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Individual Traits and Entrepreneurial Intentions: The Mediating Role of Entrepreneurial Self-Efficacy and Need for Cognition

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business at Virginia Commonwealth University.

by

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Acknowledgement

I would like to express my deep and sincere appreciation to Dr. Ronald H. Humphrey, my dissertation committee chair, who is an excellent advisor, colleague, and friend. Writing dissertation is a long and challenging journey. Dr. Humphrey is always available whenever I need any help from him and he always patiently and thoroughly answers every question I ask. Dr. Humphrey constantly provides me with his guidance, instructions, and support and he shares many valuable insights and suggestions with me. I learn a lot from my dissertation journey under his mentorship. Dr. Humphrey not only teaches me how to write an outstanding dissertation but also trains me to be a mature thinker, productive researcher, and effective teacher. Dr. Humphrey's mentorship plays an important role in helping me complete my dissertation. It is my greatest pleasure and honor to have Dr. Humphrey as my dissertation chair and my academic advisor.

I would like to thank my dissertation committee members, Dr. Joseph E. Coombs, Dr. In-Sue Oh, and Dr. Matthew W. Rutherford. It is my honor to have you in my dissertation committee. You are also my excellent advisors, colleagues, and friends. Thank you for your time and patience to discuss with me whenever I need any help from you and for providing me with numerous great comments, feedback, and suggestions on my dissertation. Your support and encouragement is also the driving force for me to complete this dissertation.

I would like to thank Dr. Anson Seers. You are also an excellent mentor to work with. You taught me how to be an effective teacher and a productive researcher when I embarked on my academic journey and started my academic life in the doctoral program.

I would like to thank Dr. George Banks and Dr. Jeffrey Pollack. Dr. Banks gave me many great suggestions about how to be a successful doctoral student. Dr. Banks patiently answered many questions I asked when I was a junior doctoral student. Dr. Pollack offered me many great advices about how to be a great entrepreneurship scholar. I also would like to thank management Ph.D. students, Andrew Bennett, Jae Young Choi, James Field, and Timothy Thorley, who helped me a lot whenever I need help. It is my pleasure to know you and you are all great persons to work with.

I owe a debt of gratitude to my wife, Shanshan Qian. Thank you for being supportive and for caring about me all the time. Although we physically lived in different states while we were pursuing our Ph.D. degrees, we are spiritually united all the time because of our faith, hope, and love.

I would like to thank my parents Minsheng Miao and Fang Liu. Thank you for all the encouragement and support you gave to me during my dissertation journey. Thank you for being supportive for every important decision I make in my life. I would also like to express my deep gratitude to my parents-in-law (Huai Qian and Fangfang Qin) and my wife – Shanshan Qian,

who took nearly all the parenting and nursing duties to take care of my cute daughter – Hannah R. Miao, while I lived in a different state and worked on my Ph.D. degree.

I would like to thank Pastor Geoffrey Chan as well as all the other brothers and sisters at Immanuel Baptist Church (Chinese Ministry). A special thank you is given to Tszkin Leung and Mei Liu, who provided me numerous supports in my life. I thank God, my savior, for letting me know and fellowship with so many great brothers and sisters in the church and spiritually grow with them. I thank God, my savior, for giving me wisdom and strength to finish my dissertation and my doctoral study.

Last but not least, I would like to thank all doctoral program participating faculty members and staff in the management department. It is my pleasure and honor to get to know all of you and learn from you.

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Abstract

INDIVIDUAL TRAITS AND ENTREPRENEURIAL INTENTIONS: THE MEDIATING ROLE OF ENTREPRENEURIAL SELF-EFFICACY AND NEED FOR COGNITION

By Chao Miao, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business at Virginia Commonwealth University.

Virginia Commonwealth University, 2015

Major Director: Ronald H. Humphrey, Ph.D., Professor, Department of Management

The field of entrepreneurship is rapidly advancing and matures as a discipline that receives substantial amount of attention. One popular area of research in the discipline of entrepreneurship is to investigate one's intent to start a business, which is entrepreneurial intention. This is an important construct that warrants ongoing research because entrepreneurial intention is not only a great predictor of entrepreneurial behavior but also an important step in the process of becoming an entrepreneur. The present study, based on a sample of 321 subjects along with 264 observers, makes five contributions to the entrepreneurship literature. First, I examined the psychometric property of entrepreneurial take-over intention and found that it is a construct different from entrepreneurial start-up intention. Second, the results demonstrated that risk propensity and proactive personality are positive predictors of entrepreneurial start-up and take-over intentions, whereas cognitive ability is a negative predictor of entrepreneurial start-up

and take-over intentions. Rebelliousness is a positive predictor of entrepreneurial take-over intention and also has an inverted U-shaped relationship with entrepreneurial take-over intention. Third, entrepreneurial self-efficacy mediates the relationship between three individual traits (i.e., emotional intelligence, risk propensity, and proactive personality) and entrepreneurial start-up and take-over intentions. Need for cognition mediates the relationship between two individual traits (i.e., cognitive ability and proactive personality) and entrepreneurial start-up intention. Fourth, 2D:4D ratio (a proxy measure for prenatal testosterone exposure level) negatively predicts risk propensity. There also exist two two-step mediations from 2D:4D ratio to both entrepreneurial start-up and take-over intentions through risk propensity and entrepreneurial self-efficacy. Fifth, the results suggest that observer ratings of individual traits only contribute modest incremental validity above and beyond self-reported ratings of them in predicting entrepreneurial start-up and take-over intentions. I discuss implications, limitations, and future directions informed by the present study.

I. INTRODUCTION

The field of entrepreneurship is rapidly growing and advances significantly over the past a few decades (Shane, 2012). In their seminal article, Shane and Venkataraman (2000) defined the field of entrepreneurship as “the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited” (p. 218). They proposed a framework for the field of entrepreneurship that explains and predicts a set of phenomena and outcomes not explained or predicted by theoretical frameworks exist in other fields. During the past decade, the seminal article by Shane and Venkataraman (2000) significantly impacted the field of entrepreneurship and navigated entrepreneurship literature toward the four dimensions of entrepreneurship proposed in their article, which are “(1) the idea of entrepreneurship as a distinctive scholarly domain; (2) the definition of entrepreneurship as a process rather than an event or embodiment of a type of person; (3) the nexus of opportunities and individuals; and (4) means-ends relationships, innovation, and new combinations” (Shane, 2012, p.18).

Within the above four dimensions of entrepreneurship research proposed by Shane and Venkataraman (2000), the current study falls under the theoretical framework of the nexus of opportunities and individuals. Shane (2003) argued that it is the individual that discovers the opportunity and brings it to life. In the theoretical model of entrepreneurial process, he discussed why individual differences influence who exploits the opportunity and who does not. Thus,

individual differences are associated with peoples' decisions to engage in entrepreneurial activities.

Despite the importance of individual traits as described by scholars, there still exist opposing views and skepticisms about the value of individual traits in entrepreneurship. For instance, Gartner (1985) argued that entrepreneurs are composed of a highly heterogeneous pool of people; as such, an average personality profile (i.e., an "average entrepreneur") cannot be determined and therefore should not exist. Low and McMillan (1988) suggested that trait-based studies do not promote the development of entrepreneurship theories. Aldrich (1999) indicated that scholars should discontinue the investigation of traits in entrepreneurship research since "research on personal traits seems to have reached an empirical dead end" (p. 76).

Recently, with the advent of meta-analytic reviews in the field of entrepreneurship, much controversies and criticisms regarding the value of psychological traits in entrepreneurship appear to cease (Frese & Gielnik, 2014) because a series of meta-analytic evidence yielded support for the trait-based approach to entrepreneurship. For instance, in an early meta-analytic review, Stewart and Roth (2001) found that risk propensity of entrepreneurs is higher than that of managers. Although Miner and Raju (2004) performed another meta-analysis on the same topic where they found not only a contrasted finding (i.e., entrepreneurs being more risk avoidant) but also a substantially weaker relationship between risk propensity and entrepreneurial status, Stewart and Roth (2004) examined Miner and Raju's (2004) meta-analysis, addressed the methodological issues Miner and Raju's meta-analysis had, and performed another meta-analysis and found that their conclusion remains the same as their original findings in 2001, indicating that entrepreneurs are more risk-tolerant than managers. In a follow-up meta-analytic review, Stewart and Roth (2007) further found that achievement motivation of entrepreneurs is greater

than that of managers. Building on the five-factor model of personality (FFM; Costa & McCrae, 1992), the meta-analytic study by Zhao and Seibert (2006) indicated that there are significant differences between entrepreneurs and managers on four personality dimensions, where entrepreneurs exhibit higher scores on conscientiousness and openness to experience and lower on neuroticism and agreeableness. Rauch and Frese (2007) analyzed a comprehensive set of psychological traits and found that psychological traits are associated with business creation and success. The magnitude of relationships reported in their meta-analysis is from small to moderate in size, with traits matched to entrepreneurship having higher effect sizes. In light of a large stream of cumulative evidence supporting the importance of the relationship between individual traits and entrepreneurial processes, Frese and Gielnik (2014) coined the term “The Psychology of Entrepreneurship” and highlighted the critical role that psychological traits play in entrepreneurship research based on the existing supportive evidence.

Before an individual decides to exploit an opportunity, he/she will develop a psychological intention to determine whether or not the opportunity exploitation is a desirable and feasible option. Hence, the entrepreneurial intention is regarded as an important construct because the intention to create one’s own business is generally deemed as a critical step in the process of being an entrepreneur and intention is a great predictor of planned behavior (e.g., Bird, 1988; Krueger, Reilly, & Carsrud, 2000; Zhao, Seibert, & Lumpkin, 2010). The research concerning how entrepreneurial intention is developed is primarily explicated by three theoretical models (Shook, Priem, & McGee, 2003): (1) model of implementing entrepreneurial ideas (IEI) by Bird (1988); (2) model of the entrepreneurial event (SEE) by Shapero (1982); and (3) theory of planned behavior (TPB) by Ajzen (1987). Building on the theory of planned behavior (Ajzen, 1987, 1991), Krueger et al. (2000) argued that entrepreneurial activity is

intentionally planned behavior and understanding intention is conducive to the understanding of the act itself. Individual difference variables have been shown to be predictive of entrepreneurial intention. For instance, Zhao et al. (2010) meta-analytically examine the relationship between personality and entrepreneurial intention and found that four of the Big Five personality traits (i.e., conscientiousness, openness to experience, emotional stability, and extraversion) are statistically significant predictors of entrepreneurial intention. Analogously, Rauch and Frese (2007) meta-analyzed a comprehensive set of traits and found that traits matched to entrepreneurship are significantly associated with entrepreneurial behavior. The results of this meta-analysis yielded support to the notion that entrepreneurship research should take psychological traits into account. Because individual differences affect the development of entrepreneurial intention (Shook et al., 2003), the current study examines how different individual traits influence entrepreneurial intention.

The selection into entrepreneurship may also be explained by biological factors. Biological factors influence the tendency of people to participate in entrepreneurial activity (Nicolaou et al., 2008; Nicolaou & Shane, 2009; Shane, 2010). Introducing the biology to the field of entrepreneurship appears to be theoretically sound (Trahms, Coombs, & Barrick, 2010). One promising area of biological entrepreneurship research focuses on how digit ratio (i.e., 2D:4D ratio) predicts entrepreneurial activity. 2D:4D ratio is determined by the second-to-fourth digit length ratio (i.e., the ratio of the length of the index finger to the length of the ring finger). It is a marker for prenatal testosterone exposure as well as its influence on the brain development (Manning, 2002; Manning & Fink, 2008; Trahms et al., 2010). Preliminary research evidence suggests that 2D:4D ratio is related to career choice (Sapienza, Zingales, & Maestripieri, 2009;

Weis, Firker, & Hennig, 2007), venture performance (Trahms et al., 2010; Unger et al., 2009), and exit from entrepreneurship (Guiso & Rustichini, 2011).

In sum, the present study is important for five reasons. First, the present study will contribute to the extant literature by testing a few individual traits that are not thoroughly studied yet important in the entrepreneurship literature, such as emotional intelligence, cognitive ability, and rebelliousness. For instance, the theory of emotion, such as emotional intelligence and emotional labor, has been introduced to the field of entrepreneurship and begins to receive attention from scholars (Burch, Batchelor, & Humphrey, 2013; Cardon, Foo, Shepherd, & Wiklund, 2012; Humphrey, 2013a). Recently, Burch et al. (2013) created affective entrepreneurial events model to integrate the theory of emotion with that of entrepreneurship. This successful integration demonstrated that the emotional approach to entrepreneurship is a promising one. Research finding also suggested that intelligence is associated with entrepreneurial outcomes (Baum & Bird, 2010). Although there are a few preliminary findings related to aforementioned constructs, there is still a shortage of empirical examination of them, especially in predicting the outcomes like entrepreneurial intention.

Second, nearly all of the entrepreneurial intention research only focuses on start-up intention. To be best of my knowledge, there is no research so far tests entrepreneurial take-over intention (i.e., take over an existing firm). Different individuals may have different resources (e.g., social capital, human capital, and financial capital) before they decide to exploit an entrepreneurial opportunity. Further, individuals who decide to be an entrepreneur may also differ in risk propensity. Due to the heterogeneity in individuals' possession of resources and risk attitude, they may exhibit different preferences toward venture creation, such as starting up a firm (requires more resources and involves more risk) or taking over an existing firm (demands

less resources and involves less risk) (Shook et al., 2003). Thus, the present study adapts entrepreneurial start-up intention measure to develop entrepreneurial take-over intention scale, examines the psychometric properties of this adapted measure, and empirical tests the predictors of both types of entrepreneurial intentions.

Third, despite the fact that the antecedents of entrepreneurial intention are widely studied, it is still largely unknown how biological factor plays a role in shaping individuals' intention to be an entrepreneur. Yet, biology should play an important role in determining psychological differences among individuals, which in turn impacts one's decision and/or tendency to become an entrepreneur (Nicolaou et al., 2008; White, Thornhill, & Hampson, 2006). The current study fills this void by analyzing 2D:4D ratio (i.e., a noninvasive retrospective biological marker for prenatal testosterone exposure) as an antecedent of entrepreneurial intention.

