A Longitudinal Investigation of Leader Development and Leadership Emergence

by

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A thesis

presented to the University of Waterloo

in fulfilment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Psychology

Waterloo, Ontario, Canada, 2020

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of

Contributions included in the thesis. This is a true copy of the thesis, including any required final

revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

The body of this thesis is based on the combination of both published and unpublished works.

The research was conducted in partnership with the Royal Canadian Air Cadet Program, a research program that I proposed to my supervisor, Dr. Doug Brown, and senior leaders of the cadet program, Commander (Retired) Andrew Muir and Captain Nicole Shim. My contributions to the following manuscripts include developing theory, collecting and analyzing data, and writing of the full manuscripts.

Research presented in Chapter 2:

The research presented in Chapter 2 is currently in press at *The Leadership Quarterly* (Kwok, Shen, & Brown, *in press*).

Research presented in Chapter 3:

The research presented in Chapter 3 is currently under review at the *Journal of Applied Psychology* (Kwok, Redhead, & Brown, *under review*).

Abstract

Although it requires time to develop and emerge as leaders, there is a shortage of longitudinal research on these topics. Across two essays, this dissertation aims to address this gap in the literature. Essay 1 examines the nature and degree of leader self-view development during formal leadership training. Drawing upon theories of leader development, it is suggested that as individuals acquire new leadership skills and knowledge, their leader efficacy and identity will develop. Testing competing predictions between developmental readiness (i.e., openness to change) and developmental necessity (i.e., room to change) perspectives, Essay 1 further examines whether learning goal orientation and motivation to lead predict how much and in what ways trainees developed in their leader self-views. Cadets ($N = 240$) participating in a leadership development course self-reported their leader self-views throughout the program. Using latent growth models, results provide evidence that individuals' leader efficacy and identity developed– although differently–during leadership training. Moreover, results highlight the need to consider the developmental necessity perspective when allocating leadership development opportunities. Essay 2 examines the dynamic co-occurrence of leadership and trust over time. Drawing upon social exchange theory and models of social entrainment, it is suggested that trust can facilitate the emergence of informal leadership and informal leadership can facilitate the development of trust over time. Cadets ($N = 123$) participating in a leadership development course provided peer ratings of trust and leadership over time. Using stochastic actor-oriented models, results provide support that, over time, individuals initially perceived as trustworthy emerge as leaders and individuals initially perceived as leaders are trusted. Moreover, being trusting of others can facilitate one's own leadership emergence over time. Overall, results across these two essays shed light on the longitudinal processes that affect how leaders develop and emerge.

Acknowledgements

The completion of this dissertation truly took a village. First and foremost, thank you to my supervisor, Dr. Doug Brown, for providing me with the autonomy and flexibility to explore my program of research and for always pushing me to think more deeply about my work. I would also like to thank Dr. Winny Shen for being a trusted collaborator on countless projects, and Dr. James Beck for teaching me the importance of clearly articulating the research problem (I appreciate you even though studying for your exam was basically a comprehensive). Thank you to the Waterloo I/O Faculty, Drs. Wendi Adair, Ramona Bobocel, and Jay Michela, and my committee members, Drs. Adam Presslee and Nick Turner for their feedback and support. I would also like to extend my gratitude to Drs. Gillian Sandstrom and Sheila Woody, whose supervision and friendship served as positive and formative experiences on my development as a researcher. Finally, thank you to my collaborators Dr. Daniel Redhead, Commander (Retired) Andrew Muir, and Captain Nicole Shim – without your support, this program of research would not be possible.

I would like to thank my parents, Andrew and Lisa Kwok, for instilling in me the importance of a strong work ethic, and my great aunt, Fish, for being the reason I even have the opportunity to live, study, and work in Canada. While my brother, Verono, is known to be a man of few words, he is the embodiment of "actions speak louder than words", and his support during my move to Waterloo was integral to my adjustment to living alone. Thank you to my godparents and my extended family in Vancouver and Markham for being the ones I could count on when things inevitably got tough. Arthur, you were my only friend in Ontario for a long time, and hanging out with you on the weekends was what kept me going.

I also want to thank my amazing tribe of friends who are family – Akash, Alex, Anthony, Jason, Jay, Kevin, Richie, Ricky, Sadia, Samson, and Simon – you're all officially Navio's SEALs. I've also been incredibly lucky to have met the love of my life, Alanna, whose unconditional support has finally made Waterloo feel like home. And with Alanna, comes the rest of her amazing family and friends, which I'm fortunate enough to call family as well. Finally, thank you to the new friendships in I/O, the Sisterhood of the Traveling Pants, and the PAC Rats.

Moving to Waterloo presented itself as one of the most difficult things I've done in my life, both in terms of the pursuit of higher education, and the challenge of leaving my entire support network in Vancouver to begin a new chapter of my life. Without the people mentioned here, I would not have gotten this far. So, this degree is as much mine as it is yours – You get a PhD! You get a PhD! Everybody gets a PhD!!!

vii

Dedication

To my parents, Andrew and Lisa Kwok. Without your unwavering perseverance and support, I

would have never had the opportunity to pursue my personal, career, and educational aspirations.

Table of Contents

List of Figures

List of Tables

CHAPTER 1: INTRODUCTION

Leadership can be defined as a process that "enables organizations to function effectively, directing, inspiring, and coordinating the efforts of individuals, teams, and organizations toward the realization of collective goals" (Carter, DeChurch, Braun, & Contractor, 2015, p. 597). There is a rich history of leadership theory and research that spans more than a century (Avolio, Reichard, Hannah, Walumbwa, & Chan, 2009). In particular, leader development (i.e., the expansion of a person's capacity to be effective in leadership roles and processes; McCauley, Van Velsor, & Ruderman, 2010, p. 2) and leadership emergence (i.e., the process of being perceived by others as a leader; Lord & Maher, 1991, p. 11) are two leadership domains that have engendered a great deal of academic and practitioner interest (Carter et al., 2015; Day, Fleenor, Atwater, Sturm, & McKee, 2014). While it is implicit that it requires time to develop and emerge as leaders, longitudinal investigations of leader development and leadership emergence remain understudied (Day, 2011b; Shamir, 2011). As the leadership-talent gap in the current workforce continues to grow (Howard & Wellins, 2009), and as organizations become increasingly flat, with work frequently being conducted in leaderless groups (Bakker, 2010), understanding how leaders develop and emerge are critical to advancing the scholarly study of leadership and mitigating the challenges of contemporary organizations.

The goal of the current work is to investigate the processes through which individuals develop and emerge as leaders over time. Regarding leader development, Essay 1 adopts a socio-cognitive lens to examine the pace and degree of individuals' leader efficacy and leader identity development during a formal leadership training program. It is argued that as individuals acquire and enact new leadership skills, knowledge, and behaviors, their leader efficacy and leader identity will develop over time. Moreover, this study determines the impact that individuals'

1

learning goal orientation (LGO) and motivation to lead (MTL) have on the extent and nature of leader efficacy and leader identity development by considering two competing perspectives, developmental readiness (i.e., openness to change; Avolio & Hannah, 2008) versus developmental necessity (i.e., room to change; Kragt & Guenter, 2018). Data from a field study of cadets participating in a leadership development training course supported these predictions. This study contributes to the literature by highlighting that individuals' leader efficacy and leader identity develop during formal leadership training, and the need to consider individuals' LGO and MTL in determining which individuals will benefit most from training. Regarding leadership emergence, Essay 2 adopts a network lens to examine the dynamic co-occurrence of leadership and trust over time. Taking the theoretical perspective that leadership emergence is a social-relational process acknowledges that individuals are embedded within diverse social networks (Kalish, 2013) such as advice, friendship, and trust networks (Carter et al., 2015), and implies that the exchanges between these various network relationships can serve as the social context by which informal leadership arise, beyond one's personal characteristics (Mehra, Marineau, Lopes, & Dass, 2009). Drawing upon social exchange theory, in which interactions can facilitate the exchange of resources and development of relationships (Blau, 1964), and models of social entrainment, in which relationships embedded within each other can co-occur, leading to mutual interdependence (McGrath, Kelly, & Machatka, 1984), it is argued that trust can facilitate the emergence of informal leadership and informal leadership can facilitate the development of trust over time. Moreover, it is argued that being trusting of others can facilitate one's own leadership emergence. Data from a field study of cadets participating in a leadership development training course supported these predictions. This study contributes to the literature by highlighting the relational mechanisms that give rise to leadership emergence.

CHAPTER 2: I CAN, I AM: DIFFERENTIAL PREDICTORS OF LEADER EFFICACY

AND IDENTITY TRAJECTORIES IN LEADER DEVELOPMENT (ESSAY 1)

The following work is currently in press at *The Leadership Quarterly* (Kwok, Shen, & Brown, *in press*).

Literature Review

Effective leaders play a critical role in the success of teams and organizations (e.g., Bennett & Lemoine, 2014; Kaiser, Hogan, & Craig, 2008). However, there appears to be a mismatch between the complex challenges facing contemporary organizations and the availability of leadership talent to meet these demands. In recent surveys of North American (Association for Talent Development, 2018) and global (Howard & Wellins, 2009) HR professionals and leaders, most respondents report a sizeable leadership-talent gap. Given these concerns, it is unsurprising that business executives currently rank leader development as a top priority in their organizations (Deloitte University Press, 2016) and financial spending in organizations is aligned with this sentiment, with estimates ranging from $12 to $50 billion spent annually on leader development (O'Leonard & Loew, 2012; Prokopeak, 2018).

A common approach used by organizations to develop leaders is formal leadership training programs, efforts systematically designed to enhance leader knowledge, skills, and abilities (KSAs) (Day, 2000). Recent meta-analytic evidence has shown that, on average, such leadership training improves a variety of outcomes, including reactions, learning (i.e., knowledge and skills), transfer (i.e., on-the-job behaviors), and results (i.e., organizational outcomes; Lacerenza, Reyes, Marlow, Joseph, & Salas, 2017). Although this work indicates that formal leadership training can be effective, and provides some guidance regarding how to best design and deliver these programs, these studies primarily document that development *occurred* (e.g.,

Avolio, Reichard, Hannah, Walumbwa, & Chan, 2009; Collins & Holton, 2001), but provide little insight into the developmental *process* (Day & Dragoni, 2015). In other words, it remains unclear as to *how* individuals are developing during training, including whether there are meaningful forms (i.e., trajectories) of development (Ployhart & Vandenberg, 2010).

Drawing upon the distinction between *descriptive* (i.e., illustrating *how* a phenomenon changes over time) and *explanatory* (i.e., identifying the *cause* of the developmental process) longitudinal research (Ployhart & Vandenberg, 2010), the first goal of this study is to describe the developmental trajectories of *leader efficacy* and *leader identity* over the course of leadership training. These leader self-views are important components of the leader development process because they are considered to be proximal outcomes of leader development that connect individual leader capabilities with more distal developmental outcomes, such as the integration of multiple skills and competencies to navigate complex and abstract leadership challenges (Day & Dragoni, 2015) and support subsequent practice and enactment of leadership skills (Day, Harrison, & Halpin, 2009). Therefore, we expect that over the course of leadership training, most individuals should exhibit positive development in both their leader efficacy and leader identity.

The second goal is to explore the impact of two individual difference variables, *learning goal orientation* (LGO) and *motivation to lead* (MTL), in shaping leader efficacy and leader identity developmental trajectories during a leadership training program. In order for individuals to benefit from leadership training, it is typically insufficient to merely be present. Rather, individuals must also learn from the experience (Day, 2010), a process that does not occur passively (Feldman, 1986) or uniformly across individuals (Snow, 1989). Specifically, in the current study, we consider two competing perspectives, *developmental readiness* (i.e., openness to change; Avolio & Hannah, 2008) versus *developmental need* (i.e., room to change; Kragt &

Guenter, 2018), that could describe the nature of the influence of LGO and MTL on leader

efficacy and leader identity developmental trajectories.

The current study contributes to the literature in several critical ways. First, the extant

leader development literature has focused on the attainment of formal leadership positions as the

primary outcome of leader development, which does little to explain how individuals develop as

leaders (Day, 2011a). However, changes to cognitive outcomes, such as leader efficacy and

leader identity, have been proposed to bridge these gaps (Steele & Day, 2018); individuals can

self-identify as leaders or be confident in their leadership capabilities in various domains (e.g.,

being a leader in a research lab *and* on a sports team; Hammond, Clapp-Smith, & Palanski,

2017), which can be independent of their formal leadership role (Carter et al., 2015). Further, the

stronger their leader efficacy or leader identity, the more likely individuals will possess the

motivation and ability to recognize different situations as opportunities to practice and develop a

greater repertoire of leadership skills.

Second, although there is some limited research on the development of leader self-views,

the majority of this work is qualitative (e.g., Andersson, 2012; Komives, Dugan, Owen, Slack, &

Wagner, 2006; Nicholson & Carroll, 2013). This makes it more difficult to understand the nature

of developmental changes (i.e., whether they are changes in degree or in kind), which can be

empirically assessed. Additionally, existing research on leader self-views has considered *either*

leader efficacy (Quigley, 2013) or leader identity (Middleton, Walker, & Reichard, 2019;

Miscenko, Guenter, & Day, 2017) separately, without considering the simultaneous development

of both self-views (Day & Dragoni, 2015). However, by assessing both leader efficacy and

leader identity concurrently, our study not only provides evidence for the malleability of leader

self-views, but also demonstrates that the developmental trajectories of different leader self-views may vary even within the same training context, enriching future theory-building.

Finally, traditional leadership theory contributes little to our understanding of leader *development* because it does not explain the intra-individual learning and developmental processes that are involved in the process of leader development (Day et al., 2009). Historically, leadership theory has focused on linking individual differences with leadership, which if they are conceptualized as relatively immutable characteristics, is less relevant for studying leader development (i.e., change; Day, Fleenor, Atwater, Sturm, & McKee, 2014). Subsequent situational perspectives focused their efforts on understanding the circumstances that facilitated leadership *emergence* (Bass & Bass, 2008). Although behavioral approaches dominated the leadership field post-trait theories (Bass & Bass, 2008), the majority of research focused on the validity of the two-factor model of leadership behaviors and their impact on performance outcomes (Judge, Piccolo, & Ilies, 2004). Although behaviors can be developed, the behavioral approach to leadership is based in the training literature, which typically focuses on short-term interventions and as a result, contributes little to our understanding of the longer-term developmental processes of leaders (Day et al., 2014).

More contemporary theories have focused primarily on identifying the "best" leadership theory that facilitates effective leadership (Bass & Bass, 2008). For example, authentic leadership theory posits that authentic leaders are the "root" of all positive forms of leadership (Avolio, Gardner, Walumbwa, Luthans, & May, 2004). Yet, similar to behavioral approaches to leadership, these theories speak little to the intra-individual developmental processes that are experienced by leaders (Avolio & Walumbwa, 2014). By modeling the between-person differences (i.e., LGO and MTL) on within-person changes of leader self-views, this study

contributes to a scholarly topic that is inherently longitudinal but is rarely studied as such (Fischer, Dietz, & Antonakis, 2017), and begins to illuminate the black box of leader development (Day & Dragoni, 2015) and continues the ongoing movement of viewing leader development as a developmental science (Day et al., 2014).

In the following sections, we first develop hypotheses regarding leader efficacy and leader identity developmental trajectories in formal leadership training contexts. Next, we propose research questions based on the developmental readiness and developmental need perspectives, which lead to competing predictions regarding the impact of LGO and MTL, individually and jointly, on leader efficacy and leader identity developmental trajectories.

Leader Efficacy and Leader Identity

Leadership scholars have proposed that leader self-views are an important piece of the leader development puzzle (Day & Dragoni, 2015). Specifically, leader self-views reflect *cognitive* outcomes associated with leader development, which are mental models and structures that individuals utilize to carry out leadership processes (DeRue & Myers, 2014). Broadly, self-views refer to an individual's self-concept, which are global views of the self that can include content and evaluative judgments about oneself (Oyserman, Elmore, & Smith, 2012) that influences one's emotions, cognitions, and behaviors (Leary & Tangney, 2003).

Within the leader development literature, there has been an emphasis on two conceptually related, but distinct, self-views. The first is leader efficacy, an individual's level of confidence in his or her KSAs associated with leading others (Hannah, Avolio, Walumbwa, & Chan, 2012); this construct extends beyond simply possessing leadership KSAs, as it focuses on one's *confidence* to enact one's leadership capabilities (Hannah, Woolfolk, & Lord, 2009). The second is leader identity, the sub-component of one's self-concept that relates to being a leader (Day &

Harrison, 2007). An individual's leader identity serves as a cognitive schema that organizes his or her relevant knowledge and values associated with being a leader and answers the question of the extent to which an individual views him- or her-self as a leader (Lord & Hall, 2005).

Critically, it has been proposed that the development of the more observable, behavioral level of leadership KSAs (i.e., expertise) is supported by deeper (i.e., less observable) changes in these self-views, which ultimately undergird leadership effectiveness (Day et al., 2009). In other words, leader self-views are theorized to mediate the relationship between individual leader capabilities and leadership outcomes (Day & Dragoni, 2015), such as the subsequent practice (Day et al., 2009) and enactment (Burke, 1991) of leadership behaviors. In support of these theoretical arguments, leader efficacy (Hannah, Avolio, Walumbwa, & Chan, 2012; Lester, Hannah, Harms, Vogelgesang, & Avolio, 2011) and leader identity (Day & Sin, 2011) have been found to predict leadership performance and effectiveness, respectively, in leadership development contexts. Given that leader efficacy and leader identity are important drivers of subsequent leadership outcomes, understanding whether and how they change is critical to our understanding of leader development during formal leadership training (Day et al., 2014).

Developmental Trajectories

As individuals develop leadership KSAs within leadership training programs, it is expected that their leader efficacy and leader identity will change for several reasons. In the case of leader efficacy, four categories of experiences have been proposed to facilitate the development of self-efficacy: a) enactive mastery (i.e., success in a particular domain, such as being able to motivate team members in a role-play exercise), b) vicarious experience (i.e., success or effort that is modeled by others, such as watching videos of inspiring CEOs during training), c) verbal persuasion (i.e., encouragement from others, such as receiving positive

8

feedback on developmental progress from trainers or other program participants), and d) physiological arousal (i.e., physiological responses to challenging stimuli, such as experiencing sweaty palms and a heightened heart rate as one prepares to give a presentation to a large audience on one's leadership style) (Bandura, 1982). Individuals are likely to have experiences within each of the aforementioned categories during leadership training (McCall Jr., 2010). For example, developing leaders commonly report the importance of other people in shaping their development (McCall Jr., Lombardo, & Morrison, 1988). Additionally, leadership training often presents participants with novel and challenging lessons, which can provide a powerful learning experience (McCauley, Ruderman, Ohlott, & Morrow, 1994). Therefore, as individuals participate in formal leadership training, it is expected that there will be positive growth or development in their leader efficacy.

Although powerful learning experiences can facilitate leader development (McCall Jr., 2010), complementing such experiences with feedback on learning progress can further enhance development (DeRue & Wellman, 2009). By providing feedback that informs individuals how to properly engage in and the abilities required to complete a task, individuals' self-efficacy on that task will be strengthened (Gist & Mitchell, 1992). Accurate feedback helps to attenuate or prevent individuals' cognitive distortions, such as misattributing poor performance on a task to a stable trait or external circumstances, by providing individuals with accurate information about the causes of performance (Forsterling, 1985; Storms & McCaul, 1976). This suggests that in developmental contexts, where individuals are typically provided with specific feedback on their developmental progress and the means to improve, such as in formal leadership training programs, there will be positive changes to leader self-efficacy (Kluger & DeNisi, 1996).

Hypothesis 1: During a formal leadership training program, on average, individuals'
leader efficacy developmental trajectories will be positive.

In the case of leader identity, according to social-cognitive models of identity, individuals need to perceive a sense of continuity across various domains and time periods (Shamir, 1991). By possessing the cognitive resources to represent the past (Berzonsky, 2011), identities facilitate individuals' interpretations of and responses to external stimuli (Cross & Markus, 1994; Markus, 1977), and provide a sense of coherence for individuals when interacting with the environment (Fiske, 1992). Similarly, although identities are expected to be malleable (Markus & Wurf, 1987), identities are thought to be comprised of a relatively stable and enduring set of meanings associated with the self (Stryker & Burke, 2000). On the other hand, environmental feedback that is identity-incongruent tends to lead to discomfort (Burke, 1991). Therefore, in seeking and maintaining such coherence, individuals will verify their self-perceptions when interacting with others, and will tend to process feedback about the self in ways that favor confirmations of their self-views (Swann, 2012). In other words, identity change is thought to be rare unless there is an external event that initiates this process (Ashforth & Schinoff, 2016).

However, a leadership training program could be one such external event (Luthans & Avolio, 2003), as individuals are often presented with novel examples of ideal leadership, which can result in *identity work*, a process of "forming, repairing, maintaining, strengthening, or revising the [identity] constructions that are productive of a precarious sense of coherence and distinctiveness" (Alvesson & Willmott, 2002, p. 626). Through a process of *sensemaking*, in which individuals interpret situations that are novel and frame them as personally meaningful (Weick, 1995), individuals are likely to *notice* differences between the current self and ideal examples of leadership, *interpret* the discrepancies between these two states, *change* their

identity based on those differences, and *enact* this newly defined identity (Hammond et al., 2017). As individuals enact this new identity and its associated behaviors, their sense of self becomes increasingly aligned with this new identity (Tice, 1992), thus leading to positive growth or development in leader identity (Turner, 1978).

> *Hypothesis 2: During a formal leadership training program, on average, individuals'*
> *leader identity developmental trajectories will be positive.*

Developmental Readiness versus Developmental Need

During formal leadership training, not all individuals will develop uniformly, which suggests that there may be between-person characteristics that predict the development of leader efficacy and leader identity (Snow, 1989). When considering which individuals will be more likely to develop over the course of leadership training, contrasting arguments exist between the developmental readiness and developmental need perspectives. Whereas the developmental readiness perspective suggests that individuals who are more *open* to change will be more likely to benefit from leadership training, the developmental need perspective suggests that individuals who have more *room* to change will be more likely to benefit from such training.

To date, existing research tends to adopt a *developmental readiness* perspective, in which individuals who possess the ability and motivation to learn will be more likely to develop during leadership training (Hannah & Lester, 2009). The concept of developmental readiness was inspired by research in clinical psychology, which found that individuals' readiness to undergo therapy is potentially more important than the clinician or therapeutic technique in predicting the success of therapy (Avolio & Hannah, 2008). Individuals who are higher on developmental readiness are more likely to change or develop in leadership training programs because they are

11

able to reflect upon the lessons taught, make the experiences more personally meaningful, and take advantage of the challenges and opportunities presented (Avolio & Hannah, 2009).

