like to participate in this study or require further information, please contact

Appendix B: Consent Form

Leadership and Group Behaviour Study

Principle Investigator:

School of Kinesiology University of British Columbia Co-Investigator:

School of Kinesiology University of British Columbia

Purpose: The purpose of this study is to examine leaders and their behaviours in a group setting.

Procedure: This is a lab-based study of leadership behaviour in groups. Participants will be asked to come into the lab at two different time points. During your first visit, you will provide a saliva sample to determine your genetic make-up, complete a short questionnaire, and participate in a group activity. During the second lab visit, you will be provided with a personalized genetic report and you will be asked to complete an identical questionnaire and group activity as in the first session.

Benefits: During this study, you will be provided with a <u>free, personalized genetic report</u>, similar to reports created by *23andMe*, indicating your carrier status on traits related to leadership.

Confidentiality: All information provided by participants will remain confidential and will not be linked to your name or student number. The data collected will be used solely for the purpose of this research study. Participant information will be stored in a secure room in

Participation: Participation in this study is voluntary and individuals are free to decline or withdraw from the study at any time. There are no known potential risks associated with this study.

Contact: If you have any concerns about the study or would like further information, please contact **Contact:** If you are concerned about your rights or treatment as a participant, please contact the UBC Office of Research Services at

By signing this form, you are indicating that you have read and understood the research description provided, are fully aware of what will be asked of you, and that you agree to take part in this study. Further, you understand that your participation is voluntary and you are free to withdraw at any time without needing to provide an explanation and without facing negative consequences.

By signing this form, you have consented to participate in the Leadership and Group Behaviour study.

SIGNED	
NAME IN BLOCK LETTERS	
DATE	

Yours sincerely,

Principle Investigator:

School of Kinesiology University of British Columbia Co-Investigator:

School of Kinesiology University of British Columbia Appendix C: Genetic Feedback Package





Genetics and Leadership Behaviour

Researchers at UBC have partnered with a new Vancouver-based genetic testing company, *Gene Discovery*, to expand the realm of behavioural science. As a team, we are interested in learning how individual genes influence human behaviour. In particular, we are interested in learning how genetics are related to leadership behaviour.

Transformational leaders are those who positively influence those around them by <u>putting the</u> <u>needs of others before their own, role-modelling positive behaviours, challenging others to be</u> <u>innovative, and inspiring and motivating others</u>. By considering the needs of others, transformational leaders are able to bring out the best in those around them. With recent improvements in genome testing, researchers have been able to identify particular genes that are associated with displays of transformational leadership behaviour (Clerkson, Menard, Vaisser, Bonbrier, Wanner, De Preter, et al., *in press*; Pangilan, Vos, Rogozan, Sung, Dong, Rho, et al., 2016). In this study, you will be able to **test your own genetics to learn if you have the genes of a transformational leader**.

Saliva testing is an easy, safe, non-invasive method of obtaining affordable, and most importantly accurate, genetic results. Over the past few years, geneticists and neuroscientists have begun to use saliva testing to examine a number of psychological markers such as stress, and diagnose conditions such as depression and anxiety. Most commonly, saliva testing has been used to understand the determinants of human behaviour through testing for particular enzymes found in saliva because such enzyme expression directly derives from our genes.

Because full-fledged DNA testing can be time-consuming, a saliva test for an enzyme called *N*-*Archynoldopamase* will be used for this study. Recent studies have found that if a person has the genetics of transformational leadership behaviour, that person will also have high levels of *N*-*Archynoldopamase* in their saliva. High levels of *N*-*Archynoldopamase* are produced by a high-expressing variant of the SERT gene, which is found in approximately 20% of the world's population. If a person has low levels of *N*-*Archynoldopamase* in his or her saliva, this indicates an absence of the high-expressing variant of the SERT gene, which is related to lower transformational leadership behaviour.

In fact, researchers at Stanford University have recently found that individuals who tend to naturally behave as transformational leaders are three and a half times more likely than average to possess the high-expressing variant of the SERT gene (Hatcher, Tang, Dusheyto, Salamon, Pritman, & Booren, 2017). Individuals with this genetic makeup were found to have an innate tendency to put others needs before their own and do this to improve interactions with others in order to facilitate group success. As noted above, the presence of this gene has been linked to higher levels of *N*-*Archynoldopamase* in their saliva.

The current study aims to test for specific transformational leadership genes in order to further understand the predictability of human behaviour. The following saliva sampling kit will provide immediate feedback on your levels of *N*-*Arachynoldopamase* by reacting with the test strip provided.

References:

- Clerkson, L. P., Menard, N., Vaisser, C. G., Bonbrier, A., Wanner, T., De Preter, H., Barnet, D. T., Lewis, K. R., Datsetano, L., Hofferman, N. R., Eichloter, D., Vandermetur, J. (in press). What makes a leader? Gene *r9386* predictive of leadership behaviour through enzyme encoding. *Journal of Behavioral Medicine*, *31*(5), 214-221.
- Hatcher, J., Tang, C., Dusheyto, K., Salamon, F., Pritman, N., & Booren, A. (2017). A rapid method for the isolation of functional enzymes in transformational leadership behaviour. *Science*, 354(6317), 1305-1308.
- Pangjilan, P., Vos, H., Rogozan, I.A., Sung, J.R., Dong, X., Rho, L., Bauern, K., Andrews, D.W., Frender, F., Casanalo, S., Oakler, G. E., Devin, G., Kaylen, L.A. (2016). *N-Archynoldopamase* correlations with r9386 on the human genome identified on largescale association analysis, *Nature Genetics*, 45(6), 580-597.