Fourth, most of the research examining the relationship between individual psychological traits and entrepreneurial intention only focuses on the direct effect between them (Rauch & Frese, 2007; Zhao, Seibert, & Hills, 2005). The mediating mechanisms between individual traits and entrepreneurial intention still remain largely unknown. Frese and Rauch (2007) thereby called for more research to explore the missing link between psychological traits and entrepreneurial intention. The present study examines whether entrepreneurial self-efficacy (Chen, Greene, & Crick, 1998) and need for cognition (Cacioppo & Petty, 1982) are such mediating mechanisms. Some initial evidence suggested that the effect of risk propensity on entrepreneurial intention is mediated by entrepreneurial self-efficacy (Zhao et al., 2005). Zhao et al. (2005) indicated that less research has been done to clarify the theoretical role of entrepreneurial self-efficacy that may play in explaining the relationship between the previously identified antecedents and entrepreneurial behavior. The present study thus answers the call from

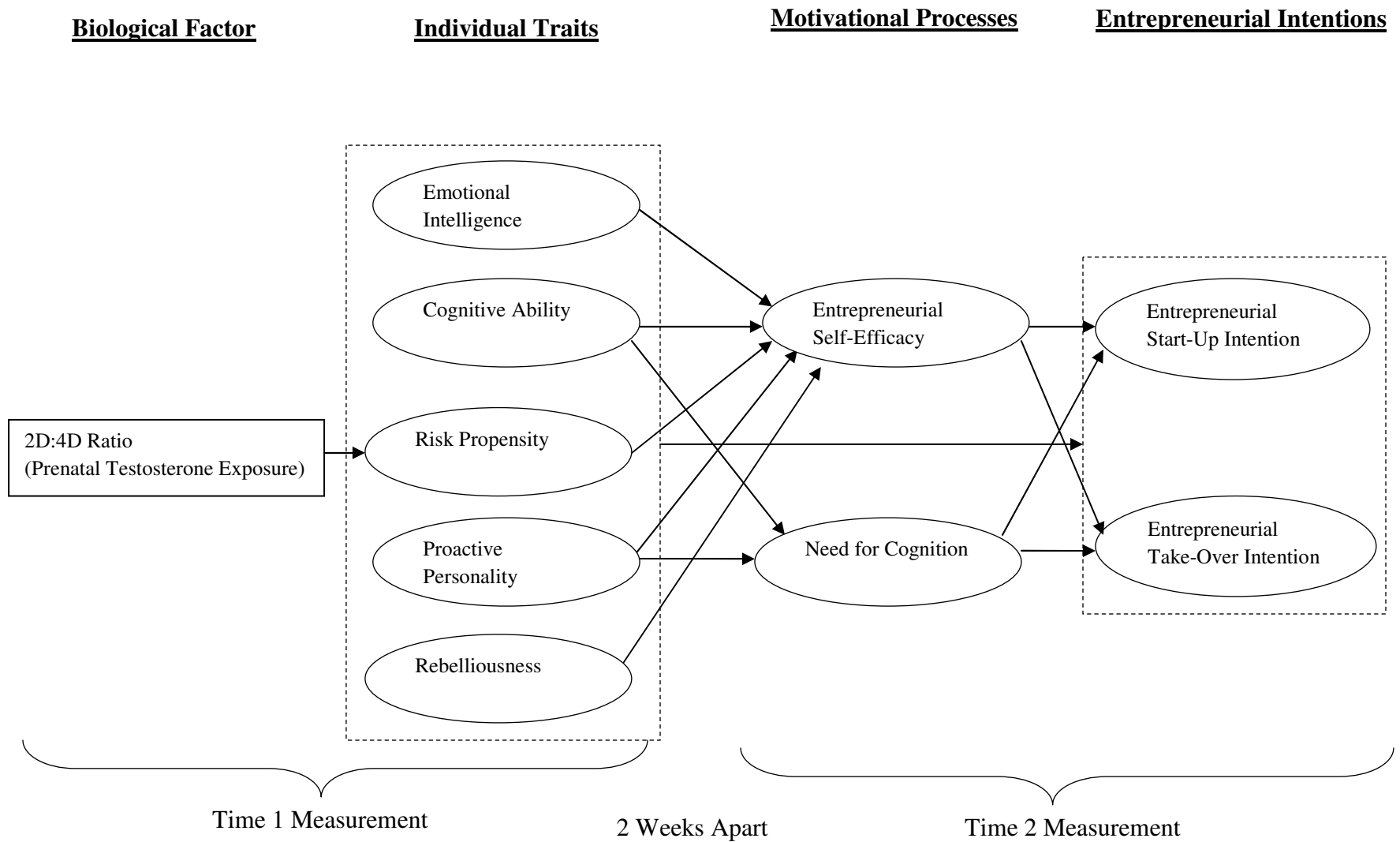
both Frese and Rauch (2007) and Zhao et al. (2005) by testing whether entrepreneurial self-efficacy mediates the relationship between individual traits and entrepreneurial intention. The present study also introduces a new mediator - need for cognition - for the aforementioned relationship. Need for cognition, as a cognitive motivation construct predictive of individual attitudes and performance (Cacioppo, Petty, Feinstein, & Jarvis, 1996), is a widely studied and well developed construct in psychology literature and yet receives nearly no attention in entrepreneurship literature. However, it should be an important construct in the field of entrepreneurship. Busenitz and Barney (1997) indicated that the job of entrepreneurship is complex and non-routine. Intelligent individuals should enjoy cognitive endeavors and prefers cognitive challenges and complex tasks (i.e., high in need for cognition) should have higher intention to become an entrepreneur according to fit theory. I bridge the gap in the literature by investigating this cognitive motivational process in the field of entrepreneurship.

Fifth, in addition to aforementioned theoretical contributions, the present study also makes a methodological contribution. After I reviewed the literature, I found that nearly all studies on the topic of entrepreneurial intention collected the quantitative data on both the predictor and the criterion variable based on self-reported ratings. However, management and psychology literature demonstrated that self-reported ratings and observer ratings of individual traits may yield different validity and observer ratings of individual traits exhibit incremental validity above and beyond self-reported ratings of individual traits (e.g., Mount, Barrick, & Strauss, 1994; Oh, Wang, & Mount, 2011). Nevertheless, these important findings are largely neglected in the field of entrepreneurship. Hence, the present study uses multi-source rating method to collect data on predictors and criteria from difference raters (i.e., self-reports and

observer-reports of individual traits) to empirically examine whether there is incremental validity contributed by observer-reports of individual traits in predicting entrepreneurial intentions.

The present study unfolds as follows. First, I develop theoretical foundations for the study, such as fit theory, emotional intelligence theory, and social learning theory. Second, I use these theories to build a conceptual model (see Figure 1) and to develop testable hypotheses. Third, I discuss research method, such as data collection method, measurement scales, and data analyses method. Fourth, I present all analysis results and discuss whether there supportive evidence for each hypothesis. Finally, I discuss the implications, limitations, and future directions of this study.

Figure 1. A Conceptual Model of Biological Factor, Individual Traits, Motivational Processes, and Entrepreneurial Intentions



II. THEORY AND HYPOTHESES

Theoretical Foundations

Fit theory. Theories concerning person-environment (PE) interactions have been studied for more than ten decades (e.g., Argyris, 1960; Hoffman & Woehr, 2006; Kristof, 1996; Kristof-Brown, Zimmerman, & Johnson, 2005; Lewin, 1935; Oh et al., 2014; Parsons, 1909). The PE fit is broadly defined as “the compatibility between an individual and a work environment that occurs when their characteristics are well matched” (p. 281, Kristof-Brown et al., 2005). The notion of fit has been explicated by a few different theoretical frameworks, such as value congruence, goal congruence, needs-supplies fit, and demands-abilities fit (Hoffman & Woehr, 2006). Kristof-Brown et al. (2005) identified four critical domains of fit, which are person–job (P-J), person–organization (P-O), person–group (P-G), and person–supervisor (P-S) fit. P-J fit is defined as “individuals’ congruence with the requirements of their job and the inducements provided to perform it” (p.69, Vogel & Feldman, 2009). P-O fit refers to “the compatibility between people and entire organizations” (p. 285, Kristof-Brown et al., 2005). P-G fit focuses on “the interpersonal compatibility between individuals and their work groups” (p. 286, Kristof-Brown et al., 2005). P-S fit refers to “the match between supervisors and subordinates” (p. 287, Kristof-Brown et al., 2005). Kristof-Brown et al. (2005) meta-analyzed different types of fit and found that they predict many important pre-entry (e.g., applicant attraction, job acceptance, and intent to hire) and post-entry individual-level criteria (e.g.,

attitudes, performance, and withdrawal behaviors). Recently, Oh et al. (2014) performed a cross-cultural meta-analysis and synthesized studies published in the East Asia, Europe, and North America. They found that all dimensions of PE fit can lead to positive outcomes, thus providing evidence that fit happens globally.

The theory of fit, which is originated in organizational behavior literature, has also been introduced to the field of entrepreneurship (e.g., Busenitz & Barney, 1997; Mitchell et al., 2002; Shane, Nicolaou, Cherkas, & Spector, 2010; Smith, Mitchell, & Mitchell, 2009; Zhao & Seibert, 2006; Zhao et al., 2010). Among four different domains of fit discussed above, person–job (P-J) fit is most relevant for entrepreneurship research. For instance, entrepreneurial cognition literature, which suggests that entrepreneurs think differently from others, indicates that cognitive difference determines who chooses to become an entrepreneur and can recognize and exploit opportunities due to a P-J fit (Mitchell et al., 2002; Smith et al., 2009). P-J fit mainly builds on two fit theoretical frameworks, which are abilities–demand fit and needs–supplies fit (Vogel & Feldman, 2009). Abilities–demand fit suggests that when individuals have necessary skills to meet job demands, they are more likely to have higher performance and to stay on the job. Needs–supplies fit suggests that when individuals’ need is satisfied by the supplies (rewards) of the job, individuals’ satisfaction and commitment to the job will be enhanced (Vogel & Feldman, 2009). Kristof (1996) argued that when the job fits their personalities, individuals are more likely to become committed to it and they feel more comfortable and perform better at it. Therefore, individuals are gravitated to the job that is compatible with their personalities (Zhao & Seibert, 2006). Baron and Markman (2004) defined entrepreneurship as a job. It thus leads to the proposition that individuals are prone to look for a job of starting a venture that fits their traits when they decide to become an entrepreneur (Shane et al., 2010). This perception of fit

allows them to work with less conscious effort or strain, thereby allowing them to be more satisfied, committed, and motivated in a particular job (e.g., entrepreneurship). Further, building on attraction–selection–attrition (ASA) model proposed by Schneider (1987), Zhao and Seibert (2006) pointed out that individuals with certain traits are more likely to be attracted to the entrepreneurial form of employment than others, and outside agents (e.g., investment bankers, venture capitalists, and suppliers) may favor individuals with certain traits. Hence, individuals who have traits fit with the entrepreneurial form of employment may find the job itself inherently satisfying and persist long enough to create a new venture and be an entrepreneur. Meta-analytic findings suggested that 1) there are significant differences between entrepreneurs and managers on scores in four dimensions of Big Five personalities (i.e., entrepreneurs scored higher on conscientiousness and openness to experience and lower on neuroticism and agreeableness) and 2) four of the Big Five personality traits (i.e., conscientiousness, openness to experience, emotional stability, and extraversion) predict entrepreneurial intention (Zhao & Seibert, 2006; Zhao et al., 2010).

Theoretical frameworks of entrepreneurial intention. Entrepreneurial intention refers to one's intent to start a business (Krueger et al., 2000). The development of entrepreneurial intention is primarily explained by three theoretical models (Shook et al., 2003): (1) model of implementing entrepreneurial ideas (IEI) (Bird, 1988); (2) model of the entrepreneurial event (SEE) (Shapero, 1982); and (3) theory of planned behavior (TPB) (Ajzen, 1987).

IEI model by Bird (1988) suggested that during the time when entrepreneurial intention is formed, personal (e.g., individuals' personal history, personality, and abilities) and social contexts (e.g., individuals' social, political, and economic context) will have interactions with rational thinking, and entrepreneurial intentions eventually lead to entrepreneurial actions with

the passage of time (Shook et al., 2003). IEI model was further revised by Boyd and Vozikis (1994) who added self-efficacy to the model. Boyd and Vozikis (1994) indicated that social support, role models, and previous career experiences influenced the perception of self-efficacy.

SEE model by Shapero (1982) demonstrated that entrepreneurial intention is formed based on the perception of desirability, perception of feasibility, and a propensity to act upon opportunities. Perceived desirability is defined as “the degree to which an individual feels attracted to become an entrepreneur and reflects individual preferences for entrepreneurial behavior” (p. 4, Schlaegel & Koenig, 2014). In short, it denotes the attractiveness of being an entrepreneur (Shook et al, 2003). Perceived feasibility refers to “the degree to which individuals are confident that they are personally able to start their own business and consider the possibility to become an entrepreneur as being feasible” (p. 4, Schlaegel & Koenig, 2014). It captures the extent to which an individual feels competent of starting a business (Shook et al, 2003). Propensity to act upon opportunities is defined as “an individual’s disposition to act on one’s decision” (p. 4, Schlaegel & Koenig, 2014). SEE model showed that the inertia will guide human behavior until some events (e.g., job loss, receiving an inheritance, and winning the lottery) happen to interrupt the inertia (Shook et al, 2003). This interruption accelerates a change in individuals’ behavior, which makes an individual look for best opportunity available from a set of alternatives and assess it based on the perception of desirability and feasibility (Krueger et al., 2000; Shook et al, 2003). For instance, Shane (2008) found that individuals are prone to become entrepreneurs if they are just laid off from their jobs and are unemployed and/or make less money in their last jobs. As such, losing one’s job and making less money increases one’s perception of desirability to become an entrepreneur. In addition, entrepreneurial intention is also affected by propensity to act upon opportunity.

TPB model by Ajzen (1987) revealed three antecedents of intention: attitude toward the act, subjective norms, and perceived feasibility (Krueger et al., 2000). Attitude toward the act refers to “the individual’s assessment of the personal desirability of creating a new venture” (p.384, Shook et al, 2003). Subjective norms refer to “an individual’s perceptions of what important people in an individual’s life think about venture creation” (p.384, Shook et al, 2003). Perceived feasibility denotes “the individual’s perception of his or her ability to successfully initiate a new venture, which is largely synonymous with entrepreneurial self-efficacy” (p.384, Shook et al, 2003).

The present study will build on SEE and TPB and the reasons are twofold. First, the theoretical mechanisms of SEE and TPB are more relevant for the present study relative to IEI. Second, these two models received more empirical support (Fitzsimmons & Douglas, 2011; Schlaegel & Koenig, 2014) compared to IEI model. One of the proposed mediators in the present study is entrepreneurial self-efficacy, which is synonymous with perceived feasibility (Douglas, 2013; Shook et al, 2003). Thus, the present study particularly draws on the theoretical link between perceived feasibility and intention as suggested by both SEE and TPB.

There is also a blurred area with respect to the operationalization of entrepreneurial intention. Shook et al. (2003) indicated that the definition of entrepreneurial intention is inconsistent across studies, with some studies defining it as the intent to own one’s own business (e.g., Crant, 1996; Kolvereid, 1996a, 1996b) whereas other studies referring it to the intent to start a business (e.g., Bird, 1992; Krueger et al., 2000; Scherer et al., 1989). Owning a business is a more encompassing concept than starting a business because the former one may refer to the intent to purchase (take over) an ongoing business. Taking over a business may involve less risk compared to creating a new venture. To gain a better understanding of the antecedents of

entrepreneurial intention, I examine both types of entrepreneurial intention (i.e., entrepreneurial start-up intention and entrepreneurial take-over intention).

Social learning theory. Social learning theory is an established theory rooted in psychology that has wide implications for the fields of management and entrepreneurship (Bandura, 1977a, 1982; Boyd & Vozikis, 1994; Chen et al., 1998; Gist, 1987; Wood & Bandura, 1989). Self-efficacy, defined as “people’s beliefs in their capabilities to mobilize the motivation, cognitive resources, and courses of action needed to exercise control over events in their lives” (p. 364, Wood & Bandura, 1989), is cited as a central construct in social learning theory (Bandura, 1977a, 1982; Wood & Bandura, 1989). It is a motivational construct that affects “an individual’s choice of activities, goal levels, persistence, and performance in a range of contexts” (p. 1266, Zhao et al., 2005).