A key component of developmental readiness is goal orientation, which is viewed as a framework for how individuals perceive and respond to achievement situations (Ames & Archer, 1987; Dweck & Leggett, 1988), including the purpose of their behavior (Brophy, 1983; Nicholls, 1984), and is generally understood as an individual difference in goal preferences (Bell & Kozlowski, 2002; Vandewalle, 1997). In particular, LGO is fundamental to developmental readiness because individuals higher on LGO tend to view themselves as incremental learners and are more likely to perceive performance feedback as developmental (Button, Matieu, & Zajac, 1996). Theoretical arguments and empirical evidence suggests that LGO facilitates development through acquiring skills, seeking challenges to grow, and viewing negative feedback as constructive, all of which are critical for leader development (Day et al., 2009).

Within leadership training programs, it is expected that individuals will experience some degree of challenge associated with their learning as they acquire new skills (McCall Jr., 2010). Possessing a higher LGO serves as an important resource that motivates individuals' learning and persistence in the face of obstacles or setbacks (Dragoni, Tesluk, Russell, & Oh, 2009), helping these individuals to develop and grow during leadership training (Reichard & Beck, 2017). Supporting these views, Middleton et al. (2019) found, in a leader development context, that at the between-person level, individuals higher on trait LGO had higher mean levels of leader identity across time, and at the within-person level, on days when individuals reported higher LGO than usual, they also reported higher leader identity than usual. Similarly, Day and Sin (2011) found that LGO served as a between-person predictor of leadership effectiveness

developmental trajectories, such that individuals higher on LGO had more desirable trajectories (i.e., less negative decline in leadership effectiveness compared with those lower on LGO).

Although the existing developmental readiness literature has primarily focused on LGO in shaping leader development, we argue that it is not the only relevant personal characteristic. Whereas LGO refers to individuals' *general predisposition* towards achievement situations, it is likely that their *specific attitude* toward leadership should also affect their response to leadership training. Thus, we argue that MTL, an individual difference construct that quantifies the type and degree of motivation that individuals possess with regards to engaging in leadership (Chan & Drasgow, 2001), should also shape one's development during a leadership training program. In their conceptualization of MTL, Chan and Drasgow (2001) proposed three aspects: a) affective MTL (i.e., individuals lead because they like to), b) non-calculative MTL (i.e., individuals lead because they are *not* calculative of the costs of leading relative to the benefits), and c) social-normative (i.e., individuals lead because of a sense of obligation or responsibility).

Kark and Van Dijk (2007) assert that individuals' regulatory focus may be manifested in different types of MTL. Individuals who are higher on promotion focus are primarily motivated by growth and development, and seek to do things because they want to (van Dijk & Kluger, 2004); thus, these individuals are more likely to be characterized by high levels of affective MTL, reflective of their personal desire to lead (Kark & van Dijk, 2007). In contrast, individuals higher on prevention focus are primarily motivated by obligations and social responsibilities, and do things because they have to (Aaker & Lee, 2001); these individuals are, therefore, more likely to be higher on social-normative MTL, or see leadership as a duty (Kark & van Dijk, 2007).

It is quite typical to encounter difficult lessons (McCall Jr., 2010) and obstacles during leadership training (Day et al., 2009). Past research has found that individuals who are higher on

13

promotion focus were more likely to take risks and persevere when engaging in a difficult task, whereas individuals who are higher on prevention focus were more likely to be cautious to avoid making errors and quit early (e.g., Crowe & Higgins, 1997; Roney, Higgins, & Shah, 1995). Thus, from a developmental readiness perspective, we predict that individuals higher on affective MTL will be most likely to develop in a formal leadership training program because of these individuals' preferences to grow, develop, and take risks, whereas individuals higher on social-normative MTL will be less likely to develop because of their preferences to maintain the status quo, tendency to quit rather than persevere, and unwillingness to take risks or make mistakes. Although we make no predictions with regards to non-calculative MTL, we also explore its potential impact on leader efficacy and leader identity developmental trajectories.

In contrast to the developmental readiness perspective, the idea of *developmental need* suggests that individuals who have more room to grow will be more likely to develop during leadership training. From this point of view, individuals higher on LGO are more likely to already have a refined repertoire of leadership skills (Day & Sin, 2011) and may have less room for further growth (at least in the short-term). Rather, it is the individuals lower on LGO, who are unlikely to seek opportunities to learn on their own, who may benefit most from a formal training program. Some support for this alternative view can also be found in the literature. For example, Middleton et al. (2019) found an LGO by time interaction, such that individuals higher on state-like LGO reported higher initial levels of leader identity at the beginning of the program, but experienced less within-person growth on leader identity over time. Similarly, Krugt and Guenter (2018) found that a leadership training program was more strongly related to subsequent leadership effectiveness for individuals with less prior leadership experience.

In the same vein, those who are higher on MTL, who possess greater interest in leadership roles and responsibilities, may be more likely to have sought out and benefited from other developmental opportunities or have had more prior leadership experience, leaving them with less to learn from this particular leadership training program. Although this may broadly be true for those higher on MTL, regardless of dimension, it seems that this may be especially true of those higher on affective (compared to social-normative or non-calculative) MTL, given that these individuals' motivation surrounding leadership is most intrinsically driven. Providing support for this claim, recent meta-analytic evidence has found that although there are significant relationships between each MTL dimension and past leadership experience, this relationship is strongest for affective MTL (Badura, Grijalva, Galvin, Owens, & Joseph, 2019). In summary, the developmental readiness perspective suggests that individuals higher on LGO and MTL may gain or develop more in their leadership-related competencies, including leader self-efficacy and leader identity, from a formal training program, whereas the developmental need perspective predicts the opposite—individuals lower on LGO and MTL should develop more.

> *Research Question 1: How do LGO and MTL, respectively, affect leader efficacy and*
> *leader identity developmental trajectories during a formal leadership training program?*

Finally, we explore the possibility that LGO and MTL may *interact* to determine leader efficacy and identity developmental trajectories during a leadership training program. Taking a developmental readiness perspective, individuals higher on both LGO *and* MTL may be most likely to develop during a leadership training program, as these individuals likely have the right interest and mindset to best absorb what the program has to offer (i.e., adding the right fuel to the fire). Alternatively, from a developmental need perspective, individuals higher on both LGO and MTL may have had sought out more opportunities to learn and develop as a leader in the past

and have more prior leadership experiences, suggesting that these individuals may already have very high leader self-views (i.e., feel very confident as a leader and see themselves as a leader). Thus, it may be the case that individuals lower on both LGO and MTL, who likely have not sought out many leadership opportunities and have not necessarily learned from experiences that came their way, that change their self-views the most in a formal leader training program.

> *Research Question 2: Does LGO and MTL interact to affect leader efficacy and leader identity developmental trajectories during a formal leadership training program?*

Method

Participants and Procedures

This study was conducted with cadets in the Royal Canadian Air Cadet Program, a governmental, not-for-profit program intended to foster in youth the development of leadership and citizenship. The cadets ($N = 240$; 68% male, $M_{age} = 15.34$) were undertaking a rigorous six-week summer training course for leadership development, which was designed to prepare participants to become leaders of the cadet program in their local units (i.e., deliver a nationally-standardized curriculum outlined by the Canadian Department of National Defense; Department of National Defence, n.d.). The cadets were taught a range of skills, including leadership skills (e.g., establishing standards and fostering teamwork when accomplishing tasks) and instructional techniques for classroom and drill (i.e., marching) lessons. Data were collected across two summers (i.e., two cohorts) and were combined to form a single sample.[1]

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[1] The pattern of results does not change when controlling for the cohort from which the data were collected, and the pattern of results is qualitatively similar in each cohort. Thus, we chose to combine the two cohorts to maximize statistical power. See Appendices E and F for descriptive statistics and correlations between the focal variables of each cohort.

This program is similar to typical formal leadership training programs offered in organizational settings, as it was delivered face-to-face, provided feedback, and included both information- and practice-based methods (Lacerenza et al., 2017). Specifically, once skills training was delivered, cadets were given assessments and feedback associated with those skills. Because the cadets' performance in the course informed promotions and selection for other training opportunities offered by the cadet program, there was a strong motivation to do well.

Prior to the commencement of training, parents of the cadets were informed about the study. At the beginning of the training course, the cadets were also provided information about the study. Specifically, they were informed that the research team was interested in the development of leadership over time and would be collecting data during their training course. The research team emphasized that participation in the study was voluntary and highlighted that data collection would not interfere with scheduled training. All data were collected using paper-and-pencil surveys. LGO and MTL were measured as traits in week 1 (T_1), and leader efficacy and leader identity were measured repeatedly at week 1 (T_1), week 2 (T_2), week 4 (T_3), and week 6 (T_4), corresponding with when cadets received feedback on their leadership assessments.

Measures[2]

Leader Efficacy. Leader efficacy was measured using two subscales of the Leader Self and Means Efficacy Scale (Hannah et al., 2012). The seven-item *leader action self-efficacy* subscale quantifies the extent to which individuals believe they possess the capabilities to enact leadership and create effects. A sample item: "As a leader I can energize my followers to achieve their best." The eight-item *leader self-regulatory efficacy* subscale assesses the extent to which

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[2] See Appendix A for complete measure items, instructions, and response scales.

individuals possess the confidence in their ability to regulate their own thinking and self-motivations. A sample item: "As a leader I can motivate myself to take charge of groups." Participants responded to the items on a 0 – 100 scale in increments of 10 (0 = '*not at all confident*', 50 = '*moderately confident*', 100 = '*totally confident*').[3]

Leader Identity. Leader identity was measured using the four-item Leadership Self-Identity Scale (Hiller, 2005), which quantifies the extent to which a leader identity was considered to be descriptive of the respondent. This measure has been frequently used in prior research (e.g., Day & Sin, 2011; Kwok, Hanig, Brown, & Shen, 2018; Miscenko et al., 2017). A sample item: "I see myself as a leader." Participants rated how self-descriptive each item was on a seven-point Likert scale, from 1 ('*not at all descriptive*') to 7 ('*extremely descriptive*').

Motivation to Lead. MTL was measured using the affective, non-calculative, and social-normative MTL subscales of the Motivation to Lead Scale (Chan & Drasgow, 2001). The *affective* MTL subscale quantifies an individual's positive affinity towards leading. A sample item: "I have a tendency to take charge in most groups or teams that I work in." The *non-calculative* MTL subscale assesses an individual's insensitivity to the costs relative to the benefits associated with leading. A sample item: "I would agree to lead others even if there are no special rewards or benefits with that role." Finally, the *social-normative* MTL subscale measures an individual's sense of duty towards leading. A sample item: "I feel that I have a duty to lead others if I am asked." Participants rated nine items for each subscale on a seven-point Likert scale (1 = '*strongly disagree*', 7 = '*strongly agree*').

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[3] We did not assess the third facet, *leader means efficacy*, defined as an individual's beliefs in the quality and utility of the means available to support the enactment of leadership, because this particular setting involved a structured program for all participants, leaving little variance in resources between individuals.

Learning Goal Orientation. The first cohort responded to the LGO subscale of the

Achievement Goal Questionnaire-Revised (α = .73; Elliot & Murayama, 2008), which contained

three items rated on a five-point Likert scale (1 = '*strongly disagree*', 5 = '*strongly agree*'). A

sample item: "My aim is to completely master material that is presented to me." The second

cohort responded to the LGO subscale of Vandewalle's (1997) instrument (α = .86), which

contained five items rated on a six-point Likert scale (1 = '*strongly disagree*', 6 = '*strongly

agree*'). A sample item: "I often look for opportunities to develop new skills and knowledge."[4]

Estimation Method

We used latent growth modeling (LGM; Grimm, Ram, & Estabrook, 2016) to model the

growth trajectories of leader efficacy and leader identity and answered our hypotheses using

Mplus 8.2 (Muthén & Muthén, 2017). LGM is a type of structural equation modeling (SEM)

technique used to assess the change of an outcome variable, including the shape of the growth

trajectory, by modeling the initial level of (i.e., intercept) and change in (i.e., slope) the outcome

variable as latent constructs (Wang & Wang, 2012). The estimated intercept and slope factors

have mean and variance parameters, which allow for the possibility of between-person

differences on within-person change (i.e., predicting whether individuals develop differently).

Because measured variables in SEMs may be affected by non-normality (West, Finch, & Curran,

1995), we estimated our model using maximum likelihood parameter estimates with standard

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[4] We note that we inadvertently used different measures to assess this construct across the two cohorts. Given differences in measures and response scales, we standardized scores separately within each cohort prior to conducting analyses for LGO. We also conducted a separate study to provide evidence of convergent validity between the two measures. Specifically, we recruited an American working sample (N = 143, M_{age} = 34.26, 65% male, M_{tenure} = 5.40 years) from Amazon's Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011). Participants rated their LGO using both measures (Elliot & Murayama, 2008; Vandewalle, 1997). The observed correlation between these two measures was 0.74; corrected for unreliability, the correlation was 0.85, indicating a high level of convergence and similar assessment of the same underlying construct (Le, Schmidt, Harter, & Lauver, 2010).

errors and chi-square statistics (i.e., Satorra-Bentler chi-square correction; Satorra & Bentler, 2001) that are robust to non-normality (Wirth & Edwards, 2007).

Although SEM and multi-level modeling (MLM) methods are quite similar in their approaches to analyzing longitudinal data, the current study used an SEM-based LGM approach because it is more flexible with testing multiple independent variables (i.e., LGO, MTL dimensions, and their interactions), provides indicators of model fit (i.e., tests the fit of the leader efficacy and leader identity trajectory shape), and handles measurement error of indicators over time, which provides more accurate estimates of the relationships between the focal variables (Grimm et al., 2016). Prior to conducting the LGMs, we evaluated for missing data effects, dimensionality of the constructs, and measurement invariance, which we explain in detail below.

For evaluating overall model fit, some researchers have suggested that the chi-square is the only means to assess model fit because it is the only *statistical test* of whether a model can reproduce the variance-covariance matrix (Barrett, 2007; Hayduk, Cummings, Boadu, Pazderka-Robinson, & Boulianne, 2007). Using the chi-square as the sole criteria to assess model fit, there are instances where our models do not fit the data well. In those instances, we inspect the modification indices for potential sources of error and their implications in the Discussion section (Antonakis, 2017). However, because each fit index includes its own set of assumptions, strengths, and weaknesses, the norm within the literature has been to report and assess model fit on more than one fit index (Jackson, Gillaspy, & Purc-Stephenson, 2009; Kenny, 2015; Schermelleh-Engel, Moosbrugger, & Müller, 2003). In keeping with these norms and recommendations, we also report the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root-mean-square error of approximation (RMSEA) in our manuscript. The use of these particular fit indices have been supported in prior simulation studies (Beauducel & Wittmann,

2005; Yu, 2002) and are among the most frequently reported fit statistics in the literature (Coovert & Craiger, 2000). Cutoff values were based on recommendations from Hu and Bentler (1999) and Vandenberg and Lance (2000) (CFI and TLI ≥ 0.90; RMSEA ≤ 0.08).

Results

Preliminary Analyses

Descriptive Statistics. Table 1 presents the intercorrelations, alphas, means, and standard deviations for the study variables. As expected, the means for both dimensions of leader efficacy and leader identity increased throughout the duration of the study, providing descriptive evidence that leader efficacy and leader identity developed positively in this formal leadership training program. In addition, there were positive correlations between LGO and each MTL dimension with leader efficacy and leader identity, respectively, suggesting that LGO and MTL may play a role in the development of leader efficacy and leader identity.

Table 1
Descriptive Statistics and Correlations

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. LI T1	4.44	1.30	(.87)															
2. LI T2	4.57	1.35	0.73	(.89)														
3. LI T3	4.95	1.34	0.68	0.80	(.90)													
4. LI T4	4.99	1.35	0.59	0.64	0.79	(.90)												
5. Action T1	69.70	16.40	0.64	0.62	0.52	0.47	(.90)											
6. Action T2	72.90	15.48	0.59	0.61	0.57	0.43	0.70	(.92)										
7. Action T3	76.13	14.79	0.42	0.48	0.59	0.50	0.51	0.71	(.93)									
8. Action T4	78.39	14.89	0.44	0.45	0.55	0.54	0.53	0.62	0.80	(.94)								
9. SR T1	71.22	18.68	0.61	0.59	0.51	0.42	0.83	0.69	0.48	0.44	(.93)							
10. SR T2	73.38	16.56	0.59	0.61	0.60	0.42	0.64	0.83	0.67	0.59	0.73	(.91)						
11. SR T3	76.14	15.48	0.44	0.50	0.63	0.49	0.49	0.66	0.86	0.72	0.56	0.73	(.92)					
12. SR T4	78.96	15.62	0.46	0.45	0.56	0.56	0.54	0.63	0.76	0.90	0.53	0.63	0.78	(.93)				
13. LGO	-	-	0.29	0.32	0.34	0.19	0.31	0.38	0.33	0.26	0.35	0.38	0.37	0.33	-			
14. Affective	4.53	1.06	0.74	0.68	0.65	0.51	0.56	0.58	0.38	0.36	0.59	0.60	0.39	0.41	0.33	(.82)		
15. NC	5.33	0.94	0.19	0.20	0.23	0.21	0.22	0.29	0.22	0.23	0.28	0.26	0.23	0.27	0.22	0.26	(.79)	
16. SN	5.03	0.96	0.51	0.44	0.42	0.32	0.47	0.47	0.32	0.32	0.46	0.46	0.33	0.34	0.39	0.51	0.28	(.78)

Note. LI = Leader identity; Action = Leader action self-efficacy; SR = Leader self-regulatory efficacy; LGO = Learning goal orientation; Affective = Affective motivation to lead; NC = Non-calculative motivation to lead; SN = Social-normative motivation to lead; T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4. All correlations are significant at the $p < .01$ level. Reliability estimates are provided in parentheses. Learning goal orientation scores are standardized.

Missing Data. Missing data are the norm in longitudinal research (Grimm et al., 2016). Across the four measurement points, no trainees dropped out of the leadership training program. However, an average of 8.75 percent of participants had missing data (ranging from 1.25% to 14.17% at each time point). We tested whether participants with complete and missing data differed significantly on leader efficacy, leader identity, LGO, MTL dimensions, and demographic characteristics (i.e., age, gender, and ethnicity). Results indicate there were no significant differences between participants with complete and missing data, which suggest that the participants can be analyzed as a single sample (Sterne et al., 2009).[5]

Dimensionality of Leader Efficacy and Leader Identity. To confirm the distinctiveness of our constructs, we conducted a confirmatory factor analysis (CFA) on our dependent variables. The results indicate that a three-factor model (i.e., leader action self-efficacy, leader self-regulatory efficacy, and leader identity) provided the best fit to the data, BIC = 32701.29, SB-χ^2 (149) = 270.67, $p < 0.001$, CFI = 0.95, TLI = 0.94, RMSEA = 0.06, 90% CI = [0.05, 0.07] (Hu & Bentler, 1999; Vandenberg & Lance, 2000), relative to a one-factor model where items from leader efficacy and leader identity were combined into a single factor, BIC = 32987.84, SB-χ^2 (152) = 501.81, $p < 0.001$, CFI = 0.85, TLI = 0.84, RMSEA = 0.10, 90% CI = [0.09, 0.11], and a two-factor model where both leader efficacy dimensions were combined into a single factor, BIC = 32763.83, SB-χ^2 (151) = 328.67, $p < 0.001$, CFI = 0.93, TLI = 0.92, RMSEA = 0.07, 90% CI = [0.06, 0.08].[6] Based on these results, subsequent LGMs were run with leader action and self-regulatory efficacy in separate analyses. However, results also indicate that

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[5] The pattern of results does not change when controlling for whether the participants had complete or missing data.
[6] Model fit results are reported for Time 1, though the pattern of results are similar for all four survey periods (see Appendix B).

the models may not fit the data well as assessed by the chi-square, which could lead to biased estimates to an unknown degree (Yuan & Bentler, 2004).

Measurement Invariance. We examined three types of measurement invariance: *configural*, *metric*, and *scalar*. At a minimum, configural and metric invariance are considered prerequisites to meaningfully assess change in constructs over time (Chan, 1998; Vandenberg & Lance, 2000). Specifically, configural invariance indicates whether the theoretical factor structure of a construct and the number of items that load onto the construct are similar over time, and is assessed by loading the same items of each construct onto the same latent factor at each respective time point and allowing the factor-loading weights to vary freely. Metric invariance indicates whether the relationship between the latent variable and the item indicators is consistent over time, and is assessed by constraining the factor-loading weights of the same item across each measurement time point to be equal. Scalar invariance indicates whether changes in the mean levels of the indicators are captured by changes in the underlying means of the latent constructs, and is assessed by constraining the intercepts of the same item across each measurement time point to be equal (Bollen, 1989; Vandenberg & Lance, 2000).

Following recommendations in the literature, the measurement error of the same items were allowed to correlate over time (Finkel, 1995; Little, Preacher, Selig, & Card, 2007; Williams & Podsakoff, 1989), and the reference item's factor loading was fixed at one and the intercept was fixed at zero (Bollen, 1989; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). We find evidence for configural, metric, and scalar invariance for all measures across time (see Appendix C), which indicates that participants interpreted these measures in the same way across time and that changes found in the construct are likely due to substantive changes in the construct and not due to shifts in the interpretation of the measure. Therefore,

these results support our interpretation of meaningful leader efficacy and leader identity developmental trajectories. However, results also indicate that the models may not fit the data well in an absolute sense as assessed by the chi-square, which could lead to biased estimates to an unknown degree (Yuan & Bentler, 2004). We return to this issue of less than ideal fit in our Discussion.

Hypothesis Testing

        Leader Efficacy Trajectory. *Hypothesis 1* predicted that the overall leader efficacy developmental trajectory would be positive. To assess the shape of this trajectory, we estimated an unconditional LGM (i.e., an LGM that is not conditioned upon predictors such as LGO and MTL) where slope loadings were fixed at 0, 1, 3, 5 to represent time in weeks, corresponding to when data were collected (i.e., week 1, week 2, week 4, week 6) (Grimm et al., 2016). First, we ran a fixed intercept model whereby only the mean of the latent intercept variable was estimated, which assumes that all individuals have an identical initial level of leader efficacy and there are no changes in leader efficacy over time. Second, we ran a random intercept model whereby the mean and variance of the latent intercept variable were estimated, which assumes that individuals differ on their initial levels of leader efficacy and there are no changes in leader efficacy over time. Third, we ran a random intercept, fixed linear slope model whereby in addition to the random intercept model, the mean of the latent slope variable was estimated, which assumes that individuals' leader efficacy changes linearly over time, but all individuals experience an identical rate of change. Fourth, we ran a random intercept, random linear slope model whereby the mean and variance of the latent slope variable were estimated, which assumes that individuals' leader efficacy changes linearly over time and they experience different rates of change. The final two

models correspond to estimations of the mean and variance of the quadratic latent slope factor,

which can be interpreted similarly to linear models (see Tables 2-3).