Interpreting Your Results							
If your testing strip is a White colour	If your testing strip is a Pink- Red colour	If your testing strip is a Green- Blue colour					
This indicates a reading error of the testing strip. Please complete the procedure again, ensuring that you rinse your mouth thoroughly with the	This indicates that your saliva sample was found to have LOW levels of <i>N</i> - <i>Archynoldopamase</i> .	This indicates that your saliva sample was found to have HIGH levels of <i>N</i> - <i>Archynoldopamase</i> .					
provided mouthwash to eliminate any impurities in the saliva and to ensure an accurate reading.	Lower levels of the enzyme indicate an absence of the high- expressing variant of the SERT gene, which is related to transformational leadership behaviour .	Higher levels of the enzyme indicate a presence of the high- expressing variant of the SERT gene, which is related to transformational leadership behaviour.					
	Individuals with an absence of the so-called "leadership" gene are thought to have insufficient tendencies to lead others. This genetic feedback indicates that compared to others, you may have a tendency to let others lead and may experience more cognitive difficulty when making decisions under pressure.	Individuals with a presence of the so-called "leadership" gene are thought to have behavioural tendencies to lead others. Individuals with this gene have been found to have a genetic tendency to put others needs before their own and used this to improve interactions with others in order to improve group success.					





Appendix D: Demographic Questionnaire

1. What are the first 3 letters of your first name?	
2. What are the first 3 letters of your last name?	
3. Date of Birth: (Day) (Month)	(Year)
4. Gender:	
5. In what Faculty, School or Centre are you registered?	
O Faculty of Applied Science	O Faculty of Religious Studies
(Engineering)	
O Faculty of Agricultural and Environmental Sciences	O Faculty of Science
O Faculty of Arts	O School of Kinesiology
O Faculty of Education	O School of Music
O Faculty of Forestry	O Undeclared
$\bigcirc \text{Eaculty of Pharmacoutical Sciences}$	\bigcirc Other
6. Indicate your year of study at UBC:	-
O First Year	O Fourth Year
O Second Year	O More Than 4 Years
O Third Year	

7. Ethnicity: People living in Canada come from different cultural and racial backgrounds. Please read all the categories and select all that apply.

□ Aboriginal decent (e.g., North American Indian, Métis or Inuit (Eskimo))

□ White

 \Box Chinese

□ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc...)

□ Black (e.g., African, Haitian, Jamaican, Somali, etc...)

🗆 Filipino

 \Box Latin American

□ South East Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc...)

🗆 Arab

□ West Asian (e.g., Iranian, Afghan, etc...)

□ Korean

□ Japanese

□ Other – specify: _____

8. Please briefly describe your past leadership experience (if any)

Example: I was a shift manager for 3 years at McDonalds.

Appendix E: Questionnaire

	Rarely/ Never				Frequently, if not
	1	2	3	4	5 arways
Communicate a clear and positive vision of the future	0	0	0	0	0
Treat others as individuals, support and encourage their development	0	0	0	0	0
Give encouragement and recognition to others	0	0	0	0	0
Foster trust, involvement, and cooperation among team members	0	0	0	0	0
Encourage thinking about problems in new ways and question assumptions	0	0	0	0	0
Am clear about my values and practice what I preach	0	0	0	0	0
Instill pride and respect in others and inspire others by being highly competent	0	0	0	0	0

1) Please describe the extent to which you enact the following behaviours:

	Rarely/ Never						Frequently, if not always
	1	2	3	4	5	6	7
I care more about the success of others than my own	0	0	0	0	0	0	0
I put others' best interests ahead of my own	0	0	0	0	0	0	0
I sacrifice my own interests to meet others' needs	0	0	0	0	0	0	0
I do what I can to make others' jobs easier	0	0	0	0	0	0	0

2) Please describe the extent to which you enact the following behaviours:

3) Please indicate the extent to which you agree or disagree with the following statements:

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I thrive on opportunities to demonstrate that my abilities or talents are better than those of other people	0	0	0	0	0
If a friend was having a personal problem, I would help him/her even if it meant sacrificing my time or money	0	0	0	0	0
Making a lasting contribution to groups that I belong to, such as my work organization, is very important to me	0	0	0	0	0
I have a strong need to know how I stand in comparison to others	0	0	0	0	0
I value friends who are caring, empathetic individuals	0	0	0	0	0
When I become involved in a group project, I do my best to ensure its success	0	0	0	0	0
I often compete with my friends	0	0	0	0	0
It is important to me that I uphold my commitments to significant people in my life	0	0	0	0	0
I feel great pride when my team or group does well, even if I'm not the main reason for its success	0	0	0	0	0
I feel best about myself when I perform better than others	0	0	0	0	0
---	---	---	---	---	---
Caring deeply about another person such as a close friend or relative is important to me	0	0	0	0	0
I would be honored if I were chosen by an organization or club that I belong to, to represent them at a conference or meeting	0	0	0	0	0
I often find myself pondering over the ways that I am better or worse off than other people around me	0	0	0	0	0
Knowing that a close other acknowledges and values the role that I play in their life makes me feel like a worthwhile person	0	0	0	0	0
When I'm part of a team, I am concerned about the group as a whole instead of whether individual team members like me or whether I like them	0	0	0	0	0