Social learning theory suggested that an individual’s perception of self-efficacy can be influenced by four processes: (a) performance accomplishments; (b) vicarious experience; (c) verbal persuasion; and (d) emotional arousal (Bandura, 1977b). Performance accomplishment is an influential source of an individual’s sense of self-efficacy because it is based on personal mastery experience. Vicarious experience influences self-efficacy via social comparison. Seeing how others perform in a threatening activity without adverse consequences will intensify observers’ efforts and persistence because this observation generates expectations in observers that they are also capable of performing the same activity. Observers simply persuade themselves that if others can do it, they can also obtain at least some improvements in performance. Verbal persuasion suggests that an individual can be led into believing that they are able to successfully deal with what has overwhelmed them. Emotional arousal indicates that an individual depends

on his/her physiological arousal to determine their anxiety and vulnerability to stress. Individuals are more self-efficacious when they are not plagued by aversive arousal.

Self-efficacy is a task specific construct that has been extended to the field of entrepreneurship (Boyd & Vozikis, 1994; Chen et al., 1998). Entrepreneurial self-efficacy is defined as “the strength of an individual’s belief that he or she is capable of successfully performing the roles and tasks of an entrepreneur” (p. 301). It is an important explanatory variable in shaping both entrepreneurial intention and the likelihood of entrepreneurial action (Boyd & Vozikis, 1994). Entrepreneurial environment can be interpreted as full of opportunities by individuals with high entrepreneurial self-efficacy but fraught with costs and risks by individuals with low entrepreneurial self-efficacy. When encountering situations filled with risks, adversity, and uncertainties, individuals with high entrepreneurial self-efficacy tend to feel more capable to cope with that reality relative to those with low entrepreneurial self-efficacy. In sum, individuals with high entrepreneurial self-efficacy (i.e., those who are self-efficacious in performing entrepreneurial roles and tasks) are more likely to enter the entrepreneurial environment than those with low entrepreneurial self-efficacy.

Emotional intelligence theory. Emotional intelligence (EI) (Mayer, Roberts, & Barsade, 2008; Mayer & Salovey, 1997; Tett, Fox, & Wang, 2005) is defined as “as the set of abilities (verbal and nonverbal) that enable a person to generate, recognize, express, understand, and evaluate their own, and others, emotions in order to guide thinking and action that successfully cope with environmental demands and pressures” (Van Rooy & Viswesvaran, 2004; p. 72). The concept of EI has received attention from both researchers and practitioners and it inspires a stream of research within the fields of psychology and management (Joseph & Newman, 2010; Kellett, Humphrey, & Sleeth, 2006; Law, Wong, & Song, 2004; Matthews, Zeidner, & Roberts,

2002; Mayer et al., 2008). Recent research also indicated that EI has strong implications for leadership research and potentially enables scholars to better understand leadership emergence, leadership effectiveness, and other specific leadership behaviors (Walter, Cole, & Humphrey, 2011). The construct of EI gained substantial empirical support and several meta-analyses (e.g., Joseph & Newman, 2010; O'Boyle et al., 2011; Van Rooy & Viswesvaran, 2004) yielded support for the predictive validity of EI.

O'Boyle et al. (2011) pointed that modern interest in EI is originated from Salovey and Mayer's (1990) work which provided an initial definition of EI. In their meta-analytic review, O'Boyle and his colleagues summarized different measures of EI, including Bar-On Emotional Quotient Inventory (EQ-i), Emotional Intelligence Scale (EIS; Schutte et al., 1998), the MSCEIT V2.0 (Mayer, Caruso, & Salovey, 1999; Mayer, Salovey, Caruso, & Sitarenios, 2003), WLEIS (Wong & Law, 2002), Workgroup Emotional Intelligence Profile (WEIP; Jordan, Ashkanasy, Hartel, & Hooper, 2002), and Work Profile Questionnaire-Emotional Intelligence Version (WPQ-EI; Cameron, 1999). Recently, Mayer, Salovey, and Caruso (2002) developed the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) to meet the traditional definition of intelligence. With regard to items and dimensions of MSCEIT, Mayer et al. (2003) suggested that "The MSCEIT V2.0 is a newly developed, 141-item scale designed to measure the following four branches (specific skills) of EI: (a) perceiving emotions, (b) using emotions to facilitate thought, (c) understanding emotions, and (d) managing emotions" (p. 99).

Ashkanasy and Daus (2005) reviewed the literature of EI and categorized the EI research into three streams: "(1) a four-branch abilities test based on the model of emotional intelligence defined in Mayer and Salovey (1997); (2) self-report instruments based on the Mayer-Salovey model; and (3) commercially available tests that go beyond the Mayer-Salovey definition" (p.

441). O'Boyle et al.'s (2011) meta-analytic review indicated that all three streams of EI correlated with job performance, particularly with stream 2 and 3 contributing incremental validities over and above cognitive intelligence and the five factor model (FFM) in predicting job performance. It also showed that all three streams of EI exhibited large relative importance for the prediction of job performance in the presence of the FFM and cognitive intelligence.

The literature review so far indicated that EI has strong implications for the field of management and psychology because EI is positively related to a set of important workplace outcomes, such as job performance, leadership, and physical and mental health (Humphrey, 2013b). Recently, EI has also been extended to the field of entrepreneurship (Burch et al., 2013; Cardon et al., 2012; Humphrey, 2013a; Shepherd, 2004, 2009). Shepherd (2004) emphasized the importance of teaching emotion in the entrepreneurship curriculum. He advocated a focus on how students “feel” rather than on how or what they “think”. Entrepreneurs’ job is generally considered being fraught with risks, uncertainties, and costs. An individual who becomes an entrepreneur risks financial status, career opportunities, family relationship, and psychic well-being (Brockhaus, 1980). Therefore, great emotional skill appears to be a necessary condition for successful entrepreneurial process due to the stressful and risky nature of it. Humphrey (2013a) proposed that entrepreneurs high on EI tend to be more resilient when facing obstacles and be more effectively working with their employees, customers, and other stakeholders. High EI gives entrepreneurs an advantage in negotiating with financial backers, suppliers, and distributors and in developing new products and services. By integrating with the fit theory discussed earlier, it leads to the prediction that individuals with high EI are more likely to be an entrepreneur because the skills they have (i.e., emotional skills) properly fit with the job demand of entrepreneurship.

Research Hypotheses

Preceding review and discussion of theoretical foundations leads to four general theoretical conclusions. First, individuals having certain psychological traits are more likely to become entrepreneurs due to the perceived fit between their traits and the demand of an entrepreneurial job. Second, individuals having high perceived feasibility toward entrepreneurship are more likely to become an entrepreneur according to SEE and TPB. Since perceived feasibility is largely synonymous with entrepreneurial self-efficacy (Shook et al, 2003), entrepreneurial self-efficacy should positively influence entrepreneurial intentions. Third, social learning theory predicted four processes via which an individual's perception of self-efficacy is shaped. Individual traits influence the perception of entrepreneurial self-efficacy through these processes (Zhao et al., 2005). Fourth, motivation (e.g., self-efficacy) is proposed to be an important mediating mechanism between entrepreneurial traits and entrepreneurial outcomes (e.g., Baum & Locke, 2004; Rauch & Frese, 2007). Hence, entrepreneurial self-efficacy may mediate the relationship between individual traits and entrepreneurial intentions. These theoretical conclusions provide groundings for the hypotheses developed in the following sections.

2D:4D ratio and risk propensity. Prenatal androgens impact behaviors of individuals because they influence the development of nervous system and brain in the uterus and enhance brains' sensitivity to the effects of circulating testosterone (Coates, Gurnell, & Rustichini, 2009; Goy & McEwen, 1980; Phoenix, Goy, Gerall, & Young, 1959). Testosterone is one of the most widely studied prenatal androgens. Research findings revealed that testosterone has significant effect on the development of body and brain and it can cause increased level of confidence, locus of control, risk preferences, and search persistence (Trahms et al., 2010). The 2D:4D ratio, which is solidified in the 13th week of fetal development, is a common proxy measure for the exposure

to testosterone, and this ratio is negatively related to prenatal and adult testosterone levels and positively related to estradiol in the uterus (Trahms et al., 2010). This means smaller 2D:4D ratio denotes high masculinity.

The career of entrepreneurs is typically portrayed as being risky, uncertain, and complex (Busenitz & Barney, 1997). Therefore, they need to possess exceptional mental power and psychological traits to survive in the marketplace. Consistent with this assertion, Stewart and Roth's (2001) meta-analytic review indicated that risk propensity of entrepreneurs is higher than that of managers, which implies that entrepreneurs are risk-tolerant individuals. Some research provided the evidence that the testosterone, measured by 2D:4D ratio, is related to risk propensity. For example, Stenstrom, Saad, Nepomuceno, and Mendenhall (2011) found that 2D:4D ratio is negatively associated with overall risk-taking. Stenstrom and Saad (2011) found that high-testosterone individuals have a higher appetite for financial risk-taking. Coates and Page (2009) found that 2D:4D ratio predicts the amount of risk taken by traders. Based on above theoretical and empirical evidence, I offer the following hypothesis.

Hypothesis 1. 2D:4D ratio is negatively related to risk propensity.

Risk propensity and entrepreneurial intention. Risk propensity refers to one's willingness to make decisions or follow courses of action involving uncertainty concerning success or failure (Jackson, 1994; Zhao et al., 2010). Proclivity to risks (i.e., risk propensity) is a critical trait related to entrepreneurs and it is deemed as a "hallmark of the entrepreneurial personality" (Baron, 2007; Begley & Boyd, 1987; Stewart & Roth, 2001; Zhao et al., 2010). Risk propensity is an important disposition because individuals who are inclined to undertake risk are interested in becoming entrepreneurs (Zhao et al., 2010). Meta-analytic findings demonstrated

that risk propensity is a positive and statistically significant predictor of entrepreneurial intention (Zhao et al., 2010). Due to these reasons, I provide following hypotheses.

Hypothesis 2a. Risk propensity is positively related to entrepreneurial start-up intention.

Hypothesis 2b. Risk propensity is positively related to entrepreneurial take-over intention.

Risk propensity and entrepreneurial self-efficacy. Compared to risk-averse individuals, risk seekers (i.e., individuals with high risk propensity) are more likely to attend to positive outcomes, overestimate opportunities, and underestimate threats; thus, risk seekers are relatively more self-efficacious (Barbosa, Gerhardt, & Kickul, 2007; Sitkin & Pablo, 1992). Within four mechanisms that influence the self-efficacy based on the social learning theory, risk propensity should exert an effect on the emotional arousal (Zhao et al., 2005). This dimension of social learning theory suggests that an individual relies on his/her physiological arousal to determine his/her perception of self-efficacy and an individual is more self-efficacious when he/she is not affected by aversive arousal. For individuals with high risk propensity, they generally feel confident that they can handle the roles and complete the tasks necessary for being a successful entrepreneur; in addition, they also feel comfortable in coping with risky situations and interpret the same situation as less risky than do others (Sitkin & Weingart, 1995; Zhao et al., 2005). Therefore, relative to risk-averse individuals, people with high risk propensity may experience less mood-dampening feelings (e.g., anxiety and frustration), have greater sense of control over outcomes, and perceive an entrepreneurial career as more feasible (Zhao et al., 2005). Based on these reasons, I offer the following hypothesis.

Hypothesis 3. Risk propensity is positively related to entrepreneurial self-efficacy.

Entrepreneurial self-efficacy and entrepreneurial intention. Self-efficacy reflects one's belief in one's capacity to successfully perform an intended act and reach one's goals;

further, it forms a motivational factor that influences processes, such as emotional and cognitive processes and employment of skills (Bandura, 1997; BarNir, Watson, & Hutchins, 2011; Gist & Mitchell, 1992; Wood & Bandura, 1989; Zhao et al., 2005). High-efficacy belief regarding performance in a specific setting causes an individual to approach that setting, whereas low-efficacy causes one to stay away from that setting (Wood & Bandura, 1989; Zhao et al., 2005). Entrepreneurial self-efficacy refers to one's belief in one's capacity to perform entrepreneurship-related roles and tasks (Chen et al., 1998) and research findings yield support for the positive relationship between entrepreneurial self-efficacy and entrepreneurial intention (BarNir, Watson, & Hutchins, 2011; Boyd & Vozikis, 1994; Chen et al., 1998; Wilson, Kickul, & Marlino, 2007). Boyd and Vozikis (1994) indicated that entrepreneurial self-efficacy is an important explanatory variable in determining entrepreneurial intention. Krueger and Brazeal (1994) argued that entrepreneurial self-efficacy is a key requirement of becoming a potential entrepreneur.

Chen et al. (1998) summarized two reasons why entrepreneurial self-efficacy influences entrepreneurial intention: (1) "the same entrepreneurial environment could be assessed as replete with opportunities by people with high ESE but fraught with costs and risks by people with low ESE" and (2) "even if people perceive an identical reality consisting of uncertainties, risks, and hardships, those with high ESE would feel more competent to deal with that reality than those with low ESE" (p. 301). Therefore, highly efficacious individuals perceive a low possibility of failure and are likely to relate challenging circumstances to rewards, whereas low efficacious persons are likely to harbor images of failures (Brockhaus, 1980; Chen et al., 1998; Hisrich & Brush, 1986). A recent meta-analysis by Schlaegel and Koenig (2014) reported a positive correlation between entrepreneurial self-efficacy and entrepreneurial intention. These lines of reasoning lead me to offer the following hypotheses.

Hypothesis 4a. Entrepreneurial self-efficacy is positively related to entrepreneurial start-up intention.

Hypothesis 4b. Entrepreneurial self-efficacy is positively related to entrepreneurial take-over intention.

Emotional Intelligence and entrepreneurial Intention. According to four branches emotional intelligence (EI) model (Mayer et al., 2003), EI refers to one's capacity to (1) perceive emotions, (2) use emotions to facilitate thought, (3) understand emotions, and (4) manage emotions. Ashkanasy and Humphrey (2011a, 2011b) proposed a five-level model of emotion where EI is located at the level two (i.e., between persons level) of this model. At this level, they indicated that individual traits determine the frequency, intensity, and duration of the experience of positive and negative emotions. Analogously, Affective Events Theory (AET; Weiss & Cropanzano, 1996) predicted that each individual has an average affective mood level and some tend to be negative whereas others tend to positive; further, this average mood level can be either diminished or elevated by positive or negative events (Humphrey et al., 2008; Humphrey, 2013b). The individuals who have an average emotional baseline in the positive half are able to return back to positive emotion quickly after experiencing mood-dampening events, whereas those who have an average emotional baseline in the negative half tend to experience negative moods more frequently (Humphrey, 2013b). It is generally agreed that individuals with high EI should have positive trait affect and be on the positive half of emotional baseline (Fox & Spector, 2000; Kong & Zhao, 2013). Carmeli (2003) indicated that emotionally intelligent individuals may consistently experience positive feeling and well-being, whereas individuals with low EI are generally angry, depressed, and disappointed. Sy, Tram, and O'Hara (2006) explained that emotionally intelligent individuals are more resilient and skilled at evaluating and

regulating their own emotions. They are also more able to understand the causes of stress and to devise plans to cope with negative outcomes than the ones with low EI. Kafetsios and Zampetakis (2008) demonstrated that use of emotion and being aware of one's own emotions associated with EI help one to regulate stress and negative emotion.