Table 2
Unconditional Latent Growth Curve Modeling to Establish the Developmental Trajectory of Leader Action Self-Efficacy

	Fixed intercept	Random intercept	Random intercept, fixed linear slope	Random intercept, random linear slope	Random intercept, random linear slope, fixed quadratic slope	Random intercept, random linear slope, random quadratic slope[b]
BIC	7322.20	6933.78	6850.29	6822.39	6824.85	6818.50
SB-χ^2 (df)	273.03*** (9)	95.83*** (8)	46.46*** (7)	14.48* (5)	12.02* (4)	0.67 (2)
ΔSB-χ^2 (df)[a]	-	72.14*** (1)	26.18*** (1)	44.49*** (2)	2.38 (1)	9.32** (2)
CSB	1.99	1.55	1.29	1.46	1.50	1.15
CFI	0.00	0.52	0.78	0.95	0.96	1.00
TLI	0.03	0.64	0.81	0.94	0.93	1.02
RMSEA	0.35	0.21	0.15	0.09	0.09	0.00
RMSEA 90% CI	0.32, 0.39	0.18, 0.25	0.11, 0.20	0.04, 0.14	0.04, 0.15	0.00, 0.09
Intercept mean	74.38***	74.86***	70.71***	70.68***	70.06***	69.93***
Intercept variance	-	158.04***	159.97***	185.47***	185.53***	217.34***
Linear mean	-	-	1.65***	1.63***	2.59***	2.62***
Linear variance	-	-	-	5.60***	5.60***	55.96**
Quadratic mean	-	-	-	-	-0.17	-0.18
Quadratic variance	-	-	-	-	-	1.57**

Note. SB-χ^2 = Satorra-Bentler chi-square correction; CSB = correction factor for the SB-χ^2 difference test; BIC = Bayesian information criterion; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation.

[a] The Satorra-Bentler scaled χ^2-difference statistic is estimated using the following formula derived from Satorra and Bentler (2001): ΔSB-χ^2 = (SB-$\chi^2_{\text{Model 0}}$ X CSB$_{\text{Model 0}}$ − SB-$\chi^2_{\text{Model 1}}$ X CSB$_{\text{Model 1}}$)/[($df_{\text{Model 0}}$ X CSB$_{\text{Model 0}}$ − $df_{\text{Model 1}}$ X CSB$_{\text{Model 1}}$)/($df_{\text{Model 0}}$ − $df_{\text{Model 1}}$)]

[b] The residual variance at Time 4 was constrained to zero due to a non-significant negative error variance to facilitate model convergence (Chen, Bollen, Paxton, Curran, & Kirby, 2001).

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 3

Unconditional Latent Growth Curve Modeling to Establish the Developmental Trajectory of Leader Self-Regulatory Efficacy

	Fixed intercept	Random intercept	Random intercept, fixed linear slope	Random intercept, random linear slope	Random intercept, random linear slope, fixed quadratic slope	Random intercept, random linear slope, random quadratic slope[b]
BIC	7439.86	7011.83	6951.22	6925.65	6931.12	6936.79
SB-χ^2 (df)	267.59*** (9)	70.73*** (8)	37.41*** (7)	5.27 (5)	5.13 (4)	0.73 (2)
ΔSB-χ^2 (df)[a]	-	72.96*** (1)	15.30*** (1)	33.16*** (2)	0.00 (1)	4.06 (2)
CSB	2.03	1.54	1.14	1.15	1.19	1.07
CFI	0.00	0.65	0.83	1.00	0.99	1.00
TLI	0.04	0.74	0.85	1.00	0.99	1.02
RMSEA	0.35	0.18	0.14	0.02	0.03	0.00
RMSEA 90% CI	0.31, 0.38	0.14, 0.22	0.09, 0.18	0.00, 0.09	0.00, 0.11	0.00, 0.10
Intercept mean	75.14***	75.21***	71.58***	71.63***	71.61***	71.57***
Intercept variance	-	187.22***	187.88***	237.26***	237.24***	245.19***
Linear mean	-	-	1.52***	1.52***	1.55*	1.54*
Linear variance	-	-	-	6.21**	6.21**	32.37
Quadratic mean	-	-	-	-	-0.00	-0.00
Quadratic variance	-	-	-	-	-	1.00

Note. SB-χ^2 = Satorra-Bentler chi-square correction; CSB = correction factor for the SB-χ^2 difference test; BIC = Bayesian information criterion; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation.

[a] The Satorra-Bentler scaled χ^2-difference statistic is estimated using the following formula derived from Satorra and Bentler (2001): ΔSB-χ^2 = (SB-$\chi^2_{Model\ 0}$ X $CSB_{Model\ 0}$ − SB-$\chi^2_{Model\ 1}$ X $CSB_{Model\ 1}$)/[($df_{Model\ 0}$ X $CSB_{Model\ 0}$ − $df_{Model\ 1}$ X $CSB_{Model\ 1}$)/($df_{Model\ 0}$ − $df_{Model\ 1}$)]

[b] The residual variance at Time 4 was constrained to zero due to a non-significant negative error variance to facilitate model convergence (Chen, Bollen, Paxton, Curran, & Kirby, 2001).

* $p < .05$ ** $p < .01$ *** $p < .001$

An unconditional LGM for leader action self-efficacy with a random intercept, random linear slope yielded an acceptable fit to the data, SB-χ^2(5) = 14.48, p = 0.01, CFI = 0.95, TLI = 0.94, RMSEA = 0.09, 90% CI [0.04 – 0.14], though we acknowledge that the chi-square is significant, which could potentially result in biased estimates. The trajectory parameters were significant (intercept β = 70.68, $p < 0.001$; linear slope β = 1.63, $p < 0.001$), indicating that leader action self-efficacy developed in a positive and linear manner. An unconditional LGM for leader self-regulatory efficacy with a random intercept, random linear slope yielded an acceptable fit to the data, SB-χ^2(5) = 5.27, p = 0.38, CFI = 1.00, TLI = 1.00, RMSEA = 0.02, 90% CI [0.00 – 0.09], including as indexed by the chi-square. The trajectory parameters were significant (intercept β = 71.63, $p < 0.001$; linear slope β = 1.52, $p < 0.001$), indicating that leader self-regulatory efficacy developed in a positive and linear manner.

Figure 1 depicts the random intercept, random linear slope unconditional LGMs of leader action and self-regulatory efficacy; in other words, they represent the average linear trajectory (i.e., change) of participants' leader efficacy over time, which does not account for the impact that between-person attributes may have on these developmental trajectories. In modeling a non-linear slope by including a quadratic latent slope, the quadratic slope mean was non-significant for both dimensions of leader efficacy. Thus, these results indicate that leader efficacy developed in a positive and linear fashion, supporting *Hypothesis 1*.

Figure 1. Unconditional linear leader efficacy trajectories

◆ Leader action self-efficacy   ● Leader self-regulatory efficacy
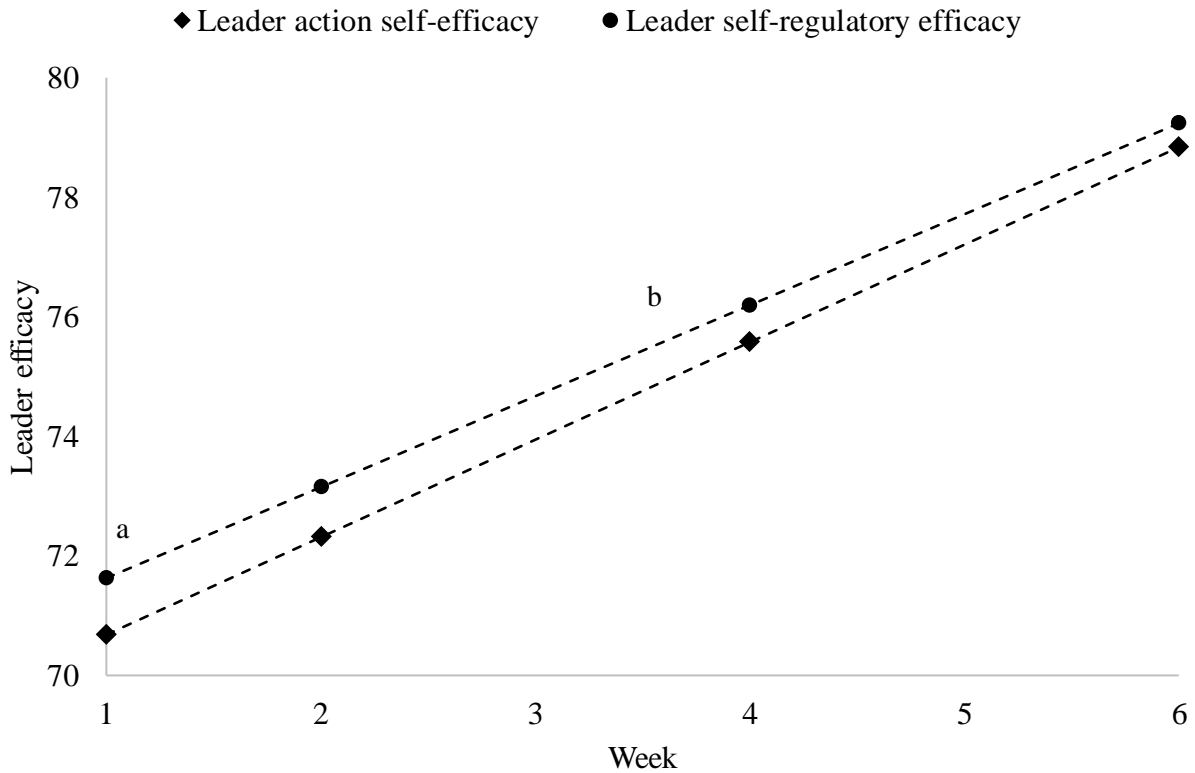
Note. The latent growth trajectories are the average leader efficacy trajectories of participants, which are estimated from a random intercept, random linear slope model. No data were collected during week 3 and week 5.
[a] The random intercept estimated allows for individuals to differ on their initial leader efficacy.
[b] The random linear slope estimated allows for individuals to differ on the linear changes to their leader efficacy.

Leader Identity Trajectory. In contrast, an unconditional LGM for leader identity with

a random intercept, linear, and quadratic slope yielded an acceptable fit to the data, SB-χ^2(1) =

4.08, p = 0.04, CFI = 0.99, TLI = 0.95, RMSEA = 0.11, 90% CI [0.02 – 0.24], though we

acknowledge that the chi-square for this model is significant, which could potentially result in

biased estimates. The trajectory parameters were significant (intercept β = 4.41, p < 0.001; linear

slope β = 0.27, p < 0.001; quadratic slope β = -0.03, p < 0.01; see Table 4), indicating that leader

identity developed in a curvilinear manner. Specifically, the overall developmental trajectory

depicts continued positive change in identity, supporting *Hypothesis 2*, but with the degree of

development decreasing over time (see Figure 2). Thus, in this leadership training program,

participants exhibited different developmental trajectories for leader efficacy and leader identity.

Table 4

Unconditional Latent Growth Curve Modeling to Establish the Developmental Trajectory of Leader Identity

	Fixed intercept	Random intercept	Random intercept, fixed linear slope	Random intercept, random linear slope	Random intercept, random linear slope, fixed quadratic slope	Random intercept, random linear slope, random quadratic slope
BIC	3043.87	2573.39	2493.14	2482.66	2478.87	2474.80
SB-χ^2 (df)	482.72*** (9)	110.20*** (8)	46.60*** (7)	32.88*** (5)	23.95** (4)	4.08* (1)
ΔSB-χ^2 (df)[a]	-	371.18*** (1)	43.85*** (1)	13.58*** (2)	8.86*** (1)	19.65*** (3)
CSB	1.28	1.28	1.18	1.02	1.01	0.92
CFI	0.00	0.70	0.88	0.92	0.94	0.99
TLI	0.07	0.78	0.90	0.90	0.91	0.95
RMSEA	0.47	0.23	0.15	0.15	0.14	0.11
RMSEA 90% CI	0.43, 0.50	0.19, 0.27	0.11, 0.20	0.11, 0.20	0.09, 0.20	0.02, 0.24
Intercept mean	4.72***	4.76***	4.47***	4.48***	4.41***	4.41***
Intercept variance	-	1.26***	1.29***	1.36***	1.36***	1.32***
Linear mean	-	-	0.14***	0.13***	0.26***	0.27***
Linear variance	-	-	-	0.03**	0.03**	0.26*
Quadratic mean	-	-	-	-	-0.03**	-0.03**
Quadratic variance	-	-	-	-	-	0.01*

Note. SB-χ^2 = Satorra-Bentler chi-square correction; CSB = correction factor for the SB-χ^2 difference test; BIC = Bayesian information criterion; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation.

[a] The Satorra-Bentler scaled χ^2-difference statistic is estimated using the following formula derived from Satorra and Bentler (2001): ΔSB-χ^2 = (SB-$\chi^2_{Model\ 0}$ X $CSB_{Model\ 0}$ − SB-$\chi^2_{Model\ 1}$ X $CSB_{Model\ 1}$)/[($df_{Model\ 0}$ X $CSB_{Model\ 0}$ − $df_{Model\ 1}$ X $CSB_{Model\ 1}$)/($df_{Model\ 0}$ − $df_{Model\ 1}$)]

* $p < .05$ ** $p < .01$ *** $p < .001$

Figure 2. Unconditional quadratic leader identity trajectory
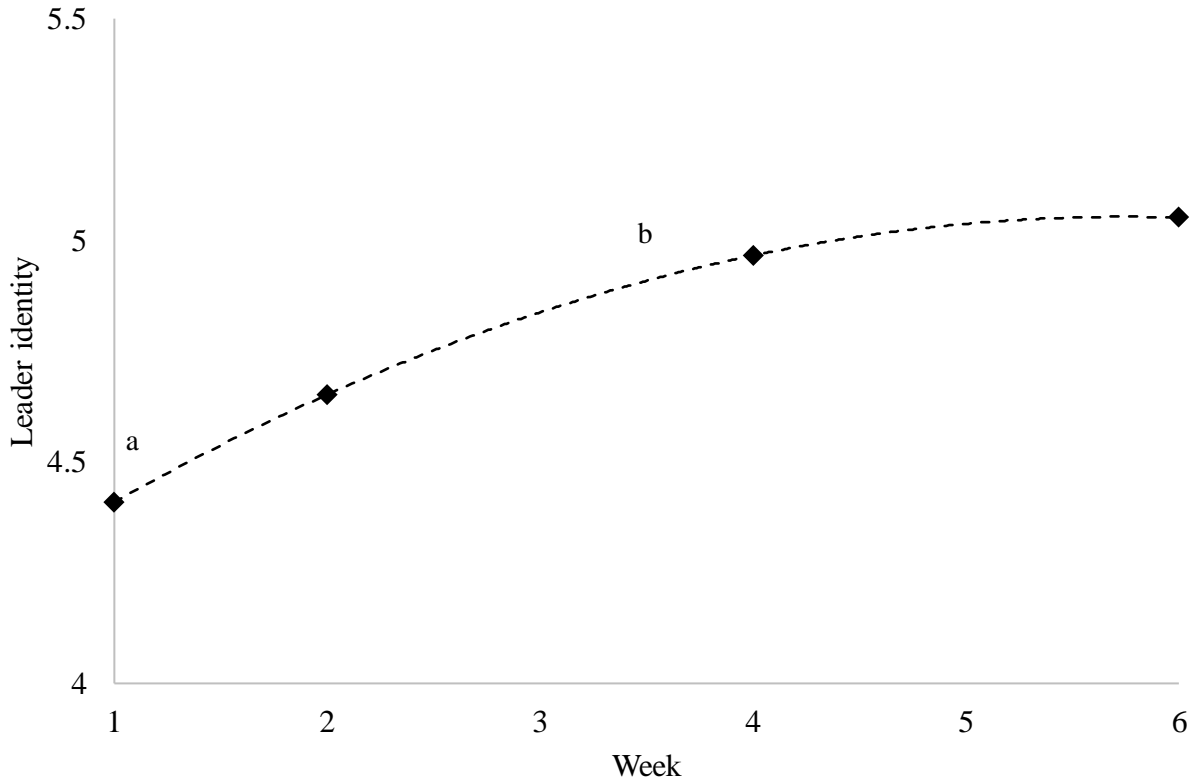
Note. The latent growth trajectory is the average leader identity trajectory of participants, which is estimated from a random intercept, random linear, and random quadratic slope model. No data were collected during week 3 and week 5.
[a] The random intercept estimated allows for individuals to differ on their initial leader identity.
[b] The random linear and quadratic slope estimated allows for individuals to differ on the linear and quadratic changes to their leader identity.

Main Effects of LGO and MTL. To answer *Research Question 1* regarding the competing developmental readiness and developmental need perspectives, LGO and MTL dimensions were included together in a conditional LGM. For leader action self-efficacy, an LGM conditioned upon LGO and MTL yielded an acceptable fit to the data as indexed by multiple fit indices, SB-χ^2(15) = 21.66, p = 0.12, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, 90% CI [0.00 – 0.08]. Results indicate that only affective MTL had a significant effect on the linear slope for leader action self-efficacy (β = -0.62, p < 0.05). Similarly, for leader self-regulatory

efficacy, an LGM conditioned upon LGO and MTL yielded an acceptable fit to the data across all reported fit indices, SB-χ^2(15) = 21.87, p = 0.11, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, 90% CI [0.00 – 0.09]. Results indicate that only affective MTL had a significant effect on the linear slope for leader self-regulatory efficacy (β = -0.71, p < 0.05) (see Table 5). Specifically, the trajectories of both efficacy dimensions for individuals higher (lower) on affective MTL began at higher (lower) initial levels, and they experienced a shallower (steeper) increase compared to individuals lower (higher) in affective MTL (see *Figure 3*). Thus, results for leader efficacy dimensions support a developmental need perspective, as those lower on affective MTL developed greater confidence over the course of the formal leadership training program.

Figure 3. Leader action and self-regulatory self-efficacy trajectories as a function of affective MTL
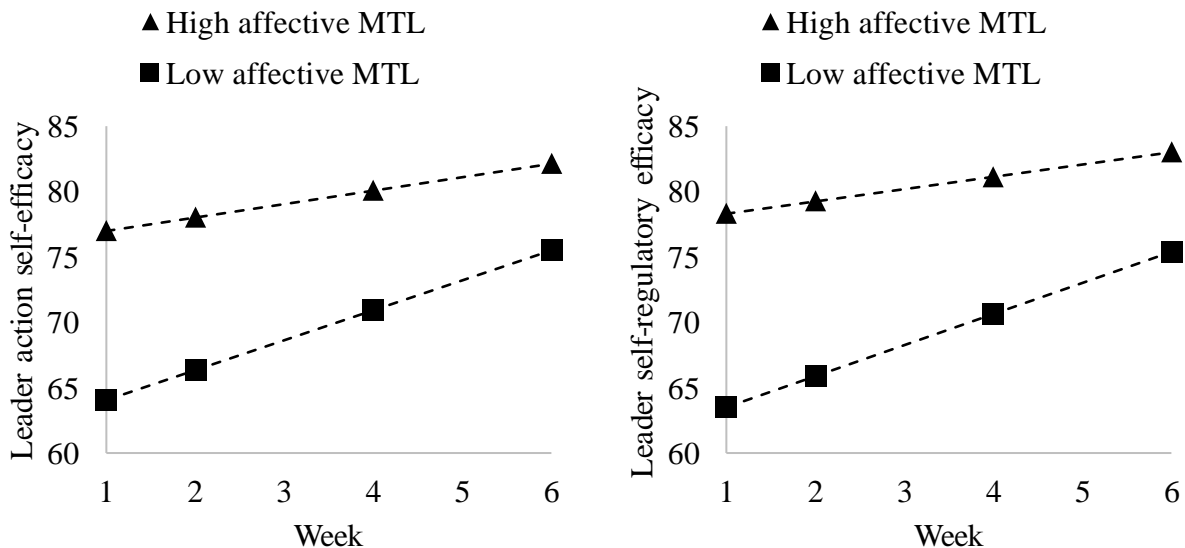
Note. No data were collected during week 3 and week 5. MTL = motivation to lead. Low and high were defined as -1 and +1 SD, respectively.

Table 5
LGO and Dimensions of MTL as Predictors of Leader Efficacy Trajectories

Variable	Step 1: Initial status		Step 2: Linear trend	
	β	SE	β	SE
Leader action self-efficacy				
Intercept	69.36***	2.60	2.41***	0.65
LGO	2.24*	1.05	-0.07	0.20
Affective	6.41***	0.99	-0.62*	0.27
Non-calculative	0.75	0.85	0.16	0.22
Social-normative	3.13**	1.09	-0.25	0.39
Cohort	0.75	1.59	-0.49	0.40
Leader self-regulatory efficacy				
Intercept	71.12***	2.91	2.59***	0.66
LGO	2.47*	1.13	0.11	0.23
Affective	7.74***	1.16	-0.71*	0.28
Non-calculative	0.66	0.98	0.20	0.24
Social-normative	3.08*	1.25	-0.38	0.31
Cohort	0.11	1.76	-0.65	0.44

Note. LGO = Learning goal orientation. Cohort = dummy variable for the summer in which data were collected.
Model fit for leader action self-efficacy: SB-χ^2(15) = 21.66, p = 0.12, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, 90% CI [0.00 – 0.08], BIC = 6400.59. Model fit for leader self-regulatory efficacy: SB-χ^2(15) = 21.87, p = 0.11, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, 90% CI [0.00 – 0.09], BIC = 6486.75
SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; BIC = Bayesian information criterion.
* p < .05 ** p < .01 *** p < .001

For leader identity, an LGM conditioned upon LGO and MTL yielded an acceptable fit to

the data across all reported fit indices, SB-χ^2(6) = 4.92, p = 0.55, CFI = 1.00, TLI = 1.01,

RMSEA = 0.00, 90% CI [0.00 – 0.08]. Results indicate that in contrast only LGO had a

significant effect on the linear (β = 0.11, p < 0.05) and quadratic slope (β = -0.02, p < 0.05) (see

Table 6). As shown in Figure 4, individuals lower in LGO demonstrated positive and linear

changes over time in their leader identity, whereas individuals higher in LGO developed in a

curvilinear manner, such that they demonstrated larger changes in their leader identity initially,

but these positive changes then slowed over time. In other words, results for leader identity did not strongly support either the developmental readiness or developmental need perspectives, as *both* individuals higher and lower on LGO experienced positive changes to their leader identity and arrived at a similar leader identity level at the end of the program. Interestingly, however, these individuals differed on *how* their leader identity developed over the course of the leadership training program.