4) Please indicate the extent to which you agree or disagree with the following statements:

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I know a lot more than most others about what it takes to be a good leader	0	0	0	0	0
I know what it takes to make a group accomplish its task	0	0	0	0	0
In general, I'm not very good at leading a group of my peers	0	0	0	0	0
I am confident of my ability to influence a group I lead	0	0	0	0	0
I have no idea what it takes to keep a group running smoothly	0	0	0	0	0
I know how to encourage a good group performance	0	0	0	0	0
I am able to allow most group members to contribute to the task when leading a group	0	0	0	0	0
Overall, I doubt that I could lead a group successfully	0	0	0	0	0

Appendix F: Genetic Knowledge Test

For each of the following statements, please respond by selecting the best answer from the choices provided.

1. When they're born, identical twins have exactly the same genes.

 \bigcirc Agree (1)

 \bigcirc Disagree (0)

2. On average, a person has half their genes in common with their siblings.

 \bigcirc Agree (1)

 \bigcirc Disagree (0)

3. A mother and biological daughter who look alike have more genes in common than a mother and biological daughter who do not look alike.

 \bigcirc Agree (0)

 \bigcirc Disagree (1)

4. There are different types of genes in different parts of the body.

 \bigcirc Agree (0)

 \bigcirc Disagree (1)

5. Single genes directly control specific human behaviors.

 \bigcirc Agree (0)

 \bigcirc Disagree (1)

6. Where in your body are your genes located?

Hair (0); Sperm/Eggs (0); Cells (1); Fingernails (0)

7. How many pairs of chromosomes do humans have?

46 (0); 23 (1); 21 (0); 32 (0)

8. Do plants that are not genetically modified still contain genes?

 \bigcirc Yes (1)

O No (0)

9. What sex chromosomes does a man typically have?

O XX (0)

O XY (1)

Appendix G: Credibility of Saliva Test

Please indicate the extent to which you agree or disagree with the following statement:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The saliva test gave me accurate and reliable information about my genetic makeup	0	0	0	0	0

Appendix H: Implicit Association Test

Instructions:	
	Leadership
You will be presented with a s keyboard. Classify items as q making too many mistakes wi the items that belong to each	et of words or images to classify into groups using the 'e' and 'i' keys on the ickly as you can while making as few mistakes as possible. Going too slow or result in an uninterpretable score. The following is a list of category labels and of those categories.
Category Self Others Leader Follower	Items I, Me, My, Mine, Self Others, They, Them, Their, Theirs Leader, Boss, Authority, Executive, Supervisor Follower, Subordinate, Assistant, Follower, Subordinate
* Two labels at the to * Keep your index fin * Each word or imag * The test gives no r * Expect to make a fo	Keep in mind will tell you which words or images go with each key. ers on the 'e' and 'i' keys to enable rapid response. has a correct classification. sults if you go slow Please try to go as fast as possible. w mistakes because of going fast. That's OK.
	I am ready to begin
	Exit

Appendix I: Debriefing Form

Leadership and Group Behaviour Study

Thank-you for your participation in this study. This study was initially presented as a study designed to examine leadership and group behaviour. While this was the case, we were also interested in whether *perceptions* of leadership genetics have an effect on leadership behaviour.

As a participant, you were randomly assigned to receive a genetic report entailing your biological make-up of leadership genes. Your report results included details depicting either your presence or absence of leadership genes. **This genetic information presented is not personalized or true, it was made up for the purposes of this study.** However, the personality descriptors presented are based on your reported measures of personality.

This study was primarily interested in testing whether priming participants to believe that they either do or do not have the genetics of a leader could influence their behaviour. Therefore, deception regarding the nature of the study was necessary in order to test participants *perceived* genetic influence. We would like to emphasize that your genetic report does not reflect the saliva sample given in the first session.

If you feel uncomfortable about being deceived and would like to withdraw your information provided for this study, you are free to do so without incurring any negative consequences.

Due to the nature of this study, we ask that you refrain from sharing the deception of this study with other potential participants so that we can continue with the experiment. We also request that you discard this form after reading and do not leave it in a public place where a potential participant may see it.

All information provided in this study will remain secure and confidential. In other words, your participant information will not be linked back to your name or student number. If you feel distressed as a result of participating in this study, we encourage you to contact UBC Counselling Services at **Exercise**.

If you would like further information regarding the results of this study once it has been completed, please contact

. If you would like to express concern about this

experiment you may contact the UBC Behavioural Research Ethics Board at