Entrepreneurs' job is fraught with risks and uncertainties, and becoming an entrepreneur means risking one's financial status, family relationship, and psychic well-being (Brockhaus, 1980). Based on the fit theory, emotionally intelligent individuals should fit the entrepreneurship career and be more likely to become an entrepreneur because they are able to conquer aversive feelings and stress and bounce back from negative feelings quickly by managing their emotion during the process of running a new venture. In addition, because emotionally savvy individuals have positive trait affect (Fox & Spector, 2000; Kong & Zhao, 2013), they are more likely to interpret things in positive light, to identify opportunities, and to be optimistic about the prospect of running a venture (Baron, 2008). Due to these reasons, I offer the following hypotheses.

Hypothesis 5a. EI is positively related to entrepreneurial start-up intention.

Hypothesis 5b. EI is positively related to entrepreneurial take-over intention.

Emotional intelligence and entrepreneurial self-efficacy. I argue that EI should positively influence entrepreneurial self-efficacy through emotional arousal. Social learning theory indicates that individuals will have an increased level of self-efficacy when aversive arousal does not pose a threat to them. As discussed above, emotionally intelligent individuals should be less vulnerable to aversive arousal. Compared to individuals with low EI who are generally angry, depressed, and disappointed, emotionally savvy individuals frequently experience positive feeling (Carmeli, 2003) because they are resilient and adept at appraising and regulating their own emotions; in addition, they have a clear understanding of the causes of stress

so that they know how to craft effective plans to cope with stress (Daus, & Ashkanasy, 2005; Sy et al., 2006). Therefore, emotionally intelligent individuals should perceive entrepreneurial career as more feasible and feel efficacious in dealing with risky situations associated with entrepreneurship because they are competent at managing their emotion to remain confident and composed and to stay away from feeling of anxiety and frustration when facing uncertain and stressful situations. Humphrey (2013a) theorized that emotionally intelligent individuals display resiliency when facing obstacles in starting their businesses and they are more likely to persist after encountering setbacks and crisis situations. Thus, emotionally intelligent individuals should have high entrepreneurial self-efficacy due to their capacity to maintain a positive emotional arousal. I provide the following hypothesis.

Hypothesis 6. EI is positively related to entrepreneurial self-efficacy.

Cognitive ability and entrepreneurial intention. Research suggested that there are cognitive differences between entrepreneurs and non-entrepreneurs and such differences spawn many studies to examine differences in decisions making processes, biases, and heuristics between entrepreneurs and non-entrepreneurs (Busenitz & Barney, 1997; Gaglio & Katz, 2001; Mitchell, Smith, Seawright, & Morse, 2000; Mitchell, 2003; Mitchell et al., 2002, 2004; Simon, Houghton, & Aquino, 2000). Nearly two decades ago, Busenitz and Barney (1997) empirically examined the differences in strategic decision making process between entrepreneurs and non-entrepreneurs. They found that entrepreneurs are more likely to take decision-making shortcut (i.e., make generalization from small and nonrandom sample [e.g., personal experience]). Cognitive difference also explains why some people but not others opt to become an entrepreneur (Mitchell et al., 2004). In sum, cognitive psychology provides strong implications for entrepreneurial intention research.

One of the most promising constructs in cognitive psychology is cognitive ability, which is defined as the “ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought” (p.77, Neisser et al., 1996). Schmidt (2002) concisely defined cognitive ability as “essentially the ability to learn” (p. 188). Cognitive intelligence consists of fluid intelligence and crystallized intelligence (Cattell, 1943; Horn & Cattell, 1966; McDaniel & Banks, 2010). The former refers to one’s capacity to solve new problems through reasoning and the latter reflects one’s capability to use prior knowledge and experience to solve problems. Examining the role of cognitive intelligence in the field of entrepreneurship is particularly important because personal characteristics of entrepreneurs determine the probability of new venture success and failure (Baum & Bird, 2010; Baum, Frese, Baron, & Katz, 2006; Bhide, 2000). Despite its obvious importance and increased attention to entrepreneurial cognition, Baum and Bird (2010) lamented that few studies addressed general or specific intelligence directly, and “intelligence has received little entrepreneurship research attention” (p. 397). This neglect of research about cognitive intelligence is also evidenced by the fact that none of the existing meta-analytic reviews addressed the role of it in shaping entrepreneurial intention and performance.

Based on the fit theory, I predict that intelligent individuals will have high entrepreneurial intention. The job of entrepreneurs is much more complex, less routine, riskier, and less certain than that of employees in the organization (Busenitz & Barney, 1997), and entrepreneurs should have “special aptitudes” to perceive and exploit opportunities (Schumpeter, 1934). Sternberg (2004) indicated that intelligence is required for successful entrepreneurship. The abilities–demand perspective of the fit theory indicates that individuals who have requisite skills to meet job demands are more likely to feel comfortable about the job, to perform better at it, and to be

attracted toward this job (Kristof, 1996; Vogel & Feldman, 2009; Zhao & Seibert, 2006). Thus, intelligent individuals should be gravitated toward the job of entrepreneurship due to the fit between abilities and job demand. Rauch and Frese (2007) demonstrated that highly intelligent people are more likely to start more firms. The above reasoning leads to the following hypotheses.

Hypothesis 7a. Cognitive ability is positively related to entrepreneurial start-up intention.

Hypothesis 7b. Cognitive ability is positively related to entrepreneurial take-over intention.

Cognitive ability and entrepreneurial self-efficacy. Cognitive ability should influence entrepreneurial self-efficacy through the emotional arousal mechanism of social learning theory and perceived feasibility mechanism of SEE and TPB. Cognitive ability is a significant predictor of job performance, earnings, and career advancement, and it helps individuals to move into more complex jobs (and thus probably jobs with higher pay) (Judge, Higgins, Thoresen, & Barrick, 1999). Judge et al. (2010) indicated that smart individuals can capitalize on their advantages of being intelligent to exploit opportunities and extract more benefits from them because cognitive ability positively influences one's knowledge acquisition. The job knowledge accumulated by intelligent individuals leads to higher performance, which can further be translated into higher pay and greater occupational prestige. Cognitive ability also predicts training performance because the skill and knowledge acquisition depends on learning, and the rate of learning is determined by cognitive ability (McDaniel & Banks, 2010). One's absorptive capacity is influenced by cognitive ability because cognitive ability sets limits on the complexity and amount of material that one can learn (O'Boyle & McDaniel, 2008).

Due to these reasons, I predict that cognitive ability should positively influence entrepreneurial self-efficacy through the emotional arousal mechanism of social learning theory and perceived feasibility mechanism of SEE and TPB. Research findings suggested that intelligence will lead to positive spiral so that smart individuals receive more psychosocial and instrumental support (Judge, Hurst, & Simon, 2009). It also positively influences core self-evaluation (one of the dimensions of it is self-efficacy) because the success caused by intelligence will produce positive feelings, and thus, positive emotional arousal. Therefore, cognitive ability is positively related to entrepreneurial self-efficacy. In addition, since cognitive ability determines the rating of learning and the complexity of materials that individuals can learn, smart individuals will accumulate more intellectual capital (Ceci & Papierno, 2005) and can learn and internalize more knowledge and skills related to entrepreneurship in the college. This enhances their perceptions of feasibility toward entrepreneurship because smart individuals will acquire more knowledge and skills required for successful entrepreneurship relative to less intelligent individuals. These lines of reasoning yield the following hypothesis.

Hypothesis 8. Cognitive ability is positively related to entrepreneurial self-efficacy.

Cognitive ability and need for cognition. Need for cognition is defined as “an individual’s tendency to engage in and enjoy effortful cognitive endeavors” (p. 306, Cacioppo, Petty, & Kao, 1984). Sadowski and Cogburn (1997) indicated that need for cognition is positively related to openness to experience because persons high in need for cognition enjoy cognitive activity. Meta-analytic findings demonstrated a positive and significant relationship between openness to experience and cognitive ability (Judge et al., 2007). Therefore, one can expect that cognitive ability should be positively related to need for cognition because intelligent

individuals are more likely to enjoy cognitive endeavors than less intelligent individuals. Due to these reasons, I offer the following hypothesis.

Hypothesis 9. Cognitive ability is positively related to need for cognition.

Need for cognition and entrepreneurial intention. As discussed above, need for cognition is related to creativity and individuals high in need for cognition enjoys cognitive endeavors (Cacioppo et al., 1984; Dollinger, 2003). In addition, innovation and creativity are two important factors determine one's likelihood to be an entrepreneur (Zhang & Arvey, 2009). Thus, individuals high in need for cognition are more likely to be an entrepreneur due to their propensity to be creative. The job of entrepreneurship is complex, non-routine, and risky (Busenitz & Barney, 1997) so that one needs to consistently engage in cognitive endeavors (e.g., learn new skills and knowledge and perform divergent thinking) to successfully search, implement, and exploit opportunities. Individuals high in need for cognition will be suitable candidates for being entrepreneurs because they feel comfortable of performing challenging cognitive tasks. I therefore provide following hypotheses.

Hypothesis 10a. Need for cognition is positively related to entrepreneurial start-up intention.

Hypothesis 10b. Need for cognition is positively related to entrepreneurial take-over intention.

Proactive personality and entrepreneurial intention. Individuals with high proactive personality are prone to find and solve problems to affect the world around them (Seibert, Crant, & Kraimer, 1999). They have the propensity to influence the environment around them and are more likely to identify and implement opportunities (Rauch & Frese, 2007). Prabhu, McGuire, Drost, and Kwong (2012) demonstrated that not all individuals recognize opportunities in the

same environment, and even among those who recognize opportunities, not all exploit them. Passive individuals generally fail to display initiative and are less likely to perceive opportunities to change things so that they are more likely to endure current environment rather than being entrepreneurial (Bateman & Crant, 1993; Fuller Jr. & Marler, 2009). On the contrary, proactive individuals are more likely to take advantage of opportunities to change the environment around them and to persist to bring about meaningful change (Fuller Jr. & Marler, 2009; Prabhu et al., 2012).

Research findings suggested that individuals high in proactive personality tend to be more entrepreneurial in their career orientation so that they constantly scan the environment for opportunities and take advantage of them; thus, proactive personality is portrayed as an entrepreneurial disposition (Fuller Jr. & Marler, 2009). Proactive individuals are also more likely to feel competent of pursuing entrepreneurial career opportunities (Fuller Jr. & Marler, 2009). Due to the fact that the career of entrepreneurship requires one to identify and exploit opportunities (Shane & Venkataraman, 2000), proactive individuals should fit the entrepreneurial career according to what have been discussed above. Due to these reasons, I provide the following hypotheses.

Hypothesis 11a. Proactive personality is positively related to entrepreneurial start-up intention.

Hypothesis 11b. Proactive personality is positively related to entrepreneurial take-over intention.

Proactive personality and entrepreneurial self-efficacy. Proactive personality should positively influence entrepreneurial self-efficacy through performance accomplishment mechanism of social learning theory and perceived feasibility mechanism of SEE and TPB. Prior

research demonstrated that individuals with high proactive personality are more likely to seize opportunities, exploit them, and produce meaningful changes toward the environment (e.g., Bateman & Crant, 1993; Fuller Jr. & Marler, 2009; Prabhu et al., 2012). Therefore, proactive individuals should have more personal mastery experience than passive individuals who are reactive toward the environment and fail to show initiative to recognize opportunities. Personal mastery experience catalyzes the development of entrepreneurial self-efficacy for proactive individuals.

Analogously, proactive individuals should also possess high perceived feasibility perception toward entrepreneurship. Since the job of entrepreneurship requires one to identify, implement, and exploit opportunities to bring about changes, this exactly matches with the disposition of a proactive individual who enjoys showing initiative to perceive opportunities and change the environment. Proactive individuals should thereby perceive the job of entrepreneurship as highly feasible because their abilities fit the requirements of this job. Due to above reasons, I provide the following hypothesis.

Hypothesis 12. Proactive personality is positively related to entrepreneurial self-efficacy.

Proactive personality and need for cognition. Research findings suggested that proactive individuals are curious about the future and the methods to seize opportunities and they are driven by a strong desire to learn (i.e., learning orientation) skills and knowledge. Proactive individuals are also creative because creativity requires one to make mental breakthrough via hard work and unstoppable flow of thought, and proactive individuals are the ones who are unconstrained by the environment and consistently look for and exploit opportunities until meaningful changes happen (Amabile, 1996; Chang & Chen, 2013; Crant, 2000; Major, Turner, & Fletcher, 2006; Shalley, 1995; Zhou & Shalley, 2003). Proactive individuals are prone to

display creative behaviors because they feel obligated to improve the world around them (Fuller Jr. & Marler, 2009; Kim, Hon, & Crant, 2009). Meta-analytic findings demonstrated that proactive personality is positively related to creativity (Fuller Jr. & Marler, 2009).

Research findings also supported that highly creative persons have high need for cognition (Dollinger, 2003). Hence, proactive individuals should also possess a high need for cognition because creative behaviors (displayed by proactive individuals) require cognitive efforts and proactive individuals enjoy cognitive endeavors. For example, a person high in need for cognition enjoys learning (Cacioppo et al., 1984); similarly, proactive individuals have an orientation to learn. This example clearly demonstrates a relationship between need for cognition and proactive personality. These lines of reasoning lead to the following hypothesis.

Hypothesis 13. Proactive personality is positively related to need for cognition.

Rebelliousness and entrepreneurial intention. Rebelliousness is a psychological trait related to entrepreneurship (Dyer & Handler, 1994; Pines, Dvir, & Sadeh, 2012; Schwartz & Malach-Pines, 2009) because entrepreneurs are known to deviate from social norms, to break rules, and to refine existing frameworks of understanding (Webb, Ireland, & Ketchen, 2014). Rule breaking reflects two motives of an individual – need for independence and autonomy, which are strongly associated with creativity and innovation in one’s future behaviors. Hence, entrepreneurship researchers consider rule breaking as similar to innovation and creativeness, which are two critical factors influencing the probability of being a successful entrepreneur (Zhang & Arvey, 2009). Non-conformistic rebelliousness is cited as the entrepreneur’s mode of behavior because entrepreneurs have strong desires to exert power and control over the environment (De Vries, 1977). The capacity to challenge socially accepted norms and the status quo is an essential condition to be a successful entrepreneur (Zhang & Arvey, 2009).

Nevertheless, becoming an entrepreneur is considered as a long, lonely, and difficult road so that individuals who become entrepreneurs are not incredibly likeable, which makes them unable to fit comfortably into traditional organizational life (Stanworth, Stanworth, Granger, & Blyth, 1989). Some entrepreneurs even have depressing early childhood experiences (e.g., unhappy family background) so that they become plagued by burdensome psychological inheritance when they grow up, which makes them less likely to conform to authority and to work cooperatively with others. All of these factors finally motivate them to be an independent economic unit (De Vries, 1977; Stanworth et al., 1989).