Table 6

LGO and Dimensions of MTL as Predictors of Leader Identity Trajectories

Variable	Step 1: Initial status		Step 2: Linear trend		Step 3: Quadratic trend	
	β	*SE*	β	*SE*	β	*SE*
Intercept	4.34***	0.20	0.10	0.14	0.02	0.03
LGO	0.00	0.07	0.11*	0.06	-0.024*	0.01
Affective	0.85***	0.06	-0.03	0.07	-0.002	0.01
Non-calculative	-0.06	0.06	0.04	0.05	-0.003	0.01
Social-normative	0.25**	0.08	-0.03	0.07	0.001	0.01
Cohort	0.03	0.12	0.12	0.09	-0.032	0.02

Note. LGO = Learning goal orientation. Cohort = dummy variable for the summer in which data were collected.

SB-χ^2(6) = 4.92, *p* = 0.55, CFI = 1.00, TLI = 1.01, RMSEA = 0.00, 90% CI [0.00 – 0.08], BIC = 2207.37

SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; BIC = Bayesian information criterion.

* *p* < .05 ** *p* < .01 *** *p* < .001

Figure 4. Leader identity trajectories as a function of trainee LGO
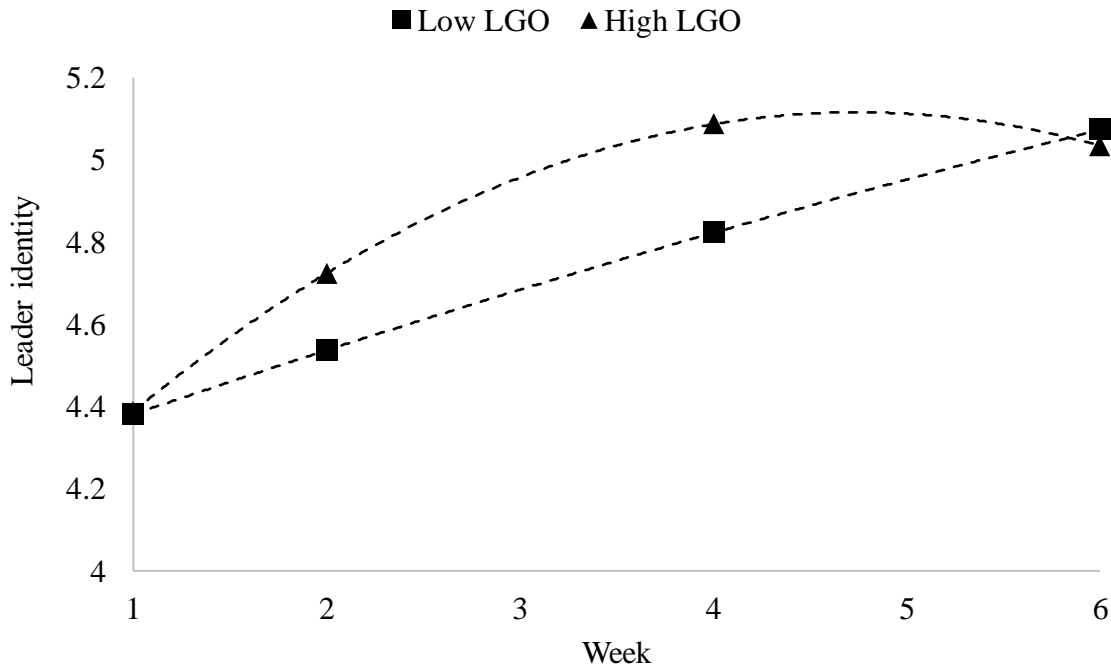
Note. No data were collected during week 3 and week 5. LGO = learning goal orientation. Low and high were defined as -1 and +1 SD, respectively.

Interactive Effects of LGO and MTL. To answer *Research Question 2*, interaction terms between LGO and each dimension of MTL were included in conditional LGMs. For leader action self-efficacy, an LGM conditioned upon LGO, MTL, and their interactive effects yielded an acceptable fit to the data across all fit indices examined, SB-$\chi^2(21)$ = 29.61, $p = 0.10$, CFI = 0.98, TLI = 0.96, RMSEA = 0.04, 90% CI [0.00 – 0.08]. Results indicate that LGO and affective MTL interacted to predict the slope of leader action self-efficacy ($\beta = 0.51$, $p < 0.05$) (see Table 7). Post-hoc simple slopes analyses indicate that the interactive effect of LGO and affective MTL was non-significant for individuals higher (+1 SD) on LGO ($\beta = 0.43$, $p > 0.05$), but was

marginally significant for individuals lower (-1 SD) on LGO ($\beta = -0.59$, $p = 0.07$).[7] As shown in

Figure 5, the main effect of affective MTL can still be strongly observed, such that trainees lower

on affective MTL experienced greater development in their leader action self-efficacy than those

higher on affective MTL. However, individuals *lower* on LGO *and* affective MTL developed the

most in their leader action self-efficacy, in line with the developmental need perspective.

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[7] The Johnson-Neyman procedure (Johnson & Fay, 1950) indicated that the simple slope was significant for individuals at 1.50 SD below the mean for LGO.

Table 7
Interactive Effects of LGO and Dimensions of MTL on Leader Efficacy Trajectories

Variable	Step 1: Initial status		Step 2: Linear trend	
	β	*SE*	β	*SE*
Leader action self-efficacy				
Intercept	68.50***	2.59	2.36***	0.66
LGO	2.71**	0.96	-0.08	0.21
Affective	6.42***	0.93	-0.57*	0.27
Non-calculative (NC)	0.60	0.84	0.21	0.22
Social-normative (SN)	3.03**	1.07	-0.24	0.29
LGO x Affective	-0.93	0.98	0.51*	0.24
LGO x NC	0.34	0.84	-0.25	0.25
LGO x SN	1.78	0.99	-0.27	0.29
Cohort	0.99	1.56	-0.46	0.40
Leader self-regulatory efficacy				
Intercept	70.98***	2.72	2.42***	0.66
LGO	2.92**	0.98	0.14	0.22
Affective	7.27***	1.03	-0.60*	0.27
Non-calculative (NC)	0.45	0.93	0.25	0.24
Social-normative (SN)	3.05*	1.19	-0.38	0.31
LGO x Affective	-2.18*	1.09	0.68***	0.19
LGO x NC	-0.84	0.92	-0.17	0.26
LGO x SN	2.36*	1.06	-0.28	0.23
Cohort	0.20	1.68	-0.59	0.42

Note. LGO = Learning goal orientation. Cohort = dummy variable for the summer in which data were collected.
Model fit for leader action self-efficacy: SB-χ^2(21) = 29.61, *p* = 0.10, CFI = 0.98, TLI = 0.96, RMSEA = 0.04, 90% CI [0.00 – 0.08], BIC = 6423.60. Model fit for leader self-regulatory efficacy: SB-χ^2(21) = 34.94, *p* = 0.03, CFI = 0.97, TLI = 0.94, RMSEA = 0.06, 90% CI [0.02 – 0.09], BIC = 6504.28
SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; BIC = Bayesian information criterion.
* *p* < .05 ** *p* < .01 *** *p* < .001

For leader self-regulatory efficacy, an LGM conditioned upon LGO, MTL, and their interactive effects yielded an acceptable fit to the data, SB-χ^2(21) = 34.94, p = 0.03, CFI = 0.97, TLI = 0.94, RMSEA = 0.06, 90% CI [0.02 – 0.09], though we acknowledge that the chi-square is significant, which could potentially lead to biased estimates. Results indicate that LGO and affective MTL interacted to predict the slope of leader self-regulatory efficacy (β = 0.68, p < 0.001). Post-hoc simple slopes analyses indicate that the interactive effect of LGO and affective MTL was non-significant for individuals lower (-1 SD) on LGO (β = -0.54, p > 0.05), but was significant for individuals higher (+1 SD) on LGO (β = 0.81, p < 0.01). As can be seen in Figure 5, although individuals lower on affective MTL experienced greater development in their leader self-regulatory efficacy than those higher on affective MTL, individuals *higher* on LGO and *lower* on affective MTL developed the most in their leader self-regulatory efficacy. Finally, LGO and the MTL dimensions did not interact to predict leader identity slope (see Appendix D).

Figure 5. Leader action and self-regulatory self-efficacy trajectories as a joint function of LGO and affective MTL
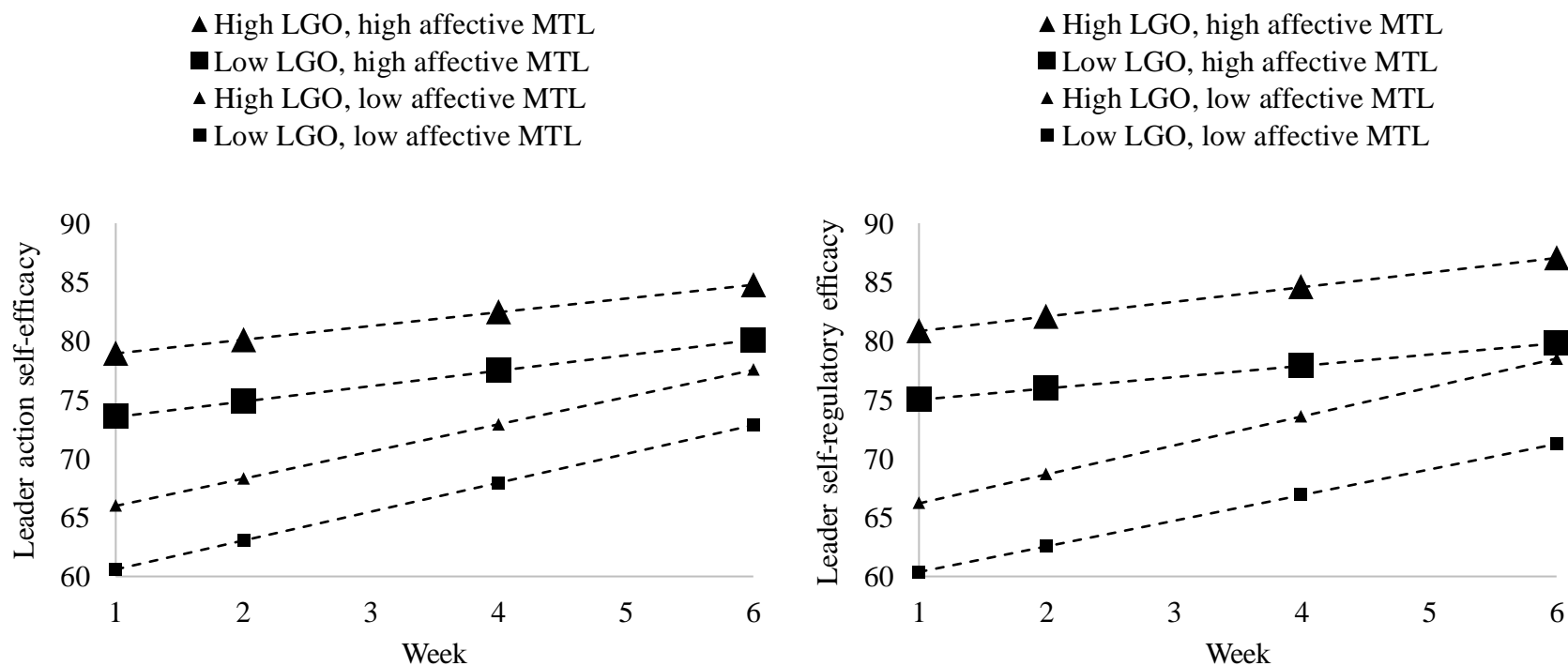
Note. No data were collected during week 3 and week 5. LGO = learning goal orientation. MTL = motivation to lead. Low and high were defined as -1 and +1 SD, respectively.

Discussion

Despite widespread interest and attention in leadership theory, research, and practice (Avolio et al., 2009), leader development processes remain understudied and poorly understood (Day & Dragoni, 2015; Riggio & Mumford, 2011). Although considerable research exists on the effectiveness of formal leadership training programs (Lacerenza et al., 2017), less is known about individuals' developmental trajectories during formal leadership training and which individuals are most likely to benefit from such programs. In the current study, we addressed these two gaps in the literature by first assessing the developmental trajectories of individuals' leadership-related self-views (i.e., leader efficacy and leader identity) during leadership training, which are key proximal indicators of leader development that are theorized to sustain future leadership effectiveness (Day & Dragoni, 2015). Second, we assessed the impact of LGO and MTL on leader efficacy and leader identity developmental trajectories by considering arguments from two contrasting perspectives, developmental readiness (i.e., openness to change; Avolio & Hannah, 2009) versus developmental need (i.e., room to change; Kragt & Guenter, 2018).

In this study, we longitudinally assessed participants' leader efficacy and leader identity after they had completed and received feedback on multiple leadership assessments, in line with theoretical arguments that development is most likely during these moments (Day et al., 2009). This theoretically-driven approach to the timing of measurements helps to ensure interpretability regarding the "true" form of change in a construct (Ployhart & Vandenberg, 2010). Additionally, the majority of the limited longitudinal research on leadership development takes place over a relatively short timeframe (e.g., many interventions are only hours or a couple of days in length; see Avolio et al., 2009). Thus, by following participants over the course of a six-week formal leadership training program, we are able to examine more substantive developmental changes.

Results from our LGMs indicate that during a formal leadership training program, leader efficacy developed in a positive and linear fashion, whereas leader identity developed in a positive and quadratic fashion (i.e., positive development with a slowing growth over time). These results suggest that leader identity may be less malleable than leader efficacy during training. Drawing from theories of self-verification (Swann, 2012) and identity (Fiske, 1992; Stryker & Burke, 2000), it may be that the subsequent slowing growth of leader identity after the faster initial increase is reflective of identity stability (Stryker & Burke, 2000) or homeostasis (Burke, 1991). Additionally, a quadratic developmental trajectory for leader identity is in line with some prior research on leader identity and skill development (Miscenko et al., 2017).

In contrast to our finding of a positive and linear developmental trajectory for leader efficacy, a prior four-day longitudinal study by Quigley (2013) among MBA students found that leader efficacy developed in a positive, cubic manner. However, as Quigley (2013) only assessed leader efficacy development over a relatively short timeframe, it is possible that over longer periods of time, leader efficacy exhibits an overall positive and linear developmental trajectory that their study was unable to capture. In fact, it has been proposed that development can consist of an ongoing dynamic between gains and losses (Baltes, 1987; Stevens-Long & Michaud, 2002), such as the cubic trajectory found by Quigley (2013), yet an ideal and successful trajectory would involve maximizing gains and minimizing losses that would result in an overall positive developmental trajectory (Day & Sin 2011), such as the one observed in this study.

Results for between-person predictors of within-individual leader efficacy development provide evidence for the developmental need perspective, whereby individuals who were lower on affective MTL experienced greater development in their leader efficacy. Moreover, results indicate that individuals who were lower on affective MTL *and* LGO experienced greater

development in their leader action self-efficacy, whereas individuals who were *lower* on affective MTL and *higher* on LGO experienced greater development in their leader self-regulatory efficacy. The differential forms of affective MTL and LGO interactions in predicting the development of the two types of leader efficacy could perhaps be explained if we viewed leader self-regulatory efficacy as more reflective of declarative knowledge (i.e., confidence in one's internal leadership capabilities, which may include leadership content knowledge, or confidence in knowing *what* to do) and leader action self-efficacy as more reflective of procedural knowledge (i.e., confidence in one's external leadership capabilities, which includes enacting and creating leadership effects, or confidence in knowing *how* to do it; Anderson, 1982). Prior research found that LGO was a significant predictor of a declarative knowledge outcome, but not a procedural knowledge outcome (Fisher & Ford, 1998); the researchers argue that individuals can acquire procedural knowledge by using other examples of a concept without necessarily having to learn a declarative representation of the concept (Anderson & Fincham, 1994). This may be why those lower in affective MTL but higher in LGO exhibited the most growth in their leader self-regulatory efficacy in the current study. Given the different pattern of results found for the two types of leader efficacy, this reinforces prior work arguing for greater clarity in understanding the dimensionality of leader self-efficacy (Day & Dragoni, 2015).

In contrast, results for leader identity did not strongly support either developmental readiness or developmental need perspectives, as individuals lower and higher on LGO ultimately experienced a similar degree of leader identity development over the course of the program, albeit via different types of trajectories. Individuals higher on LGO experienced faster initial growth of leader identity followed by a slowing growth over time, whereas individuals

lower on LGO experienced a steady, linear growth over time. Given that this pattern of results was unexpected, we offer some speculations below regarding some possible explanations.

One possibility is because individuals higher on LGO are more willing to take risks and make mistakes (Vandewalle, 1997), they set higher leaderships goals for themselves, and the plateau observed towards the end of training in their leader identity development may reflect that these bolder choices may not always pay off and that some setbacks may have halted the development of their leader identity (at least temporarily). In contrast, because individuals lower on LGO are less likely to take risks and make mistakes, they may have set lower leadership goals for themselves. In turn, these individuals may have found it easier to steadily achieve or make progress toward their leadership goals, including seeing themselves as a leader.

Alternatively, given fairly strong links between LGO and openness (Payne, Youngcourt, & Beaubien, 2007), individuals higher on LGO may hold more complex or abstract views of what it means to be a leader that they ultimately find harder to attain, leading to a plateau in leader identity, whereas individuals lower on LGO may have found it easier to internalize or achieve their more simplified view of leadership, resulting in consistent gains. Although we observed some unexpected pattern of findings, the current results ultimately support the longstanding recognition in the literature that LGO is important in learning and developmental contexts (Elliot & Murayama, 2008). These results further suggest that all individuals may have the capability to develop leadership competencies under the right conditions (Day & Harrison, 2007), counter to some prior descriptions of individuals lower on LGO (Vandewalle, 1997).

Theoretical and Practical Implications

The current study contributes to the theoretical expansion of the leader development literature in several ways. First, the nascent literature on leader development suffers from a

critical theory-data gap (Cullen-Lester & Yammarino, 2016), where there is a lack of empirical studies testing emerging theoretical developments, including one's self-views related to leadership (Day, 2000; Day & Harrison, 2007; Day et al., 2009; Lord & Hall, 2005). Additionally, the limited empirical research is often not longitudinal in nature, despite calls in the literature encouraging the use of these methods to understand how leader development processes unfold over time (Day, 2000; Day et al., 2014). Addressing these gaps in the literature, results from the present study indicate that leader efficacy and leader identity do in fact develop over the course of a formal leadership training program, in line with theoretical propositions that suggest they are key cognitive outcomes of the leader development process (Day & Dragoni, 2015).

Second, given the paucity of longitudinal research on leader efficacy and leader identity development, it is unclear as to how individuals' leader self-views develop during formal leadership training (Day & Dragoni, 2015). Understanding the developmental trajectories of leader efficacy and leader identity is critical to the study of leader development because it helps to shed light on the pace and extent of development that individuals experience over the course of leadership training (Nagin, 2005). The field of leader development is shifting away from traditional leadership theory, such as identifying theories of effective leadership, towards viewing leader development as a developmental science (Day et al., 2014), which aims to describe the course of development in humans and to understand the factors that influence this developmental process (Bronfenbrenner & Evans, 2000). By simultaneously assessing the development of leader efficacy and leader identity over the course of formal leadership training, the current study provides evidence that leader efficacy and identity can develop differently even within the same context, and contributes to the growing scientific study of leader development.

47

Third, although contemporary leadership theories have made great strides in identifying the "best" leadership theory that facilitates effective leadership (Bass & Bass, 2008), there are limited discussions on the intra-individual developmental processes that are experienced by leaders. For example, authentic leadership theory argues that authentic leaders are the "root" of all positive forms of leadership (Avolio et al., 2004), yet research in this area does not elucidate the within-person process that are experienced by developing leaders (Avolio & Walumbwa, 2014). In line with the current study, which argues that leader self-views are foundational to leader development (Day et al., 2009), prior literature has also alluded to the importance of leader self-views for authentic leadership. Specifically, individuals who are self-aware (i.e., cognizant of their identity; Gardner, Avolio, Luthans, May, & Walumba, 2005) are more likely to develop as authentic leaders (Avolio & Gardner, 2005). Results from the current study indicate that individuals undergoing leadership training experienced positive growth to their leader efficacy and identity (i.e., leader self-views). Therefore, it is possible that as the participants in the current study developed their self-views as leaders, it may also be facilitating their concurrent or future development as authentic leaders.

Practically, the current study contributes to ongoing conversations among HR professionals regarding where organizations should be devoting their resources when it comes to leader development. For example, business executives often report that they received most of their leader development training in the later stages of their career (Lipman, 2016), perhaps based on the assumption that these are the leaders who are most developmentally ready (i.e., possess the motivation and ability). Yet, younger, inexperienced leaders require development as well. Indeed, recent meta-analytic evidence has shown that transfer of training was four times

weaker for high-level leaders, compared to low- and mid-level leaders (Lacerenza et al., 2017), supporting a developmental need perspective (i.e., greater potential for growth).

Ultimately, answering the question of who is most likely to benefit from formal leadership training depends on one's definition of "benefit." Results from the current study indicate that although those lower on affective MTL generally experienced the most *growth* in their leader efficacy, individuals higher on affective MTL also experienced significant changes to their leader efficacy and by the end of the training course, this group of individuals exhibited the highest levels of leader efficacy. Therefore, an organization might focus their development efforts on the former group if they valued "bridging the gap" or enhancing the size of their overall leadership talent pool by investing in those who gain most from training, whereas an organization may focus on the latter group if they wanted to maximize their high potentials.

Organizations often have the choice to "build" or "buy" talent (e.g., DeOrtentiis, Van Iddekinge, Ployhart, & Heetderks, 2018). However, hiring new talent can be very costly, with estimated costs ranging from $4,000 to $7,000 above base salary (Dube, Freeman, & Reich, 2010) to 50 to 60 percent above the annual salary (Allen, 2008). Additionally, investing in training existing talent can help organizations develop specialized talent that is relevant to their specific needs and creating future trainers that can help disseminate organization-specific knowledge to other job incumbents (Mosteller, 2015). Although those lower on LGO and MTL, respectively, may tend to be less personally motivated to participate in leadership training, meta-analytic evidence suggests that mandatory leadership training programs actually foster better organizational outcomes (e.g., turnover, absenteeism, ROI, and profit) compared to voluntary programs (Lacerenza et al., 2017), suggesting a possible path forward.

In terms of research design and analysis, the current study highlights the utility of latent growth models as a program evaluation tool (e.g., Wang, Siegal, Falck, Carlson, & Rahman, 1999). Although leadership scholars and practitioners are interested in modeling individual change as a function of leadership training (Day et al., 2014), the majority of research conducted employs cross-sectional pre- and post-training assessments (Avolio et al., 2009; Collins & Holton, 2001). As a result, although extant research generally demonstrates overall positive effects of leadership training (Lacerenza et al., 2017), this body of work does not inform the underlying learning processes that individuals experience while undergoing leadership training (Hoole & Martineau, 2014). By employing these advanced statistical models that analyze longitudinal data, researchers and practitioners can better illuminate the underlying developmental process of individuals participating in leadership training (Bronfenbrenner & Evans, 2000), such as developmental trajectories (Ployhart & Vandenberg, 2010).