Sexton and Upton (1987) found that entrepreneurship student tend to be more rebellious and unmanageable and enjoy change and new experiences. Research findings also revealed that entrepreneurs are generally more rebellious and unruly during their teenage years than non-entrepreneurs (Coetzee, 2014; Obschonka, Andersson, Silbereisen, & Sverke, 2013; Zhang & Arvey, 2009). The need for autonomy and independence underlying rule breaking (rebelliousness) allows one to be habitual of thinking “out of the box” and to show innovative behaviors, which foster one to behave entrepreneurially. Based on a longitudinal study, Zhang and Arvey (2009) found that many entrepreneurs are rule breakers and rule breaking is positively related to entrepreneurial status. Another similar study by Obschonka et al. (2013) also indicated that rule-breaking is a positive predictor of entrepreneurial career.

Based on the above reasoning and evidence, it can be seen that individuals, who deviate from norms, challenge the status quo, enjoy independence and autonomy, and break rules, are more likely to be entrepreneurs; further, all of these characteristics are captured by the trait rebelliousness (Cloninger, 1994). Thereby, I derive the following hypotheses.

Hypothesis 14a. Rebelliousness is positively related to entrepreneurial start-up intention.

Hypothesis 14b. Rebelliousness is positively related to entrepreneurial take-over intention.

Rebelliousness and entrepreneurial self-efficacy. I predict that rebelliousness is positively related to entrepreneurial self-efficacy through the mechanism of perceived feasibility of SEE and TPB. Rebellious persons are rule breakers and feel proud of taking risks and deviating from social norms (Lee & Bichard, 2006). More importantly, they are creative rule breakers who enjoy renovating the existing frameworks and redefining the way of understanding (Webb et al., 2014). Therefore, they are unlikely to fit comfortably into conventional organizational life (Stanworth et al., 1989). Due to their capacity to be innovative and desire to exert power and control over an environment, rebellious individuals will find entrepreneurial career particularly feasible for them because their abilities fit the demand of being an entrepreneur and their need for autonomy and independence can be satisfied by becoming their own boss. Since perceived feasibility is synonymous with entrepreneurial self-efficacy (Shook et al., 2003), I therefore offer the following hypothesis.

Hypothesis 15. Rebelliousness is positively related to entrepreneurial self-efficacy.

Mediating role of entrepreneurial self-efficacy and need for cognition. Many scholars (e.g., Baum, Frese, & Baron, 2007; Baum & Locke, 2004; Herron & Robinson, 1993; Rauch & Frese, 2007) suggested that motivation is an important mediator between individual traits and entrepreneurial outcomes. However, empirical testing of mediating processes has been sparse in the entrepreneurship literature (Rauch & Frese, 2007). One exception is Zhao et al.'s (2005) study, which demonstrated that the relationship between risk propensity and entrepreneurial intention is mediated by entrepreneurial self-efficacy. Since both entrepreneurial self-efficacy and need for cognition are motivations (Chen et al., 1998; Fleischhauer et al., 2010; Sadowski &

Cogburn, 1997), I predict that they will mediate the relationship between individual traits and entrepreneurial intentions as suggested by prior literature. I also argue that this mediation should be a partial mediation rather than full mediation because there may also be some other variables that can mediate these relationships (e.g., entrepreneurial alertness; Busenitz, 1996; Tang, Kacmar, & Busenitz, 2012). Based on these reasons, I offer the following hypotheses.

Hypothesis 16. Entrepreneurial self-efficacy partially mediates the relationship between individual traits (i.e., emotional intelligence, cognitive ability, risk propensity, proactive personality, and rebelliousness) and entrepreneurial (i.e., start-up and take-over) intentions.

Hypothesis 17. Need for cognition partially mediates the relationship between individual traits (i.e., cognitive ability and proactive personality) and entrepreneurial (i.e., start-up and take-over) intentions.

Self-reported rating versus observer rating of individual traits. Nearly all studies regarding the relationship between individual traits and entrepreneurial intention relied on the quantitative data collected based on the self-reported rating of both individual traits and entrepreneurial intention. The results based on self-reported responses on both the predictor and the criterion may make the conclusions vulnerable to a few problems associated with common method bias, because research findings suggested that self-report bias may produce the artifactual covariance between the predictor and the criterion if responders provide responses on the measures of these two variables simultaneously (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). This common rater effects can be caused by consistency motif, illusory correlations, leniency biases, and transient mood state (Podsakoff et al., 2003). Thus, Sackett and Lievens (2008) indicated that it may be desirable to collect responses on the same construct by using different methods than self-reports.

The validity of observer rating of individual traits, such as personality, has demonstrated to be promising (e.g., Connolly, Kavanagh, & Viswesvaran, 2007; Mount et al., 1994; Oh et al., 2011; Zimmerman, Triana, & Barrick, 2010) because observers are not influenced by the focal responders' self-deception and they are less likely to exaggerate their evaluations of the focal individuals (Zimmerman et al., 2010). An earlier study by Mount et al. (1994) revealed that observer rating of personality contributes significant incremental variance above and beyond self-reports of personality. A recent meta-analysis by Oh et al. (2011) demonstrated that observer rating of personality traits yields significant incremental validity over self-reported rating of personality traits. An earlier meta-analysis by Connolly, Kavanagh, and Viswesvaran (2007) also indicated that, although these two methods of ratings of personality are strongly correlated, they are not perfectly related because the differences between these two types of ratings are substantive and not merely due to statistical artifacts. In light of the differences between self-reported and observer ratings of individual traits, I provide the following hypotheses.

Hypothesis 18a. Observer ratings of individual traits will exhibit incremental validity in predicting entrepreneurial start-up intention above and beyond self-reported ratings of individual traits.

Hypothesis 18b. Observer ratings of individual traits will exhibit incremental validity in predicting entrepreneurial take-over intention above and beyond self-reported ratings of individual traits.

III. METHOD

Consistent with previous studies examining entrepreneurial intention (De Clercq, Honig, & Martin, 2013; Douglas, 2013; Fitzsimmons & Douglas, 2011; Krueger et al., 2000; Levesque & Minniti, 2006; Mueller & Thomas, 2001), I tested hypotheses based on quantitative data collected from university students. The participants of the present study are the students at the School of Business at Virginia Commonwealth University. Prior literature has demonstrated that university students are ideally suitable for the study of entrepreneurial intention (De Clercq, Honig, & Martin, 2013; Krueger et al., 2000).

Study personnel briefly described the purpose of this study to potential participants during their classes. Participation in the present study was entirely voluntary. Students who were interested were invited to participate and they completed a consent form before they participated in this study. In addition to completing a self-reported questionnaire, participating students were also asked to provide three email addresses of people who are familiar with them and who would be willing to provide observer ratings of their (i.e., the participating students') individual traits. Those who decided to provide observer rating of individual traits were also required to complete a consent form before they participated in the present study. Both participating students and their observers were assigned a survey code and they used this survey code throughout the entire survey study without showing their identities. Their responses were matched based on the code reported on their survey. All participants were informed of the anonymous nature of this study so

that they were motivated to respond to questionnaires as honest and accurate as possible. Participating students were rewarded with extra credits toward the courses taken by them.

I introduced a two weeks time interval (i.e., temporal separation) during the data collection process to minimize the influence of common method bias on effect sizes (Podsakoff et al., 2003). Temporal separation is an effective way to reduce common method variance (CMV) because Johnson, Rosen, and Djurdjevic (2011) evaluated different statistical and procedural remedies that help to alleviate CMV and they found that a procedural remedy, temporal separation, is the most effective method for minimizing CMV. Reminder emails were sent out twice to increase response rate. I received responses from 407 students and 754 responses from their observers. I excluded respondents who had broken or crooked fingers since that would have hindered the measurement of the 2D:4D ratio. The subjects with severe missing responses were removed as well. I also eliminated left-handed respondents because prior research suggested a strong interaction effect between hand preference and 2D:4D ratio (Manning & Peters, 2009). I incorporated a quality control item in the survey to improve the quality of data (Buhrmester, Kwang, & Gosling, 2011). The present data collection involves one quality control item, “Did you answer truthfully on all of these questions?” Participants (including observers) who failed to answer this question with a “Yes” were excluded from analyses. Since students have multiple observers to rate their individual traits, I incorporated an item to assess their observers’ familiarity with them on a scale from 1 to 10. When multiple observers rated a participating student’s individual traits, I first excluded one or two observers’ responses if their familiarity with a participating student is greatly lower than other observers’ familiarity with this same participating student. In the case when familiarity with a student is similar or identical across different observers, I randomly chose one observer’s response (Mount

et al., 1994). After completing the steps described above, I matched all participants' responses according to their survey codes. I did a visual inspection of all students' as well as their observers' responses to assess their level of attention when answering their surveys. Since there are many reverse-worded items in the survey that require respondents to carefully answer their surveys, I eliminated one's responses if one's responses have no variance across all items. After completing the above procedures, I have 321 subjects along with 264 observers whose responses were eligible for analyses. This sample size is acceptable since prior research demonstrated that a sample size of 200 is sufficient for structural equation modeling (SEM) (Bagozzi & Yi, 2012; Garver & Mentzer, 1999; Harris & Schaubroeck, 1990; Hoelter, 1983; Hoe, 2008; Kline, 2011).

Measures

2D:4D ratio. The participants were instructed to place both hands palm down on a scanner for 20 seconds. The CanoScan LiDE210 scanner was used to scan the hands. The hands were covered by a black cloth while they were scanned to capture the finger length. 2D:4D ratio was calculated by the second-to-fourth digit length ratio (i.e., the ratio of the length of the index finger to the length of the ring finger). The measurement technique of 2D:4D ratio in the present study was consistent with the approaches suggested by Manning (2002). I measured 2D:4D ratio by using the Autometric software developed by DeBruine (2004) because research demonstrated that this software-based measurement has the highest accuracy relative to all other common measurement methods (e.g., ruler/caliper based measurement) (Kemper & Schwerdtfeger, 2008). Right hand 2D:4D ratio was used for analysis because right hand 2D:4D ratio is more strongly influenced by prenatal testosterone than left hand 2D:4D ratio (Lutchmaya et al., 2004; Zheng & Cohn, 2011).

Emotional intelligence. Emotional intelligence (EI) was assessed by the EI scale developed by Wong and Law (2002). I used 7-point scale anchored by 1 (strongly disagree) to 7 (strongly agree). I adapted Wong and Law's (2002) scale by removing the word "always" from survey items. The word "always" may cause confusion because "always" is ambiguous with respect to frequency. For instance, someone may perceive their friends' emotions from their behavior under most circumstances but not all the time. If this respondent interprets the word "always" synonymous with "all the time", he/she may choose "disagree" or "strongly disagree" to respond to this item, whereas "strongly agree" or "agree" may be more appropriate response in reality. A sample item is "I have a good sense of why I have certain feelings most of the time". Cronbach's alphas were .899 and .936 for self-reported and observer ratings of EI.

Cognitive ability. Wonderlic Classic Cognitive Ability Test was administered to measure participants' cognitive ability. It was a proctored 12 minutes test. The present study got the approval from Wonderlic, Inc. to use this test.

Risk propensity. Risk propensity was assessed by the scale from Jackson Personality Inventory (Jackson, 1994). A 5-point scale anchored by 1 (inaccurate) to 5 (accurate) was used. A sample item is "You enjoy being reckless". Cronbach's alphas were .769 and .827 for self-reported and observer ratings of risk propensity.

Proactive personality. Proactive personality was measured by the scale developed by Seibert et al. (1999). I used a 7-point scale anchored by 1 (strongly disagree) to 7 (strongly agree). A sample item is "I am constantly on the lookout for new ways to improve my life". Cronbach's alphas were .910 and .926 for self-reported and observer ratings of proactive personality.

Rebelliousness. Rebelliousness was assessed by the scale from Cloninger's Temperament and Character Inventory (TCI; Cloninger, 1994). I used 5-point scale anchored by 1 (strongly disagree) to 5 (strongly agree). Respondents were presented with a number of characteristics that may or may not describe them and they were asked to rate the extent to which they agreed or disagreed with each statement. A sample statement is "Break rules". Cronbach's alphas were .817 and .834 for self-reported and observer ratings of rebelliousness.

Entrepreneurial self-efficacy. Entrepreneurial self-efficacy was assessed by the scale developed by Chen et al. (1998). Respondents were presented with a set of roles and tasks that many business owners or managers often have to perform. They were asked to rate how sure they were in performing each of the roles and tasks based on a 5-point scale anchored by 1 (completely unsure) to 5 (completely sure). A sample role and task is "Setting and meeting market share goals". Cronbach's alpha was .925.

Need for cognition. Need for cognition was assessed by the scale developed by Cacioppo, Petty, and Kao (1984). I used a 9-point scale anchored by +4 (very strong agreement) to -4 (very strong disagreement). A sample item is "I would prefer complex to simple problems". Cronbach's alpha was .882.

Entrepreneurial start-up intention. The entrepreneurial start-up intention was assessed by the scale developed by Chen et al. (1998). Respondents rated first three items on a 5-point scale anchored by 1 (very little) to 5 (very much). Item 4 and item 5 were rated on 5-point scales anchored by 1 (very unlikely) to 5 (very likely) and by 1 (never) to 5 (within a few months) respectively. A sample item is "How interested are you in setting up your own business?" Cronbach's alpha was .920.

Entrepreneurial take-over intention. I adapted entrepreneurial start-up intention scale developed by Chen et al. (1998) to measure entrepreneurial take-over intention. I replaced the word “set up” with “take over”. Respondents rated first three items on a 5-point scale anchored by 1 (very little) to 5 (very much). Item 4 and item 5 were rated on 5-point scales anchored by 1 (very unlikely) to 5 (very likely) and by 1 (never) to 5 (within a few months) respectively. A sample item is “How interested are you in taking over a business/businesses?” Cronbach’s alpha was .905.

Control variables. In line with previous entrepreneurship studies (e.g., De Clercq, Honig, & Martin, 2013; Douglas, 2013; Fitzsimmons & Douglas, 2011; Shane, 2003), I controlled for participants’ gender, age, prior work experience, prior entrepreneurial experience, academic major, and entrepreneurial family background. To address the common criticisms regarding whether EI predicts outcomes in the presence of Big Five personality traits and cognitive ability, I ran regression analyses by controlling for both Big Five personality traits and cognitive ability to improve the methodological rigor of our study (Kluemper, DeGroot, & Choi, 2013). Cronbach’s alphas were .848, .776, .786, .767, and .768 for extraversion, agreeableness, conscientiousness, neuroticism, and openness.

IV. DATA ANALYSES AND RESULTS

The Association between Individual Traits and Entrepreneurial Intentions

Means, standard deviations, and correlations for all variables examined in this study are displayed in Table 1. Tables 2 through 6 include the tests of the hypotheses, and Table 7 provides a summary of the results.