Limitations and Future Research Directions

Youth Sample. The current study used a youth sample to study leader development. Although this may be considered by some as a limitation, we believe that this sample was well-suited to answer our hypotheses and research questions. As the primary aim of our study was to answer the theoretical question of whether and how leader self-views changed over the course of a formal leadership training program, our findings should generalize to other contexts where the effects of formal leadership training on leader efficacy and identity development are also expected to occur (Highhouse & Gillespie, 2008). Additionally, research indicates that the ways in which children and adults conceptualize typical and effective leaders are highly similar (e.g., Schyns, Kiefer, Kerschreiter, & Tymon, 2011). Finally, our current findings based on a youth

sample regarding leadership-related developmental trajectories converge with prior research based on adult samples (e.g., MBA and graduate students; Miscenko et al., 2017; Quigley, 2013).

Recent conceptualizations of leader development position it as a continuous process of development across the lifespan (Day et al., 2009), with leadership during adulthood inexorably tied to (leadership) developmental experiences from childhood (e.g., Keller, 2003; Reichard & Paik, 2011). However, most research on leader development tends to focus on developmental experiences that occur later in life (Murphy, 2011), leading to a dearth of research on leader development prior to adulthood (Popper & Amit, 2009; Popper & Mayseless, 2007). Leadership scholars have even made explicit calls for research to investigate the developmental experiences that shape young individuals' identities and self-regulatory capabilities as leaders (Murphy & Johnson, 2011). Taken together, utilizing a youth sample to understand leader development processes is not only appropriate, but also critical, to the field of leader development.

Leadership Experience. In the current study, we did not measure leadership experience directly, which is a limitation when considering our research questions of how LGO and MTL, individually and jointly, affect the development of leader efficacy and identity during leadership training. However, participants' initial leader efficacy and identity may serve as an indirect indicator of their prior leadership experience (i.e., leadership experience at the beginning of the program). In the case of leader efficacy, research on self-efficacy note that previous performance on a task is a strong determinant of self-efficacy beliefs (e.g., Bandura, 1982; Locke, Frederick, Lee, & Bobko, 1984). Additionally, meta-analytic evidence supports a robust relationship between job tenure (i.e., experience) and performance (Ng & Feldman, 2010). In other words, experience predicts performance, and performance predicts self-efficacy (as opposed to self-efficacy predicting performance; Sitzmann & Yeo, 2013). As a result, we can expect those who

51

have higher initial leader efficacy to have had more (effective) leadership experiences. In the case of leader identity, leader identity refers to individuals' cognitive schema that organizes their knowledge and experiences associated with being a leader (Day & Harrison, 2007; Lord & Brown, 2004). As individuals' leadership skills (Miscenko et al., 2017) and experiences (Hammond et al., 2017) grow, so too will their leader identity. Therefore, it is likely that those who possess a stronger initial leader identity are more likely to have had more leadership experiences. As a result, based on the aforementioned theoretical reasons, the intercept (or initial status) of the latent growth models in the current study can serve as controls of prior leadership experience, which bolsters our confidence in the results when answering our research questions.

Empirical evidence from the current study indicates that individuals higher on LGO (β = 2.24, p < .05), and affective (β = 6.41, p < .001) and social-normative (β = 3.13, p < .01) MTL report higher levels of leader action self-efficacy at the beginning of the training program (a similar pattern of results is found for leader self-regulatory efficacy). Similarly, individuals higher on affective (β = 0.85, p < .001) and social-normative (β = 0.25, p < .01) MTL report higher levels of leader identity at the beginning of the program. This pattern of results supports our argument that participants higher on LGO and MTL may have greater interest in leadership and may have had more leadership experience prior to the training course, relative to those lower on LGO and MTL, and as a result, had less developmental need for the current training program. Interpreting the results in this manner is in-line with conceptualizations of leader development as a lifelong and continuous process of development (Day et al., 2009), whereby individuals' prior leadership experiences will inevitably affect their subsequent development (Day & Sin, 2011).[8]

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[8] Unpublished data from our lab also reveals a correlation of 0.52 between leader self-efficacy (Murphy, 1992) and past leadership experience (i.e., over the past five years, how often have you taken on a role where you had to lead a group of individuals, whether at school or outside of school?), and a correlation of 0.50 between leader identity

Although we did not directly assess leadership experience in our current study, we believe that the matter of how to best assess this construct generally remains underexplored in the literature. For example, prior research has often used a single-item to assess tenure in formal leadership roles as an indicator of leadership experience (e.g., Kragt & Guenter, 2018). However, we draw upon research in the work experience literature to recommend that future leadership research should consider using a multidimensional perspective when conceptualizing and assessing leadership experience (e.g., Ford, Quiñones, Sego, & Sorra, 1992; Tesluk & Jacobs, 1998). In line with this perspective, Quinones, Ford, and Teachout (1995) proposed a levels-of-analysis and multidimensional framework that considers work experience as a function of measurement mode (i.e., amount, time, and type) and level of specificity (i.e., task, job, and organizational). Adopting such a framework to measure leadership experience in the future would provide researchers with more conceptual clarity regarding what one means with regards to leadership experience and the type(s) of experience that are most critical for each outcome. For example, how might an individual who has performed one leadership task many times at *one* organization differ on their leader efficacy and leader identity compared to an individual who has performed the same leadership task the same number of times but at *many* organizations?

Potential Sources of Model Mis-Specification. The current study employed LGMs, a SEM-based approach to modeling change in a construct, to address our hypotheses and research questions. Using the chi-square as the sole fit index, results indicate that some of our models may not fit the data well, which can lead to biased estimates (Antonakis, 2017). For our measurement models (i.e., confirmatory factor analysis and measurement invariance), a closer examination of

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(Hiller, 2005) and past leadership experience, among undergraduate students ($N = 586$). This provides some additional evidence supporting our claims.

the modification indices suggest that the chi-square values could be improved if certain item residuals were allowed to correlate. This method to improve model fit is appropriate if the items are similarly worded (Brown, 2015), as is the case for the dependent variables in the current study (i.e., leader identity and efficacy).

Although most of our structural or substantive models demonstrated good model fit, there were some instances where the chi-square indicated that model fit could be improved. For the unconditional leader action self-efficacy LGM, modification indices suggest that model fit could be improved if we correlated the residuals of leader action self-efficacy at Time 1 and Time 3, which may be due to the exclusion of covariates in the model as the chi-square index indicated that the data fit the model well in both *conditional* leader action self-efficacy LGMs where we included LGO and MTL and their interactive effects as predictors of the trajectories. For the leader self-regulatory efficacy LGM conditioned upon LGO, MTL, and their interactive effects, modification indices suggest that model fit could be improved if we correlated the residuals of leader self-regulatory efficacy at Time 2 and Time 3. Finally, for the unconditional leader identity LGM, given that the estimated model only had one degree of freedom, we were unfortunately unable to examine the modification indices to understand sources of misfit.

Although we have investigated potential sources of mis-specification based on the chi-square as recommended by prior scholars (Antonakis, 2017), this model misfit may be less of a concern for at least two reasons. First, some claim that the chi-square is almost always significant when the sample size is greater than 200 (Barrett, 2007; Putnick & Bornstein, 2016), which is the case for the current study ($N = 240$); though we do know from mathematical theory that the chi-square test is more likely to detect an incorrect model and that if the model is correct it will not be rejected asymptotically. Relatedly, because the chi-square is highly sensitive to

sample size (Cheung & Rensvold, 2002; La Du & Tanaka, 1989), relative fit indices (e.g., TLI) and non-centrality-based indices (e.g., CFI and RMSEA) were developed to evaluate model fit. Because each fit index has its own set of assumptions, strengths, and weaknesses, the recommendation in the literature is to report a variety of fit indices and evaluate the totality of evidence. Although comparing ill-fitted models on the basis of the significant chi-square does not indicate good model fit of the poor-fitted model (Ropovik, 2015), we *can* compare model fit of models using other fit indices; we do so in a heuristic way given that these comparisons have no statistical undergirding. Evaluating our models in this light, the focal models presented in the current study fit the data reasonably well, and they were the best-fitting models relative to alternative models.

Promising Future Research Directions. In the current study, we were unable to track participants' subsequent leadership effectiveness after the leadership training program. Existing theory suggests that these individuals should perform better than those who did not participate in such a training program (Lacerenza et al., 2017), and those higher on leader efficacy or leader identity should exhibit better leadership outcomes than those lower on those constructs (Day & Dragoni, 2015). Moreover, it is expected that these individuals will be more likely to engage in future self-development related to leadership (Murphy & Johnson, 2011), perhaps leading to a positive development spiral (e.g., whereby individuals will be more likely to enact their leader self-views, leading to experiences that further strengthen their leader self-views; Day et al., 2009). Future research that tests these predictions would be a fruitful endeavor.

The current study assessed participants' leadership-related self-views after they received feedback on their leadership assessments. Given that the primary goal of this research was to assess the impact of formal leadership training on the development of individuals' leader self-

views, these measurement periods were appropriate (Day et al., 2009). However, leader

development can also occur beyond formal leadership opportunities (McCall Jr., 2010), such as

the informal moments that are sandwiched between formal lessons (Harvard Business School

Executive Education, 2017). As an example, recent theoretical work suggests that through a

process of claiming and granting leadership in social interactions, individuals come to develop

their identities as leaders (DeRue & Ashford, 2010). As such, future research could use

experience sampling methods to investigate changes in or the development of leader self-views

at a more granular level, assessing how these self-views vary as a result of feedback from the

environment (e.g., whether a coworker granted or rejected a claim of leadership).

Finally, another promising research direction would be to compare the effectiveness of

leadership training programs that focus solely on developing leadership skills versus those that

focus on developing leadership skills *and* leader self-views. In the current study, we theorized

and found some support that identity work would be a natural process through which individuals

come to develop a leader identity during formal leadership training (Alvesson & Willmott,

2002). However, prior research on the development of leader identity and leadership skill found

that changes in the leadership skill of consideration led to subsequent changes in leader identity,

but changes to the leadership skill of initiating structure did not significantly relate to subsequent

changes in leader identity (Miscenko et al., 2017). This suggests that changes to leadership skills

do not always lead to changes in leader identity, and interventions that target identity change

specifically may be needed in order to optimize leader identity development. Given the

increasing recognition that some leaders may possess leadership skills, but fail to enact these

skills because they do not necessarily view themselves as leaders (e.g., DeRue & Myers, 2014;

Ibarra, Wittman, Petriglieri, & Day, 2014), participants who go through a leadership training

program that includes both skill- and identity-based interventions may be more effective in leadership roles than individuals who go through a program that is only skill-based.

Conclusion

Despite strong theoretical interest and significant organizational financial spending on formal leadership training programs, little is known about the ways in which leaders develop during these programs. The current research examined whether and how individuals' self-views of leader efficacy and leader identity developed over the course of a formal leadership program (i.e., developmental trajectories), and drew upon contrasting arguments from the developmental readiness and developmental need perspectives regarding how individuals' LGO and MTL would shape this developmental process. Results indicate different developmental trajectories for leader efficacy and identity, suggesting the need for more nuanced theories regarding the unique role each self-view (and perhaps even the specific dimensions of efficacy) plays in leader development. Moreover, results for leader efficacy largely support the developmental need perspective, whereby individuals lower on affective MTL experienced the largest changes to their leader efficacy during leadership training, providing guidance to organizations regarding how to most strategically allocate finite resources to maximize returns on leader development.

CHAPTER 3: TWO SIDES OF THE SAME COIN: THE ENTRAINMENT OF

LEADERSHIP AND TRUST NETWORKS OVER TIME (ESSAY 2)

The following work is currently under review at the *Journal of Applied Psychology*

(Kwok, Redhead, & Brown, *under review*).

Literature Review

"Leadership emergence is the process by which individuals become influential in the

perceptions of others" (Acton, Foti, Lord, & Gladfelter, 2019, p. 145). While emergent leaders

are not prescribed formal leadership authority (De Souza & Klein, 1995), compared to other

groups members, they are conferred more status (Henrich & Gil-White, 2001), exert significant

influence over the group (Taggar, Hackew, & Saha, 1999), and are more effective at facilitating

group performance (Foti & Hauenstein, 2007). Although the core question of leadership

emergence (e.g., why and how do informal leaders emerge?) has changed little over time,

contemporary perspectives have shifted from an individualized view of leadership to leadership

as a relational process (Carter et al., 2015), in which multiple leaders can emerge (Balkundi &

Harrison, 2006) on the basis of their social interactions with other group members (Lord & Dinh,

2014). Accordingly, leadership scholars are now turning to network theory, a set of theorical

frameworks and methodological tools that quantify patterns of relationships, to understand how

leadership arises (Hoppe & Reinelt, 2010). Existing network research on leadership emergence

tends to focus on one of two approaches (Carter et al., 2015). The first considers the impact of

social network ties on leadership emergence, such as actors' centrality in communication (Collier

& Kraut, 2012) and collaboration (Parker & Welch, 2013) networks as predictors of leadership

position attainment. The second approach conceptualizes leadership emergence as a network in

and of itself, and considers antecedents predicting the emergence of leadership networks within

groups, such as trait dominance (Foti & Hauenstein, 2007), general mental ability (Kalish, 2013), and emotional intelligence (Wolff, Pescosolido, & Druskat, 2002).

Notwithstanding these important insights, past network approaches to leadership emergence suffer two key limitations. First, existing research has overemphasized the investigation of the *end state* of leadership emergence (i.e., which individuals are viewed as leaders?) and underemphasized the *processes* through which individuals become leaders (i.e., how do individuals emerge as leaders?) (Acton et al., 2019). Studying emergent leadership as a static outcome of a temporal phenomenon (Day, 2011b; Shamir, 2011) is problematic, as there is a risk of drawing erroneous conclusions about its presumptive stability (Fischer et al., 2017). Indeed, when focus is shifted to exploring *changes* in network relationships over time (i.e., network churn), variability in friendships (Sasovova, Mehra, Borgatti, & Schippers, 2010) and leadership nominations (Day, 2013) can be seen. Second, leadership emergence is a social-relational phenomenon occurring within richly interconnected groups of individuals (Carter et al., 2015). At a dyadic-level, individuals are embedded within many relationships (i.e., multiplexity; Verbrugge, 1979). For example, an actor can be an advisor and a friend (Snijders, Lomi, & Torlo, 2013), and such friendship (Mehra et al., 2009) and advisor relationships (White, Currie, & Lockett, 2016) can serve as the social contexts by which informal leadership arise. Yet, existing research has underscored individual actor characteristics on leadership emergence without accounting for any influence of the relationships amongst actors. Taken together, our picture of the leadership emergence process remains incomplete, and in need of a research approach that simultaneously takes into consideration both its temporal and relational elements.

The current research is situated in a small, but growing body of literature conceptualizing leadership emergence as a network relationship (Carter et al., 2015), and investigates the

multiplexity of leadership emergence over time (Kalish, 2013). Specifically, we examine the role of trust as a relationship that gives rise to informal leadership, and the reciprocal influence of emergent leadership on trust. We derive our hypotheses by drawing upon social exchange theory, which articulates how social interactions can facilitate the exchange of resources and development of relationships (Blau, 1964), and models of social entrainment, which highlight how relationships embedded within each other can co-occur and lead to mutual interdependence (McGrath et al., 1984). In the context of leadership emergence, we argue that trust may be a particularly important relationship to consider for several reasons. First, acknowledging that leadership emergence is a social-relational phenomenon implies that repeated social interactions are an important component of the process (Lord & Dinh, 2014), and trust is at the heart of social exchanges (Holmes, 1981; Levi-Strauss, 1969). Relatedly, trust facilitates relationships that operate on goodwill and mutual obligations (Blau, 1964), and such perceptions are a hallmark of effective leadership (Stogdill & Coons, 1957).

In proposing and testing our hypotheses, the current study makes three important contributions. First, this research adopts a longitudinal lens on leadership emergence, shifting the focus from simply examining *emergent* relationships (i.e., are there emergent leaders within a network?) to understanding the *emergence* of relationships (i.e., what causes leaders to emerge within a network?; Contractor et al., 2006). Using multiplex stochastic actor-oriented models (i.e., SAOMs; Snijders, van de Bunt, & Steglich, 2010), the current study models the dynamic nature of, and tests the multiple mechanisms that may drive, leadership emergence over time. In doing so, we strive to elucidate and test the 'rules' (Acton et al., 2019; Fischer et al., 2017) that explain how this leadership emergence process unfolds.

Second, while leadership is increasingly conceptualized as a social-relational process, it remains unclear how and which relationships amongst group members give rise to leadership emergence (Carter et al., 2015). Leadership emergence can be understood through the lens of repeated social exchanges (Lord & Dinh, 2014) and trust is at the heart of such exchanges (Blau, 1964). Thus, these relationships are interrelated by nature (Van Vugt, 2012) and could conceivably co-occur over time such that there is "mutual interaction among and feedback loops between" these networks (Carter et al., 2015, p. 615). In the current study, we heed calls to draw upon multiple theories (Dinh et al., 2014; Fischer et al., 2017), namely social exchange theory (Blau, 1964) and models of social entrainment (McGrath et al., 1984), to disentangle the relationship between trust and leadership and explore the underlying mechanisms that drive their evolution. In doing so, we explore the multiplexity of (Brass, 2012) and uncover the feedback loops connecting (Carter et al., 2015) informal leadership and other forms of social networks.

Third, the majority of the research on leadership has focused on formal hierarchical structures, wherein leaders are supervisors and followers are subordinates (for review see DeRue, 2011). However, informal leaders can also facilitate group performance (Foti & Hauenstein, 2007), and in certain situations, engage in even more leadership behaviors than formal leaders. For example, in routine (versus crisis) situations, informal leaders are relied upon more heavily for guidance (White, Currie, & Lockett, 2014). Although meta-analytic evidence (Dirks & Ferrin, 2002) and literature reviews (Burke et al., 2007) exist for trust among formal leaders, this body of work has illuminated that trust has yet to be explored as a component of the leadership emergence process. As organizations become increasingly flat, with work frequently being conducted in leaderless groups (Morgeson, DeRue, & Karam, 2010), understanding the informal leadership relationships that manifest within these groups is especially relevant today. Examining

61

the emergence of trust and leadership networks has practical implications for the areas in which organizations should place their efforts to facilitate and develop leadership (Day, 2000).

In the following sections, we discuss the suitability of adopting a social network approach to study leadership emergence, and highlight that extant literature has neglected the dynamic and relational nature of this process. Next, we propose that leadership emergence can be understood from the lens of social exchanges, and the fundamental role that trust has in this process. Subsequently, we draw on models of social entrainment and social exchange theory to develop three hypotheses, whereby trust can facilitate leadership emergence (*Hypothesis 1*), perceptions of leadership can facilitate the development of trust (*Hypothesis 2*), and being trusting of others can facilitate one's own leadership emergence (*Hypothesis 3*).

Leadership Emergence and Networks

Leadership is a perennial topic in the organizational sciences, with research dating over 100 years (Behrendt, Matz, & Goritz, 2017). While a plethora of definitions exist, they center on the idea that leadership is a dynamic social process, in which the interactions that group members have with each other can dictate who emerges as a leader (Lord & Dinh, 2014). Emergent leaders are individuals who possess no formal leadership authority, yet exert substantial influence over other group members (Schneider & Goktepe, 1983; Taggar et al., 1999) and may be just as important as formal leaders in facilitating team success (Stogdill, 1974; White et al., 2014). Traditionally, discussions of leadership emergence have adopted a leader-centric view of the phenomenon, in which a single leader emerges in all situations (White et al., 2016). Yet, such an individualized perspective is inconsistent with the inherent relational nature of leadership (Katz & Kahn, 1978; Shamir, 2011), in which both leaders *and* followers contribute to the leadership emergence process (Northouse, 2004), and multiple informal leaders can emerge within a group

62

(Carson, Tesluk, & Marrone, 2007; Zhang, Waldman, & Wang, 2012). In-line with this relational perspective on leadership emergence, a growing body of research has investigated this process through the lens of social networks (Carter et al., 2015).

According to network theory, a network is comprised of a collection of nodes and a set of ties that represent the pattern of relationships among the nodes (Brass, Galaskiewicz, Greve, & Tsai, 2004; Wasserman & Faust, 1994). Within the scope of interpersonal relationships, the nodes can signify any type of actor, including individuals, teams, and organizations, while the ties can symbolize any type of connection between the actors, including formal role relationships (e.g., employer/employee), social interactions (e.g., friendship), and flows of material and non-material resources (e.g., advice; Contractor et al., 2006). A core premise of network theory is that the nodes simultaneously affect, and are affected by, other nodes' behaviors (Kalish, 2013). Thus, as individuals within a group interact, patterns of relationships will begin to form that are both antecedents and outcomes of social interactions (Marin & Wellman, 2011).

An extensive review of the literature on networks in leadership has identified four characteristics of leadership that make it suitable, if not necessary, to be understood through a network lens (Carter et al., 2015). First, as previously noted, leadership is inherently relational (Katz & Kahn, 1978) and a plethora of leadership definitions emphasize the relational nature of the construct (Carter et al., 2015). Fittingly, social networks quantify the relationships among group members (Hoppe & Reinelt, 2010). Second, leadership is situated in context, such that it is inseparable from the social environment in which it is operating (DeRue & Ashford, 2010; Hogg, 2001). Accordingly, contemporary network approaches, such as SAOMs, can disentangle the relations between various networks, such as leadership and trust (Snijders et al., 2013). Third, leadership is patterned, suggesting that its impact and quality can differ among different dyads

(Graen & Uhl-Bien, 1995). Aptly, social networks not only identify relations between a pair of individuals, but also the patterns of dyadic relationships within the group as a whole (Barnes, 1972). Finally, leadership can involve formal authority or informal influence (French & Raven, 1959). In settings where no formal leadership is prescribed, network approaches allow us to model the informal leadership relationships among group members and to investigate the mechanisms that give rise to these patterns of relationships.

Existing research that adopts network approaches to investigate leadership emergence is problematic for two main reasons. First, existing research has neglected the temporal nature of leadership emergence by focusing on single snapshots of emergent leadership networks (Carter et al., 2015). Exemplary studies in this area have focused on the end-state of such leadership perceptions (Anderson et al., 2008, 2001; Wolff, Pescosolido, & Druskat, 2002), while neglecting the intermediary processes that give rise to emergent leader relationships (Acton et al., 2019). This lack of research is concerning, especially amidst the numerous calls made by scholars to consider the role of time in organizational (Mitchell & James, 2001) and leadership emergence (Day, 2011b; Shamir, 2011) research. By exploring single snapshots of emergent leadership relations, there is an implicit assumption of stability among informal leadership perceptions (Epitropaki, Sy, Martin, Tram-Quon, & Topakas, 2013). Yet, there are theoretical and empirical reasons that challenge this stability assumption.