Table 1. Means, Standard Deviations, Reliabilities, and Intercorrelations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
Control Variables												
1. Age	24.84	5.91										
2. Gender	0.51	0.50	.018									
3. Ent Major	0.14	0.35	-.055	.024								
4. Ent Exp	0.48	1.65	.339**	.051	.186**							
5. Ent Family	0.67	0.47	-.021	-.027	.039	.088						
6. Work Exp	6.22	5.30	.750**	-.008	-.048	.381**	.055					
7. Extraversion	3.38	0.77	-.032	-.072	.041	.087	.060	.018	(.848)			
8. Agreeableness	3.89	0.58	.122*	-.172**	-.011	-.047	-.002	.091	.109 [†]	(.776)		
9. Conscientiousness	3.77	0.61	.105 [†]	-.131*	.029	.022	-.034	.135*	.150**	.449**	(.786)	
10. Neuroticism	2.68	0.67	-.094 [†]	-.256**	-.065	-.069	.002	-.085	-.225**	-.327**	-.347**	(.767)
11. Openness	3.66	0.57	.002	-.017	.160**	.164**	.057	.076	.325**	.081	.144**	-.164**
Hypothesized Variables												
12. Right Hand 2D:4D	0.95	0.03	.055	-.242**	-.013	.092	.050	.063	.061	.106 [†]	.069	.056
13. Risk Propensity	2.93	0.68	-.117*	.232**	.128*	.015	.094 [†]	.008	.264**	-.318**	-.301**	-.050
14. EI	5.81	0.75	.076	-.157**	.046	.085	.019	.094 [†]	.251**	.470**	.506**	-.432**
15. Cognitive Ability	24.87	6.23	.047	.194**	.083	.094 [†]	-.064	.046	.125*	-.163**	-.036	-.107 [†]
16. Proactive Personality	5.55	0.88	-.035	-.069	.090	.101 [†]	.068	.037	.333**	.192**	.478**	-.171**
17. Rebelliousness	2.43	0.64	-.077	.206**	.151**	.041	.078	-.012	.120*	-.479**	-.502**	.117*
18. ESE	3.80	0.59	-.064	.129*	.040	.109 [†]	.067	.043	.283**	.048	.266**	-.281**
19. NFC	0.93	1.09	.190**	0.093 [†]	.102 [†]	.086	-.025	.180**	.234**	.181**	.415**	-.342**
20. Ent Start-Up Int	3.04	1.11	.065	.182**	.307**	.306**	.173**	.096 [†]	.088	-.064	.060	-.113*
21. Ent Take-Over Int	2.64	1.03	-.101 [†]	.085	.086	.093 [†]	.176**	-.055	.113*	-.029	.035	-.001

Note: $N = 321$. List-wise deletion was used. Gender (0 = female, 1 = male); Ent Major = Entrepreneurship Major (0 = non-entrepreneurship major students, 1 = entrepreneurship major students); Ent Exp = Entrepreneurial Experience (in years); Ent Family = Entrepreneurial Family Background (0 = having no close family member who is or was self-employed, 1 = having a close family member who is or was self-employed); Work Exp = Work Experience (in years); EI = Emotional Intelligence; ESE = Entrepreneurial Self-Efficacy; NFC = Need for Cognition; Ent Start-Up Int = Entrepreneurial Start-Up Intention; Ent Take-Over Int = Entrepreneurial Take-Over Intention. Reliabilities are displayed in parentheses. [†] $p < .1$, two-tailed * $p < .05$, two-tailed ** $p < .01$, two-tailed

Table 1. Means, Standard Deviations, Reliabilities, and Intercorrelations Continued

Variables	Mean	SD	11	12	13	14	15	16	17	18	19	20	21
<u>Control Variables</u>													
1. Age	24.84	5.91											
2. Gender	0.51	0.50											
3. Ent Major	0.14	0.35											
4. Ent Exp	0.48	1.65											
5. Ent Family	0.67	0.47											
6. Work Exp	6.22	5.30											
7. Extraversion	3.38	0.77											
8. Agreeableness	3.89	0.58											
9. Conscientiousness	3.77	0.61											
10. Neuroticism	2.68	0.67											
11. Openness	3.66	0.57	(.768)										
<u>Hypothesized Variables</u>													
12. Right Hand 2D:4D	0.95	0.03	.071										
13. Risk Propensity	2.93	0.68	.263**	-.092 [†]	(.769)								
14. EI	5.81	0.75	.307**	.114*	-.145**	(.899)							
15. Cognitive Ability	24.87	6.23	.103 [†]	.016	.148**	-.017							
16. Proactive Personality	5.55	0.88	.470**	.069	.086	.453**	-.068	(.910)					
17. Rebelliousness	2.43	0.64	.088	-.086	.625**	-.316**	.142*	-.145**	(.817)				
18. ESE	3.80	0.59	.374**	-.018	.225**	.292**	.011	.446**	.032	(.925)			
19. NFC	0.93	1.09	.372**	-.032	.150**	.333**	.214**	.405**	-.065	.322**	(.882)		
20. Ent Start-Up Int	3.04	1.11	.258**	-.039	.220**	.053	-.126*	.264**	.124*	.318**	.168**	(.920)	
21. Ent Take-Over Int	2.64	1.03	.031	-.052	.242**	.045	-.172**	.214**	.181**	.273**	.045	.469**	(.905)

I used hierarchical multiple regression analyses to test how individual traits relate to entrepreneurial intentions (see Table 2). I found that risk propensity is positively related to both entrepreneurial start-up ($\beta = 0.13, p < .05$) and take-over intentions ($\beta = 0.20, p < .01$). Proactive personality is also positively related to both entrepreneurial start-up ($\beta = 0.16, p < .01$) and take-over intentions ($\beta = 0.19, p < .01$). Therefore, Hypotheses 2a, 2b, 11a, and 11b were supported. I also found support for hypothesis 14b, indicating that rebelliousness is positively related to entrepreneurial take-over intention ($\beta = 0.16, p < .05$). Nevertheless, results demonstrated that rebelliousness is not related to entrepreneurial start-up intention; as such, hypothesis 14a is not supported. In addition, hypotheses 5a and 5b were not supported, suggesting that EI was not associated with either entrepreneurial start-up or take-over intentions. It is also interesting to note that cognitive ability was negatively related to both entrepreneurial start-up ($\beta = -0.22, p < .001$) and take-over intentions ($\beta = -0.20, p < .001$), which is opposite to what I hypothesized. Hypotheses 7a and 7b were not supported because results demonstrated that intelligent individuals have less intention to become entrepreneurs.

Table 2. Hierarchical Regression Analyses for Individual Traits in Predicting Entrepreneurial Intentions

	DV = Ent. Start-Up Int.		DV = Ent. Take-Over Int.	
	Model 1	Model 2	Model 3	Model 4
	β	β	β	β
Work Experience	-0.00(0.08)	-0.03(0.08)	-0.02(0.09)	-0.08(0.08)
Gender	0.17** (0.05)	0.17** (0.05)	0.12* (0.06)	0.10 [†] (0.06)
Entrepreneurship	0.23*** (0.05)	0.23*** (0.05)	0.05(0.06)	0.02(0.05)
Major				
Ent. Family	0.14** (0.05)	0.11* (0.05)	0.16** (0.06)	0.12* (0.05)
Background				
Age	0.01(0.08)	0.06(0.07)	-0.12(0.08)	-0.04(0.08)
Ent. Experience	0.21*** (0.06)	0.22*** (0.05)	0.11 [†] (0.06)	0.13* (0.06)
Extraversion	0.00(0.05)	-0.02(0.06)	0.11 [†] (0.06)	0.03(0.06)
Agreeableness	-0.08(0.06)	-0.08(0.06)	-0.01(0.06)	0.04(0.07)
Conscientiousness	0.08(0.06)	0.05(0.07)	0.09(0.06)	0.11(0.07)
Neuroticism	-0.01(0.06)	-0.04(0.06)	0.07(0.07)	0.08(0.07)
Openness	0.18** (0.05)	0.11* (0.06)	-0.04(0.06)	-0.16* (0.06)
Risk Propensity		0.13* (0.07)		0.20** (0.07)
EI		-0.05(0.07)		0.05(0.07)
Rebelliousness		-0.02(0.07)		0.16* (0.08)
Proactive		0.16** (0.07)		0.19** (0.07)
Personality				
Cognitive Ability		-0.22*** (0.05)		-0.20*** (0.06)
R^2	0.24***	0.32***	0.08**	0.21***
ΔR^2		0.08***		0.13***

Note: $N = 321$. List-wise deletion was used. Standard errors of β were shown in parentheses. β = standardized regression weights; R^2 = multiple correlations; ΔR^2 = incremental change in R^2 ; EI = emotional intelligence; Ent. = Entrepreneurial; Int. = Intention. Statistical significance tests were one-tailed for hypothesized variables and two-tailed for control variables. [†] $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

The Mediating Role of Entrepreneurial Self-Efficacy and Need for Cognition

The proposed conceptual model was tested by SEM. I used IBM® SPSS® AMOS to perform SEM with maximum likelihood estimation. In light of the adverse influence of non-normality on coefficient estimates, their standard errors, as well as some fit indices in SEM (Brown, 2006; Byrne, 2001), I examined the degree of non-normality by assessing the Skewness and Kurtosis values of all indicator variables (Hurtz & Williams, 2009; Kline, 2011). I found that Skewness and Kurtosis values of all indicator variables in the dataset fall within the range of $-/+ 3$ and $-/+ 10$, demonstrating that non-normality should not pose a threat to SEM model. In addition, I used maximum likelihood estimation in SEM, which is an estimation technique that is quite robust for small to moderate violations of assumption of non-normality (Brown, 2006; Byrne, 2001), thus further minimizing the influence of non-normality on the SEM model.

I followed Anderson and Gerbing's (1988) two-step approach to SEM. The first step was to assess the soundness of measurement model by using confirmatory factor analyses (CFA). The second step is to test and contrast a series of nested structural models to assess which model best accounts for the covariance among all exogenous and endogenous variables. I created parcels by combining item scores and used them as indicators for latent constructs (Kline, 2011; Little, Cunningham, Shahar, & Widaman, 2002; Williams & O'Boyle, 2008; Williams, Vandenberg, & Edwards, 2009). I reported several goodness-of-fit indices, such as Tucker–Lewis coefficient (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). A value of .90 or higher for CFI, .90 or higher for TLI, .08 or lower for RMSEA, and .10 or lower for SRMR are typically said to demonstrate adequate fit (Hu & Bentler, 1995, 1999; Weston & Gore, 2006). I performed χ^2 difference test to compare a set of nested models.

The first phase of Anderson and Gerbing's (1988) two-step approach is to determine the fit of a CFA model with observed data. I found that two fit indices of this baseline model (Model 1 in Table 3) fail to meet the criteria of adequate fit (CFI = .89 and TLI = .86). I examined modification indices to identify the sources where model misfit emanates from. I found that adding two covariance between the items of entrepreneurial start-up intention and of entrepreneurial take-over intention would greatly improve model fit indices. Usage of modification indices for model respecification should be consistent with theory (Bell & Kozlowski, 2008). Given that the measurement items of entrepreneurial start-up intentions are similar to these of entrepreneurial take-over intentions, this may explain why modification indices can be so high and adding covariance between items from these two constructs is justified. After covariance is introduced to the measurement model (see Model 2 in Table 3), χ^2 was reduced by 171.56 ($p < .001$) and all model fit indices met the cutoff value of acceptable fit (CFI = .92, TLI = .90, RMSEA = .05, and SRMR = .05). All factor loadings from items to their respective constructs were significant and exceeded the recommended level of .50, suggesting the link between indicators and constructs and thus convergent validity (Hair, Black, Babin, Anderson, & Tatham, 2006).

Table 3. Comparison of Measurement and Structural Models.

	χ^2	<i>df</i>	<i>p</i> value of χ^2	CFI	TLI	RMSEA	SRMR	χ^2 Comparison	$\Delta\chi^2(\Delta df)$
Criteria of adequate fit	-	-	-	>.90	>.90	<.08	<.10		
Comparison of measurement models									
Model 1: Baseline Model	1161.27	517	.000	.89	.86	.06	.05		
Model 2: Revised Model (Covariance Added)	989.71	515	.000	.92	.90	.05	.05	Model 2 vs. Model 1	171.56*** (2)
Model 3: Alternative Model (Combine two types of entrepreneurial intentions)	1953.11	530	.000	.77	.71	.09	.07	Model 3 vs. Model 2	963.40*** (15)
Comparison of structural models									
Model 4: Hypothesized Model	1703.89	598	.000	.82	.80	.08	.10		
Model 5: Revised Model	925.53	446	.000	.91	.90	.06	.07	Model 5 vs. Model 4	778.36*** (152)

Note: *N* = 321. List-wise deletion was used. *df* = degree of freedom; CFI = comparative fit index; TLI = Tucker–Lewis Index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation. *** *p* < .001, two-tailed

To further assess the construct convergent and discriminant validity of entrepreneurial start-up and take-over intentions, I combined these two types of entrepreneurial intentions. The results showed that χ^2 was increased by 963.40 ($p < .001$) and model fit indices were worsen and failed to meet the criteria of adequate fit (CFI = .77, TLI = .71, and RMSEA = .09). Additionally, I applied exploratory factory analysis using principal axis factoring with a promax rotation method. The analysis demonstrated an anticipated two factor structure and revealed that factor loadings were close or above .70 and cross-loadings below .10, suggesting convergent validity and discriminant validity of both constructs (Jansen, Van Den Bosch, & Volberda, 2006). In addition, the correlation between entrepreneurial start-up and take-over intentions was .469, which is below the critical level of .65 (Tabachnick & Fidell, 1996). Thus, I found some evidence to support that entrepreneurial start-up intention is different from take-over intention.