Theoretically, individuals' behaviors are highly variable (Fleeson, 2001), suggesting that group members may not accurately perceive all possible behaviors of emergent leaders in a single snapshot, necessitating that the process be investigated over time (Day, 2011b). Moreover, since leadership emergence can be conceptualized as a network relationship in and of itself (Carter et al., 2015), and relationships are fundamentally dynamic and unfold over time (Burt &

Knez, 1996), an investigation of leadership emergence must consider the temporal nature of the process. Empirically, research dating back to the early 1960s has found that emergent leaders can vary depending on particular task requirements (Barnlund, 1962), a perspective that has waned from contemporary leadership emergence research. More recent research on changes in network relationships has found that individuals' nominations of friendships change over time, even though group-level characteristics such as the overall connectivity of the network (i.e., density) can appear to be stable (Sasovova et al., 2010). Relatedly, Day (2013) found that participants' leadership nominations in a leadership development program also demonstrated considerable variability over time, with 60 – 70% of leadership nominations being different among participants between consecutive measurement periods.

Second, existing research has primarily focused on identifying the characteristics of emergent leaders, such as Big Five personality (Emery, Calvard, & Pierce, 2013), emotional intelligence (Emery, 2012), and leader role identity (Emery, Daniloski, & Hamby, 2011), and neglected the relational nature of leadership emergence (Katz & Kahn, 1978). In particular, conceptualizing leadership as a relationship implies that the social relationships individuals are embedded within can serve as the context through which informal leadership emerges (Carter et al., 2015). While some research has investigated whether social network relationships, such as communication (Collier & Kraut, 2012) and collaboration (Parker & Welch, 2013) impact the attainment of leadership positions, this research has similarly neglected the dynamic nature of relationships (Snijders et al., 2010).

Social Exchange Theory, Trust, and Leadership Emergence

Taking the perspective that leadership emergence is a dynamic, social-relational process that unfolds over a series of social interactions (Lord & Dinh, 2014), leadership emergence can

be understood through the lens of social exchanges. Social exchange theory conceptualizes social

interactions as an exchange process between a minimum of two individuals, in which each

individual possesses resources that others may find valuable (Levi-Strauss, 1969), such as

instrumental (e.g., advice) and relational (e.g., friendship) support (Blau, 1960). When

individuals interact, an exchange of resources can occur (Molm, 2001). Unlike economic

exchanges, in which contractual obligations dictate how resources will be exchanged (e.g., an

employee accepts a job offer for a specific salary), social exchanges entail "unspecified

obligations…that create diffuse future obligations…and that nature of the return cannot be

bargained" (Blau, 1964, p. 93). To ensure long-lasting relationships, exchange partners must

abide by certain unwritten 'rules' of exchange, which provide guidelines for the exchange

process (Cropanzano & Mitchell, 2005). The norm of reciprocity dictates that when an individual

offers a benefit, the recipient should reciprocate in kind (Gergen, 1969). Once this process is set

in motion, each subsequent interaction can create a self-reinforcing cycle.

At the heart of social exchanges is the development of trust in the relationship (Holmes,

1981; Levi-Strauss, 1969). Trust is defined as "a psychological state comprising the intention to

accept vulnerability based upon positive expectations of the intentions or behavior of another"

(Rousseau, Sitkin, Burt, & Camerer, 1998, p. 395). In the absence of binding agreements such as

contracts, there is an inherent risk within social exchanges, in that an individual's offer of

resources may not be reciprocated (Molm, 2001). Although initially unnerving, uncertainty about

a social partner's willingness to reciprocate can actually *promote* trust (Levi-Strauss, 1969).

Specifically, it serves to highlight circumstances in which social partners could have broken the

unwritten rules of social exchange, but did not. In this way, partners demonstrate that they can be

trusted in future exchanges. Indeed, empirical evidence has supported this claim, whereby

exchanges bound by contractual agreements (i.e., no uncertainty) promoted less trust, relative to exchanges without binding agreements (Molm, Takahashi, & Peterson, 2000). Similar to network theory, in which relationships between group members serve as both antecedents and outcomes of social interactions (Marin & Wellman, 2011), trust is a fundamental component of social exchanges such that over a series of repeated interactions, trust is simultaneously a predictor and consequence of social exchanges (Cropanzano & Mitchell, 2005). We will revisit this point when we consider how trust and leadership can co-occur over time.

In addition to the integral role of trust in leadership emergence from the lens of social exchanges, trust is also important from the perspective of more traditional organizational psychologists. For example, individuals' ability to gain influence in a group is contingent on other group members' perceptions of them and their relationships with each other (Briscoe, Hoobler, & Byle, 2010). An individual who trusts an emergent leader will perceive their relationship to extend beyond a quid pro quo economic exchange to one that operates on goodwill and mutual obligations (Blau, 1964). Such perceptions demonstrate to the individual that the emergent leader has a relational consideration for others (Dirks & Ferrin, 2002), which is a hallmark of effective leadership (Stogdill & Coons, 1957). Therefore, an individual will be more likely to emerge as a leader if they are perceived to be trustworthy (Burke, Sims, Lazzara, & Salas, 2007). Moreover, a cross-cultural examination of leadership traits surveying over 15,000 middle managers from 60 different cultures identified being trustworthy as a universally endorsed aspect of effective leadership (Den Hartog et al., 1999), a finding that suggests an evolutionary basis for the relationship between trust and leadership (Van Vugt, 2012).

While it is important that followers trust their leaders, it is equally critical for leaders to trust their followers. As one individual within a dyad trusts the other individual, the partner also

tends to feel a sense of mutual trust (Sparrowe & Liden, 2005), which enhances the quality of the relationship and effectiveness of the leader (Liden, Sparrowe, & Wayne, 1997). When leaders trust their followers to carry out their assigned tasks, followers are more likely to experience a sense of psychological empowerment, defined as "intrinsic task motivation reflecting a sense of control in relation to one's work and an active orientation to one's work role" (Seibert, Wang, & Courtright, 2011, p. 981), which is associated with effective leadership (Spreitzer, De Janasz, & Quinn, 1999). Taken together, the fundamental role of trust in leadership suggests that trust may serve as the social context through which informal leadership arises.

Social Entrainment, Social Exchange Theory, and Leadership Emergence

In an effort to understand how multiple networks can affect each other's development, we begin our discussion on how relationships develop within a single network. According to conventional network scholars (Boorman & White, 1976; Burt, 1986), the existing social structures and relationships within individuals' networks can facilitate its own development over time. These self-reinforcing mechanisms are termed *endogenous* mechanisms (i.e., within a network; Snijders, 2016), and are based on theories such as preferential attachment (Barabasi & Albert, 1999) and social exchange (Blau, 1964). Preferential attachment describes a "Matthew Effect" (Merton, 1968) or indegree popularity effect (Snijders et al., 2010), which is understood colloquially as, "The rich get richer." Within a given network, individuals who initially receive numerous network nominations (i.e., indegree) may be more likely to receive more nominations over time (Barabasi & Albert, 1999). As described above, according to social exchange theory, the norm of reciprocity dictates that by reciprocating resources offered by another individual, long-lasting relationships and exchanges will emerge between exchange partners (Blau, 1964). Thus, over time, relationships within a given network will likely be reciprocal in nature.

68

While self-reinforcing mechanisms explain how a single network relationship can facilitate its own development over time, leadership emergence is a process that is embedded in other relationships (Carter et al., 2015). This notion that individuals are simultaneously embedded in multiple relationships suggests the possibility of social entrainment, which describes the co-occurrence between two different forms of relationships (Shi & Prescott, 2012). The concept of entrainment is traditionally defined as "the synchronization of the tempo and/or phase of two or more activities within a system" (Pérez-Nordtvedt, Payne, Short, & Kedia, 2008, p. 785). For example, at a biological level, the circadian rhythms and endocrine systems of the human body naturally synchronize and co-occur with external stimuli such as sunlight (Aschoff, 1979; Oatley & Goodwin, 1971). At the organizational level, consumer companies often align their product launches with the holiday season to increase sales performance (Gersick, 1994).

From a network perspective, social entrainment focuses on the extent to which multi-relational networks possess a co-occurring cadence (Rank, Robins, & Pattison, 2010), and has received growing attention amongst leadership emergence scholars. For example, Mehra and colleagues (2009) investigated the coevolution of friendship and leadership, and found that over time, while individuals tend to view friends as emergent leaders, they do not develop friendships with emergent leaders. Relatedly, the extent to which entrainment occurred between these two forms of relationships had a positive impact on team performance (Song, Fang, Wang, & Shi, *in press*). Taken together, this literature suggests that leadership is likely to co-occur with other relationships that group members are embedded within, a process that we argue exists between trust and leadership.

Based on prior work on social entrainment (Pérez-Nordtvedt et al., 2008), we suggest that trust and leadership possess particular qualities that undergird potential entrainment over time.

First, entrainment only occurs when there is temporal change in a system (Ancona & Chong, 1996). Given the dynamic nature of networks such as trust and leadership, we expect entrainment to occur. Second, a system needs to be self-reinforcing (McGrath et al., 1984), such as the aforementioned endogenous mechanisms (e.g., preferential attachment) of network relationships (Snijders et al., 2010). Third, entrainment is a process that occurs over many sequences (Oatley & Goodwin, 1971). Given that leadership can be understood as a process of repeated interactions (DeRue & Ashford, 2010), it follows that entrainment is likely to occur between trust and leadership. Fourth, while physical and biological systems may naturally entrain, social entrainment can be a strategic choice taken by the actor (Fraisse, 1963). Since trust predicts and is an outcome of effective social exchanges (Cropanzano & Mitchell, 2005), and individuals are more likely to follow those they trust (Burke et al., 2007), it appears to be more strategically advantageous for an actor to nominate emergent leaders based on who they perceive as trustworthy.

From the notion that trust predicts social exchanges (Cropanzano & Mitchell, 2005), we propose that trust is an antecedent of leadership emergence over time. When individuals engage in social exchanges, the provision of resources such as advice and friendship (Blau, 1960) are expected to engender trust from others (Burke et al., 2007), and the exchange of such resources are often associated with effective leadership (Bass, 1985; Judge et al., 2004). As individuals continue to interact, the perceptions of trust will continue to develop and facilitate future social interactions (Cropanzano & Mitchell, 2005), which in turn will enable further sharing of resources and perceptions of leadership to emerge. Through repeated interactions over time, the perceptions of trust will strengthen and further reinforce the impressions that are formed between

group members (Burt & Knez, 1996). Thus, over time, an individual who is trusted will increasingly be seen as an emergent leader.

Hypothesis 1: An individual who is initially perceived by a peer as trustworthy will, over time, be perceived by that peer as an emergent leader (i.e., if person i initially trusts person j, over time, person i will come to view person j as a leader).

From the notion that trust is an outcome of social exchanges (Cropanzano & Mitchell, 2005), we propose that emergent leadership is an antecedent of the development of trust over time. In the context of emergent leadership, individuals can form perceptions of leaders fairly quickly (Bales, 1950; Ridgeway, 2001). Once this emergent leader perception forms, individuals will be more likely to observe and interact with the emergent leader through this lens (Hansbrough, Lord, & Schyns, 2015). For example, through attribution-based processing, which involves backward reasoning from an outcome (Lord & Maher, 1991), individuals may deduce that a cause of the emergent leader perception is due to effective leadership stemming from the emergent leader, such as being trustworthy (Den Hartog et al., 1999). Moreover, individuals tend to gravitate towards and interact with those who they perceive to have higher status (e.g., emergent leaders, Henrich & Gil-White, 2001), which can facilitate further development of trust. While we expect individuals' leadership perceptions to fluctuate, repeated interactions over time often increase the strength of the perceptions and further reinforce the impressions that are formed between group members (Burt & Knez, 1996). Thus, over time, an individual perceived to be an emergent leader will increasingly be seen as trustworthy.

Hypothesis 2: An individual who is initially perceived by a peer as a leader will, over time, be perceived by that peer as trustworthy (i.e., if person i initially views person j as a leader, over time, person i will come to trust person j).

71

Until this point, we have emphasized that being perceived as trustworthy will predict leadership emergence over time. However, we also argue that being *trusting* of others can also facilitate leadership emergence. According to social exchange theory, individuals will generally develop a sense of trust in their social partners as their behaviors become more predictable. In this vein, an exchange partner may demonstrate trustworthiness by reciprocating an exchange despite having the opportunity not to return the favor. Thus, trust within the dyad becomes reinforced (Cook & Rice, 2006). Within the context of leadership, leaders who engage in behaviors that engender follower trust have been shown to develop a mutual trust toward followers over time (Sparrowe & Liden, 2005). Despite power and status differences across leaders and followers within a group, this mutual trust must exist in order for the group to function well. For example, followers must have confidence in the manner in which their leaders exert power (e.g., fairness; Chughtai, Byrne, & Flood, 2015), and those who do will reinforce their leaders' authority (Burke et al., 2007). Leaders must also demonstrate trust in their followers' ability to carry out tasks. In this way, when followers feel trusted by leaders, they experience psychological empowerment (Seibert et al., 2011), which is a critical aspect of effective leadership (Liden, Wayne, Zhao, & Henderson, 2008; Peterson, Galvin, & Lange, 2012). Thus, we suggest that an individual who is trusting of others can facilitate their own leadership emergence over time (Lau & Liden, 2008).

Hypothesis 3: An individual who initially perceives a peer as trustworthy will, over time, be perceived by that peer as an emergent leader (i.e., if person i initially trusts person j, over time, person j will come to view person i as a leader).

In summary, given the dynamic and social-relational nature of leadership emergence, we propose that the study of leadership emergence necessitates an approach that considers its

temporal and relational components. Taking the perspective that leadership emergence unfolds over a series of interactions, this process can be understood through the lens of social exchanges. At the heart of social exchanges is the development of trust, therefore we consider the impact of trust on leadership emergence. Drawing upon models of social entrainment and social exchange theory, we hypothesize that over time, trust can facilitate leadership emergence (*Hypothesis 1*), emergent leadership can facilitate the development of trust (*Hypothesis 2*), and being trusting of others can facilitate one's own leadership emergence (*Hypothesis 3*).

Method

Participants and Procedures

The primary goals of the research were to propose and test the entrainment (i.e., co-occurrence) of trust and leadership networks over time. As a form a purposive sampling (Neuman, 2015), which is defined as the choice of a sample for a specific purpose in mind, we required a study sample and setting that met specific criteria: a) individuals must be on equal-standing such that no formal leaders were prescribed, b) group members must interact on a frequent and consistent basis in order to accurately observe and be influenced by each other's behaviors, c) the groups must not have pre-existing relationships prior to the study, and d) leadership (as broadly defined/understood) needed to be salient. With these considerations in mind, we conducted our study with cadets in the Royal Canadian Air Program undertaking a summer training course for leadership development. The cadet program is a governmental not-for-profit program intended to foster in youth the development of leadership and citizenship.

The participants ($N = 123$, 61% male, $M_{age} = 15.43$, $SD_{age} = 0.93$) formed six randomly assigned mixed-gender groups, which ranged in size from 12 to 25 cadets ($M = 20.50$, $SD = 4.81$), and they remained in these groups for the entire duration of the training course (i.e.,

classroom instruction, meals, and sleeping quarters). The rigorous six-week summer training course was designed to prepare participants to become leaders of the cadet program in their local units. The cadets were taught a range of skills, including instructional techniques for classroom and drill (i.e., marching) lessons, and leadership skills, such as establishing standards and fostering teamwork when accomplishing tasks. Once skills training was delivered, cadets were given assessments and feedback associated with those skills. Since the cadets' performance in the course informed promotions and selection for other training opportunities offered by the cadet program, there was a strong motivation to do well.

Prior to the beginning of the training, all parents of the cadets were notified about the study. At the beginning of the training course, the cadets were informed that the research team was interested in the development of leadership over time. The research team emphasized that participation in the study was voluntary and highlighted that data collection would not interfere with scheduled training. All data were collected using paper-and-pencil surveys. The initial networks were collected at week 2 (Time 1) of the course to provide cadets the opportunity to interact and form initial connections. Subsequent networks were collected at week 4 (Time 2), after cadets worked together to prepare for their initial set of assessments, and at week 6 (Time 3), which marked the completion of the assessment portion of the training program.

Measures[9]

At each time point (i.e., week 2, week 4, week 6), directed networks were captured through a roster design, in which all participants were presented with a list of names of all other

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[9] See Appendix G for complete measure items, instructions, and response scales.

cadets in their group (Marsden, 1990) and were asked to rate each cadet on the network

relationships below.

Leadership network. The leadership network was operationalized as influence (Carter et

al., 2015). Participants were asked to respond to the following question on a five-point Likert

scale, ranging from 1 ('*very little influence*') to 5 ('*a great deal of influence*'): "How much

influence does this person have in your group?". The peer ratings of influence were

dichotomized such that scores equal to or greater than four were coded as one, and scores equal

to or less than three were coded as zero (Porath, Gerbasi, & Schorch, 2015; Ripley, Snijders,

Boda, Voros, & Preciado, 2019).[10]

Trust network. Participants were asked to respond to the following question on a five-

point Likert scale, ranging from 1 (*'very little'*) to 5 (*'very much'*): "To what extent do you find

this person trustworthy?" (Lord, Foti, & De Vader, 1984). As above, the peer ratings of trust

were dichotomized such that scores equal to or greater than four were coded as one, and scores

equal to or less than three were coded as zero (Porath et al., 2015; Ripley et al., 2019).

Analytical Strategy: Stochastic Actor-Oriented Models

Networks are inherently non-independent (Contractor et al., 2006). Since nodes in a

network simultaneously affect, and are affected by, other nodes (Kalish, 2013), and the ways in

which a network was previously connected will affect how it is subsequently connected (Snijders

et al., 2010), traditional statistical methods that assume data are independently and identically

distributed (i.i.d.) are inappropriate for longitudinal network data (Snijders, 2016). Therefore, we

leverage SAOMs (Snijders, 2001), a new class of models designed for longitudinal networks that

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[10] It is a prerequisite of the analytical method (described below) used to test our hypotheses to dichotomize the
network data (Ripley et al., 2019).

do not make assumptions of i.i.d., to analyze our data, using RSiena software in R (i.e.,

Simulation Investigation for Empirical Network Analysis; Ripley et al., 2019).

When network data are collected, the ways in which the nodes are connected are one such

configuration among many possibilities (Contractor et al., 2006). For example, even a network

with six actors has over one million different configurations (Steglich, Snijders, & West, 2006).

The total set of possible network configurations is termed the *sample space* (Wasserman &

Faust, 1994). The changes in network connections from one configuration to the next are

connected by an aggregate of many individual tie changes, which are assumed to be actor-driven

and hence the term *actor-oriented* within SAOMs (Snijders et al., 2010). Using the first

observation as a starting point for estimation, SAOMs answer the question, "What effects or

tendencies cause the connections within a network to change over time?" (Kalish, 2013). By

hypothesizing and testing the effects that explain how a network's connections change, SAOMs

identify the network configurations that are more probable within the sample space; this logic is

analogous to statistical inferences regarding individuals, except in the case of networks,

researchers are interested in the distribution of network configurations as opposed to individual

scores (Contractor et al., 2006).

The extent to which the effects explain how a network's connections have changed over

time is captured by the parameters in the model. The output of SAOMs is a set of parameters

(i.e., log-odds) and standard errors associated with the effects that explain how the initial

network changed over time. These estimates can be interpreted in a similar way as regression

coefficients; the parameters represent the unique impact of each effect in explaining the changes

to the network, controlling for all other effects in the equation. A parameter is statistically

significant if its *t*-value is 1.96 times greater than its standard error (Snijders et al., 2010). For

example, if there is a significant positive effect of trust on the emergence of leadership, this indicates that there is a higher probability for actors within the network to nominate leaders whom they trust. For a more detailed description of SAOMs, see Appendix H, and for more technical descriptions of SAOMs, readers are referred to work by Snijders and colleagues (e.g., Ripley et al., 2019; Snijders, 2016; Snijders et al., 2013, 2010).

For the current study, a multiplex SAOM (Snijders et al., 2013; Snijders, Steglich, & Schweinberger, 2007) was specified to simultaneously assess how the trust and leadership networks co-occurred over time. In line with existing theory and research on network dynamics, we controlled for several endogenous effects that predict the development of network relationships over time: *outdegree* (i.e., the tendency to send outgoing nominations, such as of emergent leaders), *reciprocity*, *transitivity* (i.e., the tendency for one tie to form between three individuals if two ties already exist, such as developing a perception of trust that converges with those who you already trust), *indegree popularity*, and *outdegree activity* (i.e., the tendency for individuals who initially send many outgoing nominations to send more nominations over time) (Snijders et al., 2010). As there were no substantial differences in estimation between groups, peer nominations of leadership and trust across the six groups were combined and analyzed as a single group and it was specified that relationships between groups could not exist (i.e., structural zeros; Ripley et al., 2019). There was a relatively small fraction (1%) of missing data at each time point, which was accounted for by using the last observation carry forward method (i.e., LOCF; Lepkowski, 1989). The LOCF method provides more reliable parameter estimates and standard errors compared to complete-case analyses or other imputation methods for handling missing data (see Huisman & Steglich, 2008). Our model achieved convergence

(maximum convergence ratio < 0.25 and all parameter convergence *t*-ratios < 0.10) and

demonstrated good fit to the data (Lospinoso, Schweinberger, & Snijders, 2012).[11]

Results

Descriptive statistics for the leadership and trust networks are shown in Table 8. On

average, throughout the study, participants nominated eight emergent leaders and ten individuals

whom they trusted (i.e., average tie nomination). As indicated by the Jaccard coefficient, which

assesses the degree of similarity between successively measured networks, there was variability

in participants' leadership and trust nominations over time, as 39 – 50% of leadership, and 47 –

57% of trust, nominations were different across measurement periods. The increasing density

(i.e., the number of ties relative to the total number of possible ties) of influence (0.06 – 0.07)

and trust (0.07 – 0.09) networks indicate that nominations gradually increased throughout the

study. Table 9 outlines the normalized indegree and bivariate correlations of the networks. There

were positive and significant correlations between the leadership and trust network indegrees (*r*

= .33 – .67, *p* < .01). Thus, initial descriptive results suggest that both networks developed over

time and that these networks were positively associated. Graphical representations, mathematical

expressions, and detailed descriptions of each effect in the full multiplex model are provided in

Table 10. Results for the multiplex SAOM are presented in Table 11.

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[11] We controlled for individuals' overall performance (Leary et al., 2014), Big Five personality traits (Selfhout et al., 2010), and gender and ethnicity homophily (McPherson et al., 2001), as previous research has shown these attributes can predict network development over time (see Appendix I). However, the pattern of results do not change in any substantive way when these attributes are not included as control variables.

Table 8
Descriptive Statistics for the Leadership and Trust Networks

	Leadership Network			Trust Network		
	T_1	T_2	T_3	T_1	T_2	T_3
Density	0.06	0.07	0.07	0.07	0.08	0.09
Average tie nomination	6.65	8.55	8.77	8.27	9.90	10.44
Asymmetrical ties	966	1100	1064	880	952	894
Mutual ties	280	454	448	516	692	736
Missing fraction of ties	0.01	0.01	0.01	0.01	0.01	0.01
Jaccard coefficient		.39	.50		.47	.57

Note. T_1 = Time 1, T_2 = Time 2, T_3 = Time 3. N = 123

Table 9
Network Indegree Descriptive Statistics and Correlations

Variables	M	SD	1	2	3	4	5	6
1. Influence indegree T1	0.32	0.20	-					
2. Influence indegree T2	0.39	0.20	.62	-				
3. Influence indegree T3	0.41	0.21	.49	.66	-			
4. Trust indegree T1	0.39	0.17	.58	.55	.44	-		
5. Trust indegree T2	0.46	0.19	.35	.65	.45	.61	-	
6. Trust indegree T3	0.48	0.19	.33	.60	.67	.51	.67	-

Note. Indegree statistics are normalized. T1 = Time 1, T2 = Time 2, T3 = Time 3.
All correlations are significant at the *p* < .01 level

Table 10

RSiena Effects Included in the Full Multiplex Model

Effect	Mathematical Expression	Graphical Expression		Interpretation
		Configuration at time t	Configuration at time $t+1$	

Endogenous Network Effects

| Outdegree | $\sum_j x_{ij}$ | | | The average tendency for actors to create outgoing ties to random alters. |

| Reciprocity | $\sum_j x_{ij} x_{ji}$ | | | The average tendency for actors to reciprocate ties. |

| Transitivity (GWESP) | $\sum_{k=1}^{n-2} x_{ij}\, e^{\alpha}\{1-(1-e^{-\alpha})\sum_{h=1}^{n} x_{ih} x_{hj}\}$ | | | The average tendency for network closure. |

| Indegree popularity | $\sum_j x_{ij} \sqrt{\sum_h x_{hj}}$ | | | The average tendency for actors to attract greater incoming ties from alters due to their high current indegree ties. |

| Outdegree activity | $x_{i+}\sqrt{x_{i+}}$ | | | The average tendency for actors to create outdegree ties due to their high current outdegree ties. |

Cross-Network Effects

| Mixed direct association | $\sum_j x_{ij}\, w_{ij}$ | | | The effect of creating a tie with an actor in network (W) on forming a tie with that actor in network (X). |

| Mixed reciprocation | $\sum_j x_{ij}\, w_{ji}$ | | | The effect of creating a tie with an actor in network (W) on reciprocating a tie with that actor in network (X). |

Note. Solid line denotes initial tie and dashed line denotes emerging tie.

[a] The degrees of network (W) are centered to reduce the correlation between these effects and the degree effects of network (X).

Table 11

Results for the Leadership and Trust Multiplex Model

Parameter	Leadership Network			Trust Network		
	Estimate (β)	SE	OR	Estimate (β)	SE	OR
Rate T_1-T_2	14.56***	0.98	-	13.97***	0.93	-
Rate T_2-T_3	11.31***	0.72	-	10.93***	0.67	-
Endogenous Network Effects						
Outdegree	-2.06***	0.20	0.13	-1.92***	0.12	0.15
Reciprocity	-0.28**	0.08	0.76	0.18*	0.08	1.20
Transitivity (GWESP)	0.12	0.24	1.12	0.69***	0.17	1.99
Indegree popularity	0.29**	0.10	1.34	0.01	0.06	1.01
Outdegree activity	0.13*	0.07	1.14	0.10*	0.04	1.11
Cross-Network Effects						
Mixed direct association						
H1: Trust on leadership	0.70***	0.10	2.01	-	-	-
H2: Leadership on trust	-	-	-	0.62***	0.11	1.86
Mixed reciprocation						
H3: Trust with leadership	0.28**	0.11	1.33	-	-	-
Leadership with trust	-	-	-	0.15	0.12	1.16

Note. $N = 123$. OR = odds ratio.

* $p < .05$ ** $p < .01$ *** $p < .001$

Before presenting our hypothesized cross-network effects, we first present the endogenous effects that drive the development of the trust and leadership networks over time. As expected, there was a significant negative outdegree for both the leadership (β = -2.06, SE = 0.20, $p < 0.001$, OR = 0.13) and trust (β = -1.92, SE = 0.12, $p < 0.001$, OR = 0.15) network, which indicates that individuals were increasingly selective about who they nominated as emergent leaders or trustworthy (i.e., nominating individuals on the basis of no information about other network relationships). Whereas emergent leader relationships were less likely to be reciprocal over time (β = -0.28, SE = 0.08, $p < 0.01$, OR = 0.76), trust relationships were more likely to be reciprocal over time (β = 0.18, SE = 0.08, $p < 0.05$, OR = 1.20). While the leadership network did not display transitivity over time (β = 0.12, SE = 0.24, $p > 0.05$, OR = 1.12), which suggests that over time, group members' perceptions of emergent leaders did not necessarily converge with those who they perceived to be emergent leaders themselves, the trust network did display transitivity over time (β = 0.69, SE = 0.17, $p < 0.001$, OR = 1.99), which suggests that over time, group members' perceptions of trust converged with those who they perceived to be trustworthy. While there was a significant positive indegree popularity effect for the leadership network (β = 0.29, SE = 0.10, $p < 0.01$, OR = 1.34), which indicates that individuals who initially received more emergent leader nominations were more likely to receive more emergent leader nominations over time, there was a nonsignificant indegree popularity effect for the trust network (β = 0.01, SE = 0.06, $p > 0.05$, OR = 1.01), which indicates that individuals who initially received more trust nominations were not necessarily more likely to receive more trust nominations over time. Finally, there was a significant positive outdegree activity effect for both the leadership (β = 0.13, SE = 0.07, $p < 0.05$, OR = 1.14) and trust network (β = 0.10, SE = 0.04, $p < 0.05$, OR = 1.11), which indicates that individuals who initially nominated more emergent

leaders and trustworthy group members were more likely to nominate more individuals as emergent leaders and trustworthy over time.

Having presented the self-reinforcing mechanisms of network relationships over time, we now turn to our hypothesized cross-network effects. *Hypothesis 1* predicted that individuals who are initially perceived as trustworthy will, over time, be perceived as emergent leaders. Finding support for Hypothesis 1, there was a significant direct association effect of the trust network on leadership emergence over time ($\beta = 0.70$, $SE = 0.10$, $p < 0.001$, $OR = 2.01$), which suggests that if person i initially perceived person j to be trustworthy, over time, person i was more likely to view person j as a leader. Thus, we find support that trust facilitates the emergence of informal leadership over time. *Hypothesis 2* predicted that individuals who are initially perceived as leaders will, over time, be perceived as trustworthy. Finding support for Hypothesis 2*,* there was a significant direct association effect of the leadership network on the trust network ($\beta = 0.62$, $SE = 0.11$, $p < 0.001$, $OR = 1.86$), which suggests that if person i initially viewed person j as a leader, over time, person i was more likely to come to trust person j. Thus, we find support that emergent leadership facilitates the development of trust over time. *Hypothesis 3* predicted that individuals who are trusting of others will, over time, be perceived as emergent leaders. Finding support for Hypothesis 3, there was a significant mixed reciprocation effect for the trust network on the leadership network ($\beta = 0.28$, $SE = 0.11$, $p < 0.01$, $OR = 1.33$), which suggests that if person i initially trusted person j, over time, person j was more likely to view person i as a leader. Thus, we find support that being trusting of others facilitates one's own leadership emergence over time.

Discussion

While the process of leadership emergence is inherently dynamic, extant research has focused primarily on the end state of leadership emergence, thus limiting our understanding of how leaders emerge in groups (Acton et al., 2019). Moreover, despite its relational nature, existing research has paid disproportionate attention on individual traits, neglecting the impact that other social relationships themselves can have on emergent leadership (Mehra et al., 2009). In the current study, we addressed these two gaps in the literature by investigating whether and how trust facilitates leadership emergence over time. We focus specifically on trust because leadership emergence can be understood as a process that unfolds over a series of interactions between group members (Lord & Dinh, 2014), and at the heart of such social exchanges is the development of trust (Holmes, 1981). Drawing upon models of social entrainment (McGrath et al., 1984) and social exchange theory (Blau, 1964), we argue that trust and leadership will simultaneously impact each other's development over time. Specifically, we suggest that over time, individuals who are perceived as trustworthy will emerge as leaders, individuals who are perceived as emergent leaders will become trustworthy, and being trusting of others will facilitate individuals' own leadership emergence.

Results from the SAOM indicate that trust facilitated the emergence of leadership over time. Specifically, if person i initially perceived person j as trustworthy, over time, person i will also come to view person j as a leader. As hypothesized, this effect also occurred in the opposite direction; if person i initially perceived person j as a leader, over time, person i will also view person j as trustworthy. Finally, results also indicate that being trusting of others facilitated one's own leadership emergence, such that if person i initially trusts person j, over time, person j will perceive person i as a leader. Notably, this pattern of results remained consistent even when

84

controlling for the self-reinforcing endogenous mechanisms that drive the development of networks over time and the impact of other relevant individual characteristics.

Theoretical Implications

Theoretically, our study contributes to leadership emergence research in several ways. First, the current study contributes to the relatively limited longitudinal studies on leadership emergence (Day, 2011b; Shamir, 2011). Leadership emergence inherently unfolds over time, yet existing research primarily focuses on the end state of the leadership emergence process (Acton et al., 2019). Although time in and of itself does not explain why constructs change, researchers must consider the role of time to understand how dynamic processes unfold (Ployhart & Vandenberg, 2010). Previous research suggests that leadership hierarchies tend to be stable over time (Magee & Galinsky, 2008), yet this is inconsistent with empirical results in the current study and other research (Day, 2013). This pattern of apparent stability may be due to the relatively short timeframes on which previous research has focused. For example, prior leadership emergence research often involves participants interacting in a leaderless group activity, after which they are asked to nominate who they believe to have had influence over the group (Guastello, 2007). Given the variability of individuals' behaviors (Fleeson, 2001), such brief timeframes do not provide an accurate picture of how informal leadership emerges in more naturalistic settings. In the current study, we assessed our initial leadership network one week after the participants began their training in order to provide them with the opportunity to develop initial relationships amongst each other. Yet, despite the formation of these initial relationships, there was still significant variability within the emergent leader relationships over time, thus calling into question their implied stability within groups (Epitropaki et al., 2013). As

a result, it is both theoretically and empirically important to consider the role of time when studying the process of leadership emergence (Fischer et al., 2017).

Second, leadership emergence is understood as a social-relational process, whereby the relationships that individuals are embedded within can give rise to informal leadership (Carter et al., 2015). Yet, prior research has overemphasized personological-based determinants, such as the characteristics of individuals, and neglected the relational-mechanisms that facilitate the emergence of informal leadership (Acton et al., 2019). Despite calls for research to consider the entrainment or co-occurrence of leadership and other social networks (Carter et al., 2015), there still remains a paucity of research attention. In the current study, we adopted a social exchange perspective to understand whether and how trust impacted leadership emergence over time. Finding support for our hypotheses, such that trust and leadership simultaneously affected each other's development over time, we contribute to a small but growing literature that emphasizes the multiplexity of informal leadership influence (Mehra et al., 2009; Song et al., *in press*; White et al., 2016). In particular, the result that individuals being trusting of others can facilitate their own leadership emergence over time highlights the positive effects of empowered group members (Seibert et al., 2011). The majority of research on trust in leadership primarily focuses on the perspective that followers need to trust their leaders (e.g., Badawy, Gazdag, Brouer, & Treadway, 2019; Peng & Dongkyu, *in press*). Yet, results from the current study highlight an equally important perspective that leaders need to trust their followers, not only to contribute to the psychological empowerment of their followers, but also to facilitate or reinforce their own leadership emergence in groups.

Interestingly, while our pattern of results remained similar when controlling for the impact of theoretically-relevant individual characteristics on leadership emergence, a closer

examination of the results indicate that Big Five personality was not a significant predictor of leadership emergence (see Appendix I). While this may be unexpected, we argue that these non-significant effects can be understood through the lens of situational strength, a concept that refers to the environmental influences that dictate the desirability of individuals' behaviors (Snyder & Ickes, 1985). Whereas strong situations describe circumstances in which rules dictate how individuals should behave, leaving less variance for the impact of individual traits, weak situations describe circumstances in which there is less structure with respect to appropriate behaviors, thus providing more flexibility for individual characteristics to influence behavior (Meyer, Dalal, & Hermida, 2010). Given the military-based training environment, we argue that the current study context can be conceptualized as a strong situation, whereby participants' behaviors were largely dictated by the rules of the training program. As a result, informal leadership emergence in the current study appear to be driven by the relational contexts that group members are embedded within as opposed to the impact of individual traits. This pattern of results highlights a potential boundary condition of the effect of individual characteristics, and the importance of considering the simultaneous impact of traits and situational characteristics (e.g., relationships; Reis, 2009), on leadership emergence (Mischel, 1968).

In a similar vein, prior research that has not taken into consideration the dynamic and social-relational nature of leadership emergence overlooks the intermediary processes or 'rules' that give rise to emergent leadership (Acton et al., 2019). More specifically, network approaches to leadership emergence necessitates that we consider the endogenous mechanisms that drive the development of networks over time. Yet, most psychological research on leadership emergence underemphasizes the impact of such mechanisms (Carter et al., 2015). By adopting a longitudinal lens on leadership emergence and employing recent advances in SAOMs, we find that over time,

emergent leader relations were less likely to be reciprocal, yet individuals who both initially received and sent more leader nominations were more likely to receive and send leader nominations. While such mechanisms were not the focus of the current study, it is theoretically important to consider how the endogenous and cross-network effects, and the effect of individual characteristics, concurrently constrain and enable each other's impact on leadership emergence (Carter et al., 2015; Kalish, 2013).

Practical Implications

Drawing on the distinction made by Day (2000) between *leader* and *leadership* development, the results from the current study have practical implications for how organizations can facilitate the emergence of informal leaders. *Leader* development focuses on competency training and skill building on an individual level. Therefore, organizations might design interventions targeted at promoting employee behaviors that engender trust from coworkers, such as those that demonstrate ability, benevolence, or integrity (Mayer, Davis, & Schoorman, 1995). As individuals engage in these trust-cuing behaviors, the results of this study suggest that they would be more likely to emerge as leaders within their group. Moreover, interventions targeted at developing an individual's identity as a leader can also facilitate leadership emergence. Leader identity theory suggests that the extent to which an individual will continue to engage in leadership behaviors and be motivated to practice and develop leadership skills depends on his or her level of self-identification as a leader (Day et al., 2009). For example, if two individuals are similarly trained to engage in leadership behaviors that engender trust, the one who has a stronger leader role identity is more likely to persist in their leadership behaviors over time (Lord & Hall, 2005). This is particularly important when faced with obstacles or setbacks associated with one's leadership performance (Day et al., 2009). Since an individual can self-identify as a

leader in different domains (e.g., being a leader on a sports team and being a leader in a research lab), the more an individual has an overall leader role identity, the more likely it is that they will recognize opportunities to practice leadership skills (Hammond et al., 2017).

Leadership development, on the other hand, is a relational process in which the development of mutual trust, respect, and common responsibility to the organization is emphasized across multiple individuals (e.g., a group of individuals in a self-managed team) (Dalakoura, 2010). Management might elect to establish policies and procedures targeted at broader organizational-level processes (Burke & Litwin, 1992) that promote team-based, collaborative work. Given that our results suggest individuals who trust others are likely to emerge as leaders over time, policies that establish collaborative work as a fundamental component of the organizational culture can facilitate the development of mutual trust (Sparrowe & Liden, 2005). As our results dictate, mutual trust might be the catalyst that promotes the emergence of leaders within the group in more than one way. For example, as group members collaborate and work together to complete tasks and projects, individuals who are trustworthy in the eyes of other group members will emerge as leaders. Importantly, as group members increasingly trust others, they will also likely be viewed as emergent leaders themselves. Once an entire team begins to establish perceptions of mutual trust, such relationships can support work the group will complete in the future. Group-based approaches to leadership development can also improve communication within the group, foster mutual accountability of group members, and facilitate the awareness of each group members' accountabilities (Berchelmann, n.d.). Importantly, there is a positive impact on team performance in group contexts where multiple informal leaders emerge (Carson et al., 2007; Zhang et al., 2012).

Strengths, Limitations, and Future Directions

The current study used stochastic actor-oriented models (SAOMs; Snijders et al., 2010) to test the hypotheses, which provides at least two notable strengths. First, there is a growing body of research among network scholars that argues the development of network relationships over time is the function of both the existing connections *within* a network and the connections *between* networks (Contractor et al., 2006; Kalish, 2013; Monge & Contractor, 2003). Existing network approaches to leadership have not only focused primarily on cross-sectional snapshots of networks—thus failing to model the temporal and dynamic nature of such networks—but this body of research has also neglected the cross-network effects that drive the development of network relationships. Second, although one may be tempted to analyze the longitudinal social network data used in the current study with different methods, such as with repeated measures ANOVA or hierarchical linear modeling (Raudenbush & Bryk, 2002), these conventional statistical methods are inappropriate for assessing longitudinal network data (Snijders, 2016). Typical statistical methods within psychology operate on the assumption that observations are independently and identically distributed (i.i.d.), yet network relationships are inherently non-independent (Carter et al., 2015). In response to this limitation of conventional methods, SAOMs are a statistical tool that does not make assumptions of i.i.d. and allows for a more holistic test of the theoretically-relevant mechanisms that impact the development of networks. By employing SAOMs in the current study, we expand upon prior leadership network research that was limited by methodological determinism (Monge, 1990) or the 'law of the hammer' (Kaplan, 1964), in which the available methodological tools impacted researchers' ability to accurately and holistically investigate the process leadership emergence.

The present design and context also provided important strengths to test our research questions as they met several criteria: 1) the individuals in these groups must not have formal leadership authority, 2) the individuals must interact in groups frequently and consistently enough to be able to make accurate judgments about each other's behaviors, 3) the relationships between group members are still developing (i.e., leadership structures have not matured or stabilized), and 4) the study setting must emphasize leadership. The summer cadet sample was chosen as a form of purposive sampling (Neuman, 2015), which is defined as the choice of a sample for a specific purpose in mind, because it met all the aforementioned criteria. By sampling within this setting, the current research was able to assess the longitudinal nature of leadership and trust networks. A further strength of this study was the use of multi-source ratings for the variables of interest. Given that the network variables were aggregated peer nominations, the likelihood of common-method bias affecting our results is greatly diminished (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

The current research used a mid-to-late adolescent sample to answer the research question of whether leadership and trust networks co-occurred. Although it may be viewed as a limitation by some to use an adolescent population rather than an adult sample in an organizational setting, it must be highlighted that it was appropriate to use this particular sample to investigate our research question. First, because our primary goal was to test the *theoretical* question of how leadership and other social networks develop over time, the present findings should generalize to other research samples where the processes of social entrainment and social exchange are also expected to occur (Highhouse & Gillespie, 2008). Second, although it may appear that face validity is a concern with the current sample, previous research has found that conceptualizations of leaders, social status, and leader behaviors bear similarity between

91

children, adolescents, and adults (Redhead, Cheng, & O'Gorman, 2018a; Schyns, Kiefer, Kerschreiter, & Tymon, 2011). Additionally, as social beings, affiliation and social belongingness are fundamental human motives (Anderson, Hildreth, & Howland, 2015; Baumeister, Zhang, & Vohs, 2004; Deci & Ryan, 2008) and discrepancies in status between peers are present at all stages of life and between cultures (Leavitt, 2005; Redhead et al., 2018b).

There are limitations to using single-item questions to measure our leadership and trust networks, such as the inability to assess the internal reliability of the network measures. However, it is the norm for social networks to be constructed through single-item questions (Marsden, 2011). Although multiple-item scales are preferred, having each participant rate each person on more than one item would likely induce fatigue and careless responding. In support of this view, Wanous, Reichers, and Hudy (1997) argue that single-item measures are acceptable if the content or domain of the item is straightforward and clear to respondents, and situational constraints limit the use of a multi-item scale. Indeed, prior work has suggested that individuals have an implicit understanding of both trust (Murray et al., 2011) and leadership (Ridgeway, 2001). As such, in considering feasibility, we remained consistent with prior work in the networks literature while acknowledging that there are limitations to using single-item measures.

The current study hypothesized and found support for the co-occurring nature of trust and leadership over time. According to models of social entrainment, this process of mutual entrainment can have a positive impact on performance through coordination and collaboration between individuals (Lazega & Pattison, 1999). Indeed, this line of thinking has begun to emerge in organizational research. For example, Song et al. (*in press*) found that top management teams with greater leadership ties that were entrained with friendship ties performed better than teams with less entrained leadership and friendship ties. Thus, it may be fruitful for future research to

92

consider the degree of entrainment between trust and leadership ties on group performance. It may also be worthwhile for future research to consider how other types of leadership behaviors that have been shown to be associated with leadership effectiveness facilitate leadership emergence. For example, how might positive leadership behaviors, such as leader self-sacrifice (van Knippenberg & van Knippenberg, 2005), or negative behaviors, such as abusive supervision (Tepper, 2000), impact the development of informal leadership relationships on an ongoing basis? By employing SAOMs to answer these research questions, one can test competing predictions of whether leader self-sacrifice or abusive supervision impacts leadership emergence, or whether informal leadership influence impacts the extent to which emergent leaders are self-sacrificial or abusive. Adopting a trait-based perspective, how might various individual characteristics differentially predict initial versus sustained leadership emergence? For example, although gender might predict initial leadership emergence (Eagly & Karau, 2002), over time, more substantive traits such as intelligence (Kalish & Luria, 2016) may predict more sustained leadership emergence.

Conclusion

Despite the inherent dynamic and relational nature of leadership, few studies have explored the relational bases by which leadership can emerge over time. The current study aimed to contribute to what many scholars consider as the frontier of leadership theory and research. Leveraging stochastic actor-oriented models, a theoretically-relevant analytical tool for assessing longitudinal networks, the current study demonstrated that trust and leadership networks co-occurred over time. In doing so, the current study shifts the field toward more accurate models that reflect the temporality and relational basis of emergent leadership. As a burgeoning field, we strongly encourage future empirical research in this area.

CHAPTER 4: CONCLUDING REMARKS

Longitudinal investigations of leader development and leadership emergence are critical to advancing our understanding of the processes through which leaders develop and emerge. Despite numerous calls for research to consider the role of time on leadership processes, there still exists a paucity of research attention. Across two essays, the current work sought to address this gap in the literature. Essay 1 drew upon socio-cognitive theories of leader development to understand whether and how individuals' leader efficacy and leader identity developed during a formal leadership training program, and considered how individuals' learning goal orientation and motivation to lead impacted this developmental process. Essay 2 drew upon social exchange theory and models of social entrainment to understand the dynamic co-occurrence of leadership and trust over time. Taken together, the findings from Essay 1 and Essay 2 provide a basis for predicting how individuals develop over the course of formal leadership training and how individuals emerge as informal leaders.