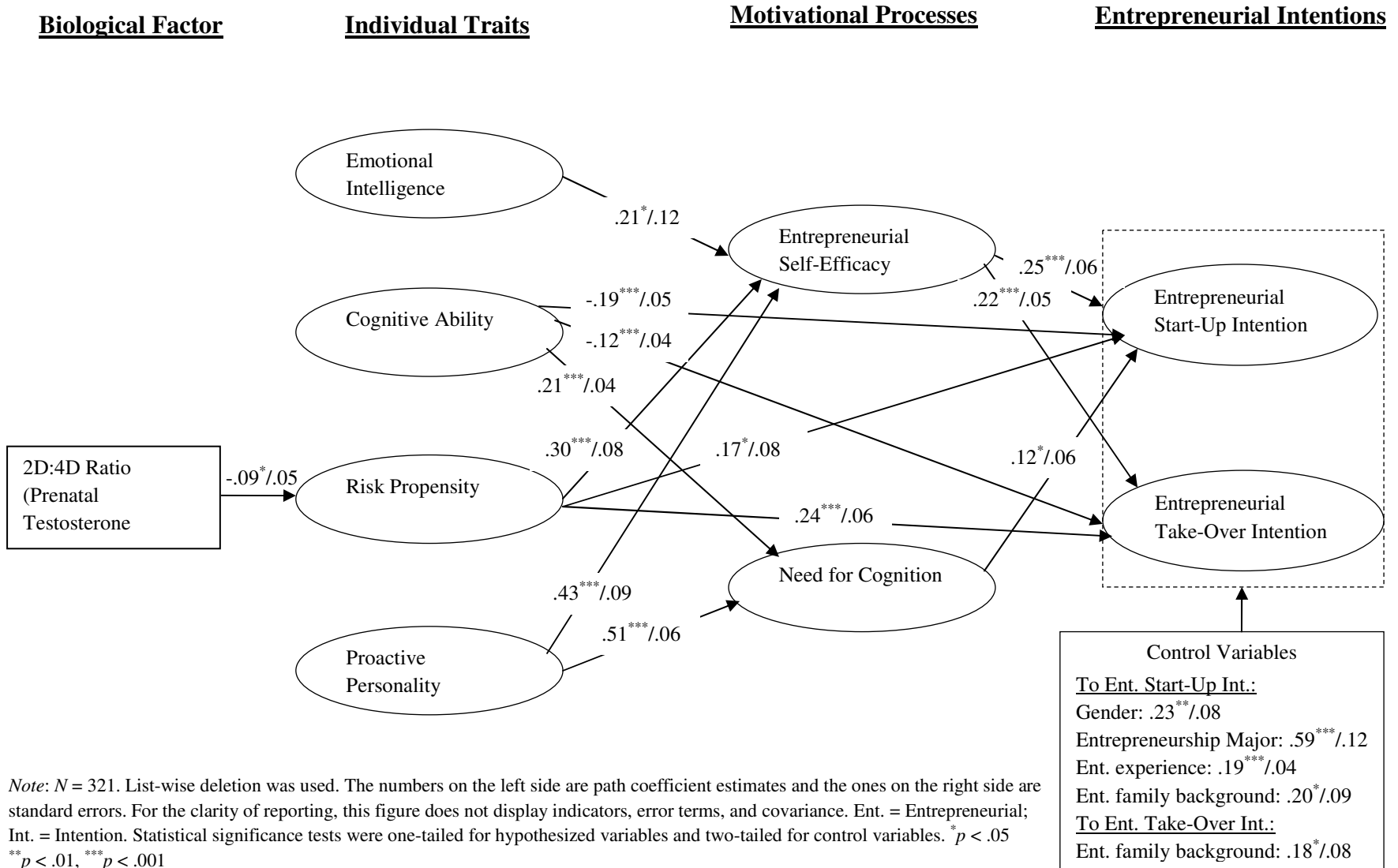
The second phase of Anderson and Gerbing's (1988) two-step approach is to find a model that best accounts for the covariance among all exogenous and endogenous variables. I fitted the data to the hypothesized model (see Model 4 in Table 3) and the model fit indices failed to meet the criteria (CFI = .82, TLI = .80, RMSEA = .08, and SRMR = .10). Thus, I modified the hypothesized model by trimming paths that were insignificant and I trimmed paths one at a time (Hurtz & Williams, 2009). After making modifications to the structural model, age, work experience, and rebelliousness all had insignificant paths and thus were trimmed so that their parameters no longer need to be estimated by AMOS. In addition, a few direct paths from individual traits to two types of intentions were removed due to lack of statistical significance. As a result, the χ^2 value of revised model (Model 5 in Table 3) was markedly reduced by 778.36 ($p < .001$) relative to originally hypothesized model. This revised model displayed adequate fit

(CFI = .91, TLI = .90, RMSEA = .06, and SRMR = .07). All path coefficient estimates were shown in Figure 2.

The path model (Figure 2) displayed how biological factor, individual traits, motivational processes, and entrepreneurial intentions are related. This model showed that 2D:4D ratio is negatively related to risk propensity ($b = -.09, p < .05$). As such, hypothesis 1 is supported. It is also noted that risk propensity ($b = .30, p < .001$), EI ($b = .21, p < .05$), and proactive personality ($b = .43, p < .001$) were positively related to entrepreneurial self-efficacy. Thus, hypotheses 3, 6, and 12 were supported. In addition, cognitive ability ($b = .21, p < .001$) and proactive personality ($b = .51, p < .001$) were positively related to need for cognition. Hypotheses 9 and 13 were supported. However, neither rebelliousness nor cognitive ability were related to entrepreneurial self-efficacy; as such, hypotheses 8 and 15 were not supported.

In terms of the association between motivational processes and entrepreneurial intentions, I found that entrepreneurial self-efficacy has a positive relationship with both entrepreneurial start-up ($b = .25, p < .001$) and take-over intentions ($b = .22, p < .001$). Thus, hypotheses 4a and 4b were supported. Further, need for cognition were positively related to entrepreneurial start-up intention ($b = .12, p < .05$) but not to entrepreneurial take-over intention. Hence, hypothesis 4a was supported and 4b was rejected.

Figure 2. Final Structural Model.



I tested mediation effect by using four widely utilized approaches: Sobel test, Aroian test, Goodman test, and bias-corrected (BC) bootstrap method (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Cheung & Lau, 2008). Given that mediation testing involves an examination of the product of the path from an independent variable to a mediator and the path from a mediator to a dependent variable, assumption of normality may be violated because this product term is not normally distributed (Cheung & Lau, 2008). Therefore, one should use BC bootstrap method to test mediation effects and this method has been proven to have greater control of Type I error and higher power than traditional mediation tests (MacKinnon et al., 2002). According to Cheung and Lau's (2008) recommendation, I performed BC bootstrap method based on 1000 bootstrap samples.

Table 4 displayed the results for mediation testing. Mediation effect is said to exist if above-mentioned mediation tests demonstrate a significant indirect path. This table shows that all indirect effects as shown in the final structural model from individual traits to entrepreneurial intentions were statistically significant. Unlike EI and proactive personality, cognitive ability and risk propensity still have direct effects on entrepreneurial start-up and take-over intentions in the presence of mediators. Thus, entrepreneurial self-efficacy fully mediated the relationships between EI and proactive personality and entrepreneurial start-up and take-over intentions and partially mediated the relationships between risk propensity and entrepreneurial start-up and take-over intentions. Accordingly, hypothesis 16 is partially supported. Analogously, need for cognition partially mediated the relationship between cognitive ability and entrepreneurial start-up intention and fully mediated the relationship between proactive personality and entrepreneurial start-up intention. Therefore, hypothesis 17 is partially supported.

Table 4. Mediation Effects.

Indirect Paths	Indirect Effect	SE (Sobel Test)	SE (Aroian Test)	SE (Goodman Test)	SE (BC Bootstrap Test)
EI → ESE → Ent. Start-Up Int.	.053	.033*	.033 [†]	.032*	.030*
EI → ESE → Ent. Take-Over Int.	.046	.028*	.029 [†]	.028*	.031 [†]
Cognitive Ability → NFC → Ent. Start-Up Int.	.025	.013*	.014*	.013*	.016*
Risk Propensity → ESE → Ent. Start-Up Int.	.075	.027**	.027**	.026**	.021***
Risk Propensity → ESE → Ent. Take-Over Int.	.066	.023**	.023**	.023**	.022***
Proactive Personality → ESE → Ent. Start-Up Int.	.108	.034***	.035***	.034***	.035***
Proactive Personality → ESE → Ent. Take-Over Int.	.095	.029***	.030***	.029***	.035**
Proactive Personality → NFC → Ent. Start-Up Int.	.061	.031*	.032*	.031*	.030*
2D:4D → Risk Propensity → ESE → Ent. Start-Up Int.	-.007	-	-	-	.016*
2D:4D → Risk Propensity → ESE → Ent. Take-Over Int.	-.006	-	-	-	.022*

Note: $N = 321$. List-wise deletion was used. EI = emotional intelligence; ESE = entrepreneurial self-efficacy; NFC = need for cognition; Ent. = entrepreneurial; Int. = intention; SE = standard error. BC = bias corrected. Statistical significance tests were one-tailed for directional hypotheses (i.e., all except for two-step mediations from 2D:4D ratio to entrepreneurial start-up and take-over intentions) and two-tailed for post hoc research questions (i.e., two-step mediations from 2D:4D ratio to entrepreneurial start-up and take-over intentions). [†] $p \leq .1$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

The Assessment of Observer Rating of Individual Traits

I used hierarchical multiple regression analyses to test the incremental validity of observer ratings of individual traits relative to self-reported ratings of individual traits in predicting entrepreneurial intentions. Table 5 displays the results for incremental validity testing. I tested the incremental validity of each individual trait according to the approaches used by Oh et al. (2011). I entered self-reported rating of an individual trait in the first step and observer rating of the same individual trait in the second step to determine both coefficient estimates (β) and incremental validity (ΔR^2). All values on the left side in Table 5 refer to the test results when the dependent variable is entrepreneurial start-up intention, whereas all values on the right side refer to the test results when the dependent variable is entrepreneurial take-over intention. The ΔR^2 refers to the incremental validity of observer rating of the individual trait in that row over and above self-reported rating of the same trait in that row. For instance, in the first row, both self-reported and observer ratings of risk propensity were entered into regression equations in predicting both entrepreneurial start-up and take-over intentions. When dependent variable is entrepreneurial start-up intention, the coefficient estimate of self-reported rating of risk propensity is marginally significant ($\beta = .12, p < .1$), whereas the coefficient estimate of observer rating of risk propensity is significant ($\beta = .16, p < .05$). The incremental validity of observer rating of risk propensity is .02 ($p < .05$) above and beyond self-reported rating of risk propensity in predicting entrepreneurial start-up intention. As dependent variable is entrepreneurial take-over intention, the coefficient estimate of self-reported rating of risk propensity is significant ($\beta = .19, p < .01$), whereas the coefficient estimate of observer rating of risk propensity is marginally significant ($\beta = .08, p < .1$). The incremental validity of observer rating of risk propensity is .01 ($p < .1$) above and beyond self-reported rating of risk propensity

in predicting entrepreneurial take-over intention. I repeated the same procedure for all the other traits. Except for two cases where observer rating of EI and proactive personality fail to contribute incremental validity above and beyond self-reported rating of them in predicting entrepreneurial take-over intention, I found all the other six cases consistently demonstrated that observer rating of individual traits contributed at least marginally significant incremental validity above and beyond self-reported rating of individual traits. In sum, in light of the mixed results, I concluded that hypotheses 18a and 18b were partially supported.

Table 5. Hierarchical Multiple Regression and Relative Weight Analyses of Observer Rating of Individual Traits in Predicting Entrepreneurial Intentions.

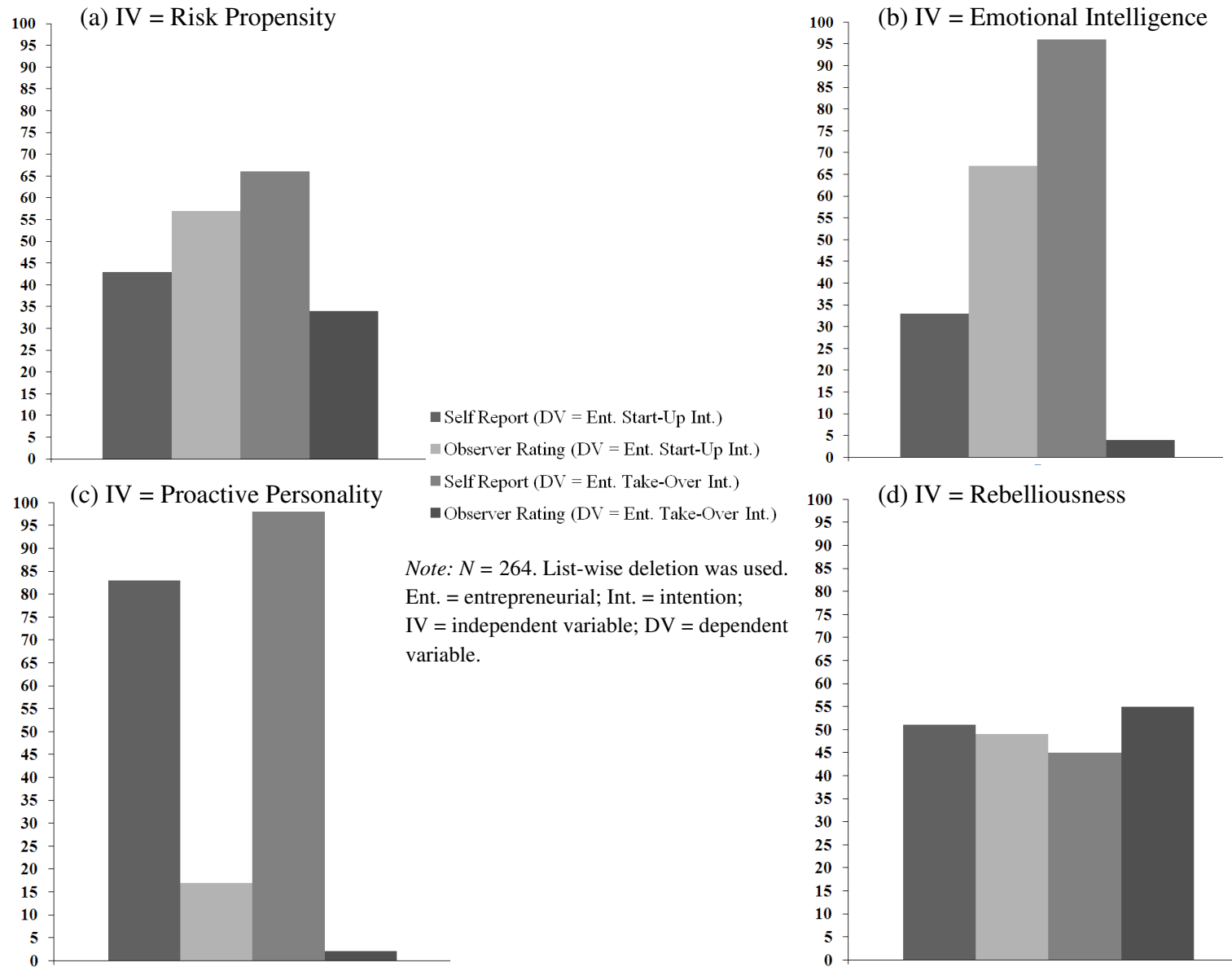
	β (Self)	β (Obs.)	ΔR^2	RW (Self)	RW(Obs.)	RW%(Self)	RW% (Obs.)
Risk Propensity	.12 [†] (0.07)/.19 ^{**} (0.07)	.16 [*] (0.07)/.08 [†] (0.07)	.02 [*] /.01 [†]	.03/.04	.03/.02	43%/66%	57%/34%
EI	.06(0.06)/.06(0.06)	.09 [†] (0.06)/.00(0.07)	.01 [†] /.00	.00/.00	.01/.00	33%/96%	67%/4%
Proactive Personality	.26 ^{***} (0.06)/.23 ^{***} (0.06)	.09 [†] (0.06)/.00(0.06)	.01 [†] /.00	.07/.05	.02/.00	83%/98%	17%/2%
Rebelliousness	.08 [†] (0.07)/.10 [†] (0.07)	.08 [†] (0.07)/.12 [*] (0.07)	.01 [†] /.01 [*]	.01/.02	.01/.02	51%/45%	49%/55%

Note: $N = 264$. List-wise deletion was used. Standard errors of β were shown in parentheses. All values on the left side were based on DV = entrepreneurial start-up intention. All values on the right side were based on DV = entrepreneurial take-over intention. When hierarchical multiple regression and relative weight analyses were performed, only two predictors were entered for each analysis – both self-reported and observer ratings of the individual trait in each row. Obs. = the results for observer rating of individual traits; Self = the results for self-reported rating of individual traits; β = standardized regression weights; RW = relative weight; RW% = percent of relative weight (computed by dividing individual relative weight by the sum of individual relative weight and multiplying by 100); R^2 = multiple correlations; ΔR^2 = incremental validity of observer rating of the individual trait in that row over and above self-reported rating of the same trait in that row. Statistical significance tests were one-tailed for all of these hypothesized variables. [†] $p \leq .1$, ^{*} $p \leq .05$, ^{**} $p \leq .01$, ^{***} $p \leq .001$