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APPENDIX A: Measure Items, Instructions, and Response Scales (Essay 1)

Leader Efficacy

Instructions: Think about yourself right now in this very moment, since we last surveyed you '***X***' week ago. Please read the following statements and rate them on the following scale.

For each item below, please indicate your level of confidence. A score of 100 represents 100% confidence, whereas a score of 0 means no confidence at all.

As a leader, I can…

	Not at all confident					Moderately confident					Totally confident
Energize my followers to achieve their best	0	10	20	30	40	50	60	70	80	90	100
Develop agreements with followers to enhance their participation	0	10	20	30	40	50	60	70	80	90	100
Coach followers to assume greater responsibilities for leadership	0	10	20	30	40	50	60	70	80	90	100
Inspire followers to go beyond their self-interests for the greater good	0	10	20	30	40	50	60	70	80	90	100
Get my followers to meet the requirements we have set for their work	0	10	20	30	40	50	60	70	80	90	100
Utilize the forms of rewards and punishments that work best with each follower	0	10	20	30	40	50	60	70	80	90	100
Get followers to identify with the central focus of our mission	0	10	20	30	40	50	60	70	80	90	100
Determine what leadership style is needed in each situation	0	10	20	30	40	50	60	70	80	90	100

Motivate myself to take charge of groups	0	10	20	30	40	50	60	70	80	90	100
Remain steadfast to my core beliefs when I'm challenged	0	10	20	30	40	50	60	70	80	90	100
Motivate myself to perform at levels that inspire others to excellence	0	10	20	30	40	50	60	70	80	90	100
Develop detailed plans to accomplish complex missions	0	10	20	30	40	50	60	70	80	90	100
Strive to accomplish the targeted goals set by my superiors	0	10	20	30	40	50	60	70	80	90	100
Think up innovative solutions to challenging leadership problems	0	10	20	30	40	50	60	70	80	90	100
Distinguish the ethical components of problems / dilemmas	0	10	20	30	40	50	60	70	80	90	100

Leader Identity

Instructions: Think about yourself right now in this very moment, since we last surveyed you '*X*' week ago. Please read the following statements and rate them on the following scale.

How DESCRIPTIVE is each statement of you?

	Not at all descriptive			Moderately descriptive			Extremely descriptive
I am a leader.	1	2	3	4	5	6	7
I see myself as a leader.	1	2	3	4	5	6	7
If I had to describe myself to others, I would include the word "leader".	1	2	3	4	5	6	7
I prefer being seen by others as a leader.	1	2	3	4	5	6	7

Motivation to Lead

Instructions: Think about yourself right now in this very moment. Please read the following statements and rate them on the following scale.

	Strongly disagree						Strongly agree
Most of the time, I prefer being a leader rather than a follower when working in a group.	1	2	3	4	5	6	7
I am the type of person who is not interested to lead others.	1	2	3	4	5	6	7
I am definitely not a leader by nature.	1	2	3	4	5	6	7
I am the type of person who likes to be in charge of others.	1	2	3	4	5	6	7
I believe I can contribute more to a group if I am a follower rather than a leader.	1	2	3	4	5	6	7
I usually want to be the leader in the groups that I work in.	1	2	3	4	5	6	7
I am the type who would actively support a leader but prefers not to be appointed as leader.	1	2	3	4	5	6	7
I have a tendency to take charge in most groups or teams that I work in.	1	2	3	4	5	6	7
I am seldom reluctant to be the leader of a group	1	2	3	4	5	6	7
I am only interested to lead a group if there are clear advantages for me.	1	2	3	4	5	6	7
I will never agree to lead if I cannot see any benefits from accepting that role.	1	2	3	4	5	6	7
I would only agree to be a group leader if I know I can benefit from that role.	1	2	3	4	5	6	7
I would agree to lead others even if there are no special rewards or benefits with that role.	1	2	3	4	5	6	7
I would want to know "what's in it for me" if I am going to agree to lead a group.	1	2	3	4	5	6	7
I never expect to get more privileges if I agree to lead a group.	1	2	3	4	5	6	7
If I agree to lead a group, I would never expect any advantages or special benefits.	1	2	3	4	5	6	7
I have more of my own problems to worry about than to be concerned about the rest of the group.	1	2	3	4	5	6	7
Leading others is really more of a dirty job rather than an honorable one.	1	2	3	4	5	6	7
I feel that I have a duty to lead others if I am asked.	1	2	3	4	5	6	7

I agree to lead whenever I am asked or nominated by the other members.	1	2	3	4	5	6	7
I was taught to believe in the value of leading others.	1	2	3	4	5	6	7
It is appropriate for people to accept leadership roles or positions when they are asked.	1	2	3	4	5	6	7
I have been taught that I should always volunteer to lead others if I can.	1	2	3	4	5	6	7
It is not right to decline leadership roles.	1	2	3	4	5	6	7
It is an honor and privilege to be asked to lead.	1	2	3	4	5	6	7
People should volunteer to lead rather than wait for others to ask or vote for them.	1	2	3	4	5	6	7
I would never agree to lead just because others voted for me.	1	2	3	4	5	6	7

Goal Orientation (Cohort 1)

Instructions: Please read each item and rate your level of agreement using the following scale.

	Strongly disagree				Strongly agree
My aim is to completely master the material presented in this class.	1	2	3	4	5
My goal is to learn as much as possible.	1	2	3	4	5
I am striving to understand the content of this course as thoroughly as possible.	1	2	3	4	5

Goal Orientation (Cohort 2)

Instructions: Please read the following statements and rate them on the following scale.

	Strongly disagree					Strongly agree
I am willing to select a challenging work assignment that I can learn a lot from.	1	2	3	4	5	6
I often look for opportunities to develop new skills and knowledge.	1	2	3	4	5	6
I enjoy challenging and difficult tasks at work where I'll learn new skills.	1	2	3	4	5	6
For me, development of my work ability is important enough to take risks.	1	2	3	4	5	6

APPENDIX B: Confirmatory Factor Analysis (Essay 1)

Appendix B
Dimensionality of Leader Efficacy and Leader Identity

Time	BIC	SB-χ^2	*df*	*p*	CFI	TLI	RMSEA	RMSEA 90% CI
Time 1								
ACT, SR, LID	32701.29	270.67	149	0.00	0.95	0.94	.06	.05, .07
EFF, LID	32763.83	328.67	151	0.00	0.93	0.92	.07	.06, .08
One factor	32987.84	501.81	152	0.00	0.85	0.84	.10	.09, .11
Time 2								
ACT, SR, LID	29341.50	278.85	149	0.00	0.94	0.93	.06	.05, .08
EFF, LID	29383.92	317.65	151	0.00	0.92	0.91	.07	.06, .08
One factor	29663.55	528.35	152	0.00	0.82	0.80	.11	.10, .12
Time 3								
ACT, SR, LID	28361.62	248.15	149	0.00	0.96	0.95	.06	.04, .07
EFF, LID	28411.11	290.76	151	0.00	0.94	0.93	.07	.05, .08
One factor	28743.19	544.09	152	0.00	0.82	0.80	.11	.10, .12
Time 4								
ACT, SR, LID	26377.29	381.77	149	0.00	0.91	0.89	.09	.08, .10
EFF, LID	26392.90	399.53	151	0.00	0.90	0.89	.09	.08, .10
One factor	26759.41	685.75	152	0.00	0.79	0.76	.13	.12, .14

Note. BIC = Bayesian information criterion; SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; LID = Leader identity, ACT = Leader action self-efficacy; SR = Leader self-regulatory efficacy; EFF = Combining both dimensions of leader efficacy.

APPENDIX C: Measurement Invariance Analyses (Essay 1)

Appendix C

Measurement Invariance Analyses

Variable	SB-χ^2	*df*	*p*	CFI	TLI	RMSEA	RMSEA 90% CI
Leader action efficacy							
Configural invariance	521.47	302	0.00	0.94	0.93	0.06	.05, .06
Metric invariance	546.45	320	0.00	0.94	0.93	0.05	.05, .06
Scalar invariance	572.03	338	0.00	0.94	0.93	0.05	.05, .06
Leader self-regulatory efficacy							
Configural invariance	690.02	410	0.00	0.94	0.92	0.05	.05, .06
Metric invariance	708.65	431	0.00	0.94	0.93	0.05	.05, .06
Scalar invariance	739.46	452	0.00	0.93	0.93	0.05	.05, .06
Leader identity							
Configural invariance	120.14	74	0.0006	0.98	0.97	0.05	.03, .07
Metric invariance	126.87	83	0.0014	0.98	0.97	0.05	.03, .06
Scalar invariance	141.71	92	0.0007	0.98	0.97	0.05	.03, .06

Note. SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root-mean-square error of approximation

APPENDIX D: Interactive Effects of LGO and Dimensions of MTL as Predictors of Leader Identity Trajectories (Essay 1)

Appendix D

Interactive Effects of LGO and Dimensions of MTL as Predictors of Leader Identity Trajectories

Variable	Step 1: Initial status		Step 2: Linear trend		Step 3: Quadratic trend	
	β	*SE*	*β*	*SE*	*β*	*SE*
Intercept	4.35***	0.06	0.27***	0.06	-0.028**	0.01
LGO	0.05	0.07	0.12*	0.06	-0.025*	0.01
Affective	0.85***	0.06	-0.04	0.07	-0.001	0.01
Non-calc	-0.07	0.06	0.04	0.05	-0.001	0.01
Social-norm	0.25**	0.07	-0.04	0.07	0.002	0.01
LGO x Affective	-0.04	0.06	-0.03	0.05	0.008	0.01
LGO x Non-calc	-0.05	0.06	-0.01	0.06	0.000	0.01
LGO x Social-norm	0.16**	0.06	0.03	0.06	-0.007	0.01

Note. LGO = Learning goal orientation; Affective = Affective motivation to lead; Non-calc = Non-calculative motivation to lead; Social-norm = Social-normative motivation to lead

SB-χ^2(8) = 8.57, p = 0.38, CFI = 1.00, TLI = 1.00, RMSEA = 0.02, 90% CI [0.00 – 0.08], BIC = 2233.90

SB-χ^2 = Satorra-Bentler chi-square correction; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation; BIC = Bayesian information criterion.

* $p < .05$ ** $p < .01$ *** $p < .001$

Appendix E

Cohort 1 Descriptive Statistics and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. LI T1	4.38	1.43	(.90)															
2. LI T2	4.48	1.44	.82**	(.91)														
3. LI T3	4.94	1.37	.73**	.82**	(.92)													
4. LI T4	5.16	1.33	.64**	.72**	.85**	(.90)												
5. Action T1	69.14	18.19	.72**	.67**	.59**	.57**	(.92)											
6. Action T2	73.13	15.02	.64**	.66**	.59**	.56**	.71**	(.90)										
7. Action T3	76.47	13.45	.46**	.51**	.58**	.61**	.48**	.71**	(.90)									
8. Action T4	80.25	13.33	.45**	.50**	.51**	.59**	.45**	.63**	.84**	(.92)								
9. SR T1	70.55	21.23	.69**	.63**	.63**	.61**	.86**	.70**	.51**	.45**	(.95)							
10. SR T2	74.07	16.83	.62**	.62**	.62**	.53**	.60**	.85**	.74**	.64**	.70**	(.91)						
11. SR T3	77.45	14.86	.44**	.50**	.66**	.64**	.42**	.62**	.83**	.74**	.54**	.73**	(.91)					
12. SR T4	81.57	13.79	.48**	.52**	.60**	.66**	.53**	.66**	.83**	.89**	.60**	.68**	.83**	(.92)				
13. LGO	4.47	0.58	.29**	.33**	.36**	.24*	.35**	.30**	.23*	.15	.33**	.30**	.27*	.21*	(.73)			
14. Affective	4.51	1.20	.77**	.73**	.75**	.62**	.60**	.60**	.51**	.41**	.65**	.61**	.48**	.47**	.42**	(.87)		
15. NC	5.44	0.98	.22*	.25*	.36**	.35**	.28**	.33**	.24*	.25*	.25*	.20*	.22*	.28**	.24*	.23*	(.78)	
16. SN	5.05	0.96	.45**	.37**	.35**	.30**	.47**	.44**	.25*	.22*	.48**	.38**	.22*	.22*	.53**	.48**	.30**	(.73)

Note. LI = Leader identity; Action = Leader action self-efficacy; SR = Leader self-regulatory efficacy; LGO = Learning goal orientation; Affective = Affective motivation to lead; NC = Non-calculative motivation to lead; SN = Social-normative motivation to lead; T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4. Reliability estimates are provided in parentheses.

$* p < 0.05$ $** p < 0.01$

APPENDIX F: Cohort 2 Descriptive Statistics and Correlations (Essay 1)

Appendix F
Cohort 2 Descriptive Statistics and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. LI T1	4.48	1.21	(.85)															
2. LI T2	4.63	1.28	.65**	(.87)														
3. LI T3	4.95	1.32	.63**	.78**	(.89)													
4. LI T4	4.86	1.36	.55**	.58**	.74**	(.91)												
5. Action T1	70.09	15.10	.57**	.57**	.45**	.38**	(.89)											
6. Action T2	72.73	15.89	.55**	.58**	.55**	.32**	.72**	(.93)										
7. Action T3	75.88	15.75	.40**	.46**	.59**	.43**	.55**	.71**	(.94)									
8. Action T4	76.96	15.90	.44**	.43**	.57**	.50**	.58**	.62**	.78**	(.96)								
9. SR T1	71.69	16.75	.52**	.54**	.39**	.25**	.79**	.69**	.48**	.44**	(.91)							
10. SR T2	72.82	16.38	.56**	.61**	.59**	.36**	.68**	.83**	.62**	.55**	.76**	(.91)						
11. SR T3	75.18	15.91	.44**	.51**	.61**	.39**	.55**	.69**	.87**	.71**	.60**	.74**	(.93)					
12. SR T4	76.95	16.67	.45**	.42**	.54**	.49**	.56**	.60**	.73**	.91**	.49**	.60**	.74**	(.94)				
13. LGO	4.88	0.76	.28**	.31**	.33**	.15	.26**	.45**	.40**	.33**	.37**	.45**	.44**	.41**	(.85)			
14. Affective	4.54	0.95	.72**	.62**	.56**	.42**	.52**	.56**	.29**	.33**	.52**	.59**	.33**	.38**	.25**	(.78)		
15. NC	5.25	0.91	.18*	.16	.12	.08	.18*	.26**	.21*	.20*	.31**	.32**	.23*	.25**	.20*	.30**	(.80)	
16. SN	5.01	0.96	.56**	.51**	.47**	.38**	.48**	.50**	.36**	.38**	.46**	.52**	.41**	.41**	.27**	.53**	.26**	(.81)

Note. LI = Leader identity; Action = Leader action self-efficacy; SR = Leader self-regulatory efficacy; LGO = Learning goal orientation; Affective = Affective motivation to lead; NC = Non-calculative motivation to lead; SN = Social-normative motivation to lead; T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4. Reliability estimates are provided in parentheses.
* *p* < 0.05 ** *p* < 0.01

APPENDIX G: Measure Items, Instructions, and Response Scales (Essay 2)

Leadership Network

How much influence does this person have in your group?

	Very little influence				A great deal of influence
Name of group member	1	2	3	4	5

Trust Network

To what extent do you find this person trustworthy?

	Very little				Very much
Name of group member	1	2	3	4	5

APPENDIX H: A Primer on Stochastic Actor-Oriented Models (Essay 2)

Analyses were conducted using stochastic actor-oriented models (SAOMs, Snijders, 2001) with RSiena (Simulation Investigation for Empirical Network Analysis) software in R (Ripley et al., 2019). SAOMs use data from the first measured time point to *simulate* and *estimate* the changes that led to the final observed network, and further tests the hypothesized effects that may explain these changes. Although our data were collected at three discrete time points (i.e., at Time 1, Time 2, and Time 3), SAOMs assume that the changes occur continuously through a Markov process. In other words, the models do not predict changes from Time 1 to Time 2, and Time 2 to Time 3; rather, they estimate the entire latent change process (i.e., Time 1 to Time 3). These continuous changes are actor-driven, hence the term actor-oriented, and actors are assumed to control their outgoing relations in a succession of multiple small steps (i.e., *microsteps*, Snijders, 2009), in which actors are given the opportunity to change their outgoing network ties to maximize their network *objective function* (Snijders et al., 2010), both of which are described in more detail below.

The actual simulation and estimation procedures are rather computationally and mathematically complex; for simplicity, we briefly describe and explain how SAOMs work, and encourage interested readers to refer to primary works for elaboration (Ripley et al., 2019; Snijders, 2001, 2009, 2016; Snijders et al., 2007, 2010; Steglich, Snijders, & Pearson, 2010). At the first step of the estimation procedure, initial parameter values (either inputted by the researchers or provided by the statistical software) are used to predict the types of network dynamics that might occur to explain the next observed network (e.g., an effect of reciprocity or a cross-network effect of trust on leadership; Ripley et al., 2019). These parameter values will ultimately form the objective function.

Based on these initial parameter values, a subsequent network is simulated, using the

initial network as a starting point. Though changes in network connections are complex, they can

be regarded as an aggregate of many small tie changes between individuals within a group

(Snijders et al., 2010). To simplify this complicated process, the network simulation is conducted

by reducing all the tie changes to the smallest possible step, called a microstep (i.e., an

opportunity for one actor to change a tie at a time). At a microstep, an actor is randomly selected

and has the opportunity to create, maintain, or terminate one of his or her ties within the network.

The total number of times an actor is selected in the simulation to make a potential network tie

change is called the rate function, which is determined by the product of various factors,

including the total number of changes between measured networks (i.e. periods), actor

covariates, and the network position of the actor, which includes the number of outgoing,

incoming, and reciprocated ties for a given individual (Snijders, 2001).

When presented with this opportunity to make a tie change, the actor evaluates all of its

possible choices (i.e., to whom the actor can choose to become connected with or with whom the

actor can maintain or terminate a relationship) that he or she could make given the current

composition and structure of the network and the expression of certain individual differences of

the actors (e.g., gender). The processes that govern who an actor chooses to be connected with

are the effects that are included in the model, which is called the objective function. These

effects consist of the endogenous structural (e.g., reciprocity) and exogenous (e.g., cross-

network) mechanisms that may explain why a network relationship exists between actors over

time (Snijders et al., 2010). The actor's goal (or objective) in this microstep is to strive for higher

values in the objective function. After evaluating all possible choices that the actor has, the actor

146

will make the optimal change (with a small amount of randomness) in the network that maximizes his or her objective function (Snijders et al., 2010).

Once a network is simulated, the initial network, which was measured, is compared with the simulated network (i.e., how the network relationships have changed), which generates *expected values*. However, since a subsequent network was actually measured, the actual changes between the measured networks can be assessed, which generates *target values*. Therefore, the expected values (from the simulated network) and the target values (from the actual measured network) can be compared to assess convergence. If there are differences between the expected and target values – that is, the first simulation was not completely able to re-create the measured network and the associated effects that led to the changes in network relationships – the initial parameter values are updated based on this particular simulation (Ripley et al., 2019). It is statistically improbable for the first run to simulate the measured network, as there are essentially an infinite number of possible network configurations (e.g., even a network with six actors has over one million different configurations). Once the initial parameter values are updated, the process is repeated, where another network is again simulated, and the parameter values are updated.

Once there is convergence, where the parameter values are able to very closely simulate the actual measured network, several more simulations are run and standard errors around those values are computed (Ripley et al., 2019). The output of SAOMs is a set of parameters (and standard errors) associated with the endogenous and exogenous effects, and can be interpreted as preferences for creating, maintaining, or terminating ties based on the parameter's positive, negative, or negligible impact on the objective function; a parameter is statistically significant if its *t*-value is 1.96 greater than its standard error (Snijders et al., 2010). For example, if there is a

147

significant positive parameter estimate for the effect of a trust tie on the formation of a leadership tie, this indicates that there is a tendency for actors within the network to form a leadership tie with those who they have a trust tie.

APPENDIX I: Additional Controls in the Full Multiplex Model (Essay 2)

In this section, we present supplementary analyses to the full multiplex model, which includes several theoretically-relevant individual characteristics. Specifically, we control for a gender and ethnicity homophily effect (i.e., similarity), as previous research suggests that relationships often emerge on the basis of homophily (McPherson, Smith-Lovin, & Cook, 2001). Moreover, we specified an effect of individuals' overall course performance and personality, as previous research suggests that individuals' competence (i.e., overall performance) (Leary, Jongman-Sereno, & Diebels, 2014) and Big Five personality traits (Selfhout et al., 2010) can impact network development over time.

Appendix I
Additional Controls in the Full Multiplex Model

Parameter	Leadership Network			Trust Network		
	Estimate (β)	SE	OR	Estimate (β)	SE	OR
Rate T_1-T_2	14.93***	0.99	-	14.08***	0.94	-
Rate T_2-T_3	11.35***	0.73	-	10.85***	0.69	-
Endogenous Network Effects						
Outdegree	-1.99***	0.21	0.14	-1.82***	0.14	0.16
Reciprocity	-0.30***	0.09	0.74	0.15	0.08	1.17
Transitivity (GWESP)	0.06	0.21	1.06	0.59**	0.18	1.81
Indegree popularity	0.24*	0.09	1.27	-0.04	0.06	0.96
Outdegree activity	0.17**	0.06	1.18	0.15**	0.05	1.16
Attribute-Related Effects						
Ethnicity similarity	-0.03	0.06	0.97	-0.08	0.06	0.93
Gender similarity	0.12*	0.05	1.13	0.12*	0.05	1.12
Performance alter	0.12***	0.03	1.12	0.12***	0.03	1.13
Extraversion alter	0.02	0.02	1.02	0.01	0.03	1.01
Conscientious alter	0.01	0.02	1.01	0.04	0.02	1.04
Agreeableness alter	-0.00	0.03	1.00	0.02	0.03	1.02
Openness alter	0.02	0.03	1.02	-0.06*	0.03	0.94
Emotional stability alter	0.01	0.02	1.01	-0.06**	0.02	0.94
Cross-Network Effects						
Mixed direct association						
H1: Trust on leadership	0.69***	0.10	1.99	-	-	-
H2: Leadership on trust	-	-	-	0.59***	0.11	1.80
Mixed reciprocation						
H3: Trust with leadership	0.24*	0.11	1.28	-	-	-
Leadership with trust	-	-	-	0.17	0.13	1.19

Note. $N = 123$. OR = odds ratio. Alter = receiving a tie nomination. Performance = Overall course performance.
* $p < .05$ ** $p < .01$ *** $p < .001$