Although incremental validity can be evaluated with hierarchical multiple regression analysis and beta weights produced from this analysis can be compared in terms of rank-order, relative contribution/weight of each predictor to the total variance explained cannot be assessed based on this analysis (Johnson, 2000; Johnson & LeBreton, 2004). One can only examine the relative contribution of each predictor in a model using beta weights when predictors are uncorrelated (O'Boyle et al., 2011). Under the circumstance where predictors are correlated, beta weights may yield misleading information concerning relative weight of each predictor (Johnson & LeBreton, 2004). To investigate the relative weight of observer rating of each individual trait in predicting entrepreneurial intentions, I ran a supplemental analysis by performing relative weight analyses to produce more accurate estimates of the relative importance of each predictor in predicting an outcome in a model with correlated predictors (Johnson, 2000; Tonidandel & LeBreton, 2011). For instance, a weight of .6 for a predictor is twice as important as another predictor having a weight of .3 in a model where these two predictors are correlated. I ran bootstrapped relative weight analysis (bootstrap number = 10,000) (Tonidandel, LeBreton, & Johnson, 2009) by using the R web server developed by Tonidandel and LeBreton (2015). The sixth and seventh columns in Table 5 displayed the relative importance of each individual trait from two sources of rating in predicting entrepreneurial start-up and take-over intentions. Figure 3 is a graphical illustration of relative importance of all individual traits. Although observer rating of proactive personality did not demonstrate higher relative importance than self-reported ratings of it in predicting both types of entrepreneurial intentions and observer rating of EI did not display higher relative importance than self-reported rating of it in predicting entrepreneurial take-over intention, observer ratings of risk propensity and rebelliousness displayed noticeable relative importance compared to self-reported ratings of them in predicting both types of

entrepreneurial intentions and observer rating of EI showed higher relative importance than self-reported rating of it in predicting entrepreneurial start-up intention. For example, when dependent variable is entrepreneurial start-up intention, observer rating of risk propensity and rebelliousness has 57% and 49% relative importance compared to 43% and 51% relative importance of self-reported rating of them. When dependent variable is entrepreneurial take-over intention, observer rating of risk propensity and rebelliousness has 34% and 55% relative importance compared to 66% and 45% relative importance of self-reported rating of them. Thus, the results from this study yielded some preliminary evidence of the importance of observer rating of individual traits in predicting entrepreneurial outcomes.

Figure 3. Comparison of Relative Weight of Self and Observer Reports of Individual Traits in Predicting Entrepreneurial Intentions.



Robustness Check

The robust check involves whether 2D:4D ratio still predicts risk propensity after gender, entrepreneurial family background, and the interaction between gender and 2D:4D ratio were controlled. Prior research findings showed that 2D:4D ratio is sexually dimorphic with higher average 2D:4D ratio in females compared to males (Hönekopp, Bartholdt, Beier, & Liebert, 2007) and males on average are more risk-loving than females (Croson & Gneezy, 2009). In addition, there exists a cross-generational transmission of 2D:4D ratio in such way that people born in the same family share similar 2D:4D ratio because 2D:4D ratio is largely genetically determined (Paul, Kato, Cherkas, Andrew, & Spector, 2006; Voracek & Dressler, 2009). Previous research also suggested that 2D:4D ratio should be more predictive of risk propensity for males than females because 2D:4D ratio is related to a number of masculine behaviors and it is undesirable for female to appear risk-loving despite a low 2D:4D ratio (high exposure to prenatal testosterone) since males prefer to seeing traits in women that signal high reproductive capacity rather than traits signal risk taking (Li, Bailey, Kenrick, & Linsenmeier, 2002; Paul, Kato, Hunkin, Vivekanandan, & Spector, 2006; Stenstrom, Saad, Nepomuceno, & Mendenhall, 2011).

When all these controls are included in the structural model, the path coefficient from 2D:4D ratio to risk propensity is marginally significant ($b = -.09, p < .1$). Although it does not influence the interpretation of our results, it does suggest that some covariance between 2D:4D ratio and risk propensity can be accounted for by demographical characteristics.

Post Hoc Analyses

As prenatal testosterone exposure, captured by 2D:4D ratio, impacts one's brain development and should thus influence one's masculine behavioral patterns (Auyeung et al., 2009; Byrnes, Miller, & Schafer, 1999; Hines, 2010), such as risk-taking, which in turn affects

one's entrepreneurial self-efficacy as proposed in the current study and finally one's intention to start up a new business and/or take over an existing business. This logic chain suggests a two-step mediation effect, which is 2D:4D ratio → risk propensity → entrepreneurial self-efficacy → entrepreneurial start-up and take-over intentions. I tested this two step mediation using BC bootstrap test and two-step indirect effects from 2D:4D ratio to both entrepreneurial start-up and take-over intentions are significant (see Table 4).

Rebellious individuals are known to have behavioral under-control, act impulsively, and are inclined to display risk-taking behaviors (Finn & Frone, 2003). As such, rebelliousness is categorized as one of the aggressive attributes that cause aggressive behaviors (Finn & Frone, 2003; Susman et al., 1987). Taking over an existing firm requires one to socialize and adapt into a new organizational culture; as such, conflicts with existing organizational members are likely to occur (Davis & Harveston, 1999). I predict that rebelliousness will have an inverted U-shaped relationship with entrepreneurial take-over intention. I suspect that when a person is too rebellious, it will be less likely for him/her to cooperatively work with others and to socialize into a new organizational culture because of their socially dysfunctional behaviors and impulsive actions resulted from extreme rebelliousness. As such, taking over an existing firm which requires one to make social adjustment and act cooperatively with existing organizational members becomes a suboptimal option for them, meaning that extreme level of rebelliousness should reduce the likelihood for one to take over an existing firm.

In a similar vein, risk propensity should have an inverted U-shaped relationship with entrepreneurial take-over intention as well. Fit theory suggests that when individuals' need is satisfied by the supplies (rewards) of a job, individuals' satisfaction and commitment to a job will be enhanced (Kristof, 1996; Kristof-Brown et al., 2005; Vogel & Feldman, 2009). When a

job fits one's personality, one will be more likely to become committed to it and they feel more comfortable and perform better at it. Therefore, individuals are gravitated to the job that is compatible with their personalities (Zhao & Seibert, 2006). When one's risk propensity is too high, he/she may find taking over an existing venture not to be an option that fits his/her personality because relative to starting up a new venture from scratch, taking over an existing firm demands less resources and involves less risk (Shook et al., 2003). Therefore, an extremely risk-loving individual may not find taking over an existing firm to be a desirable option.

I ran hierarchical multiple regression analyses to test these two post hoc research questions. A curvilinear relationship (inverted U-shaped relationship) is said to exist when the coefficient estimate of a squared term is statistically significant in the presence of both control variables and a first order term. Table 6 displayed the results for post hoc analyses. I found that rebelliousness has an inverted U-shaped relationship with entrepreneurial take-over intention (β for rebelliousness squared = -0.11, $p < .05$). However, risk propensity does not have an inverted U-shaped relationship with entrepreneurial take-over intention (β for risk propensity squared = -0.06, $p = n.s.$).

Table 7 displayed all hypotheses tested in the current study as well as whether there is supportive evidence for each hypothesis.

Table 6. Post Hoc Tests of Curvilinear Relations between Risk Propensity and Rebelliousness and Entrepreneurial Intentions.

	Model 1	Model 2	Model 3	Model 4	Model 5
	β	β	β	β	β
Gender	0.08(0.05)	0.06(0.06)	0.07(0.06)	0.04(0.06)	0.03(0.06)
Age	-0.13(0.08)	-0.11(0.08)	-0.12(0.08)	-0.07(0.08)	-0.07(0.08)
Entrepreneurship Major	0.05(0.06)	0.03(0.06)	0.04(0.06)	0.03(0.05)	0.03(0.06)
Ent. Family Background	0.16** (0.06)	0.16** (0.05)	0.16** (0.05)	0.15** (0.05)	0.15** (0.05)
Work Experience	-0.01(0.09)	-0.02(0.08)	-0.01(0.08)	-0.05(0.08)	-0.04(0.08)
Ent. Experience	0.11 [†] (0.06)	0.11 [†] (0.06)	0.11 [†] (0.06)	0.11 [†] (0.06)	0.11 [†] (0.06)
Rebelliousness		0.14* (0.06)	0.13* (0.06)		
Rebelliousness Squared			-0.11* (0.05)		
Risk Propensity				0.21*** (0.06)	0.20*** (0.06)
Risk Propensity Squared					-0.06(0.05)
R^2	.06**	.08***	.09***	.10***	.11***
ΔR^2		.02*	.01*		.01

Note: $N = 321$. List-wise deletion was used. Standard errors of β were shown in parentheses. Dependent Variable = entrepreneurial take-over intention. β = standardized regression weights; R^2 = multiple correlations; ΔR^2 = incremental change in R^2 ; Ent. = Entrepreneurial. Statistical significance tests were two-tailed for both control variables and post hoc research questions. [†] $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 7. Summary of Results for All Hypotheses

	Hypotheses/Post Hoc Research Questions	Predicted Direction	Actual Direction	Statistical Significance	Results
	Hypotheses				
1	2D:4D ratio is negatively related to risk propensity.	(-)	(-)	Sig.	Supported.
2a	Risk propensity is positively related to entrepreneurial start-up intention.	(+)	(+)	Sig.	Supported.
2b	Risk propensity is positively related to entrepreneurial take-over intention.	(+)	(+)	Sig.	Supported.
3	Risk propensity is positively related to entrepreneurial self-efficacy.	(+)	(+)	Sig.	Supported.
4a	Entrepreneurial self-efficacy is positively related to entrepreneurial start-up intention.	(+)	(+)	Sig.	Supported.
4b	Entrepreneurial self-efficacy is positively related to entrepreneurial take-over intention.	(+)	(+)	Sig.	Supported.
5a	EI is positively related to entrepreneurial start-up intention.	(+)	(-)	n.s.	Not Supported.
5b	EI is positively related to entrepreneurial take-over intention.	(+)	(+)	n.s.	Not Supported.
6	EI is positively related to entrepreneurial self-efficacy.	(+)	(+)	Sig.	Supported.
7a	Cognitive ability is positively related to entrepreneurial start-up intention.	(+)	(-)	Sig.	Not Supported.
7b	Cognitive ability is positively related to entrepreneurial take-over intention.	(+)	(-)	Sig.	Not Supported.
8	Cognitive ability is positively related to entrepreneurial self-efficacy.	(+)	NE	n.s.	Not Supported.
9	Cognitive ability is positively related to	(+)	(+)	Sig.	Supported.

	need for cognition.				
10a	Need for cognition is positively related to entrepreneurial start-up intention.	(+)	(+)	Sig.	Supported.
10b	Need for cognition is positively related to entrepreneurial take-over intention.	(+)	NE	n.s.	Not Supported.
11a	Proactive personality is positively related to entrepreneurial start-up intention.	(+)	(+)	Sig.	Supported.
11b	Proactive personality is positively related to entrepreneurial take-over intention.	(+)	(+)	Sig.	Supported.
12	Proactive personality is positively related to entrepreneurial self-efficacy.	(+)	(+)	Sig.	Supported.
13	Proactive personality is positively related to need for cognition.	(+)	(+)	Sig.	Supported.
14a	Rebelliousness is positively related to entrepreneurial start-up intention.	(+)	(-)	n.s.	Not Supported.
14b	Rebelliousness is positively related to entrepreneurial take-over intention.	(+)	(+)	Sig.	Supported.
15	Rebelliousness is positively related to entrepreneurial self-efficacy.	(+)	NE	n.s.	Not Supported.
16	Entrepreneurial self-efficacy partially mediates the relationship between individual traits (i.e., emotional intelligence, cognitive ability, risk propensity, proactive personality, and rebelliousness) and entrepreneurial (i.e., start-up and take-over) intentions.				Partially Supported. Entrepreneurial self-efficacy fully mediated the relationships between EI and proactive personality and entrepreneurial start-up and take-over intentions. It partially mediated the relationships between risk propensity and entrepreneurial start-up and take-over intentions.
17	Need for cognition partially mediates the relationship between individual traits (i.e., cognitive ability and proactive personality) and entrepreneurial (i.e., start-up and take-over) intentions.				Partially Supported. Need for cognition partially mediated the relationship between cognitive ability and entrepreneurial start-up intention and fully mediated the relationship between

18a	Observer ratings of individual traits will exhibit incremental validity in predicting entrepreneurial start-up intention.		proactive personality and entrepreneurial start-up intention. Partially Supported. Observer rating of risk propensity contributed significant incremental validity, whereas all other traits contributed marginally significant incremental validity, in predicting entrepreneurial start-up intention above and beyond self-reported rating of them.
18b	Observer ratings of individual traits will exhibit incremental validity in predicting entrepreneurial take-over intention.		Partially Supported. Observer rating of risk propensity and rebelliousness contributed marginally significant and significant incremental validity, whereas EI and proactive personality contributed no incremental validity, in predicting entrepreneurial take-over intention above and beyond self-reported rating of them.
Post Hoc Research Questions			
1a	The relationship between 2D:4D ratio and entrepreneurial start-up intention is mediated in two steps, first, by risk propensity, and then, entrepreneurial self-efficacy.	Sig.	Supported.
1b	The relationship between 2D:4D ratio and entrepreneurial take-over intention is mediated in two steps, first, by risk propensity, and then, entrepreneurial self-efficacy.	Sig.	Supported.
2	Does rebelliousness have an inverted U-shaped relationship with entrepreneurial take-over intention?	Sig.	Supported.

3	Does risk propensity have an inverted U-shaped relationship with entrepreneurial take-over intention?	n.s.	Not Supported.
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Note: n.s. = not statistically significant; Sig. = statistically significant; NE = not estimated (variables showing insignificant paths were all trimmed out during SEM model revision process; as such, these path coefficients were not estimated in SEM).

V. DISCUSSION

The objectives of this dissertation are to investigate (1) the difference between entrepreneurial start-up intention and entrepreneurial take-over intention; (2) how biological factor and individual traits influence entrepreneurial intentions; (3) how motivation processes (i.e., entrepreneurial self-efficacy and need for cognition) mediate the relationship between individual traits and entrepreneurial intentions; and (4) whether observer-reports of individual traits contribute incremental validity in predicting entrepreneurial intentions above and beyond self-reports of individual traits. Based on a sample of 321 subjects along with 264 observers, there are five major findings in this dissertation. First, after examining the psychometric property of entrepreneurial take-over intention, I found that it is a construct different from entrepreneurial start-up intention. Second, risk propensity and proactive personality positively predict entrepreneurial start-up and take-over intentions. Cognitive ability negatively predicts entrepreneurial start-up and take-over intentions. Rebelliousness positively predicts entrepreneurial take-over intention and also demonstrates an inverted U-shaped relationship with it. Third, entrepreneurial self-efficacy plays a mediating role in the relationship between three individual traits (i.e., emotional intelligence, risk propensity, and proactive personality) and entrepreneurial start-up and take-over intentions. Need for cognition mediates the relationship between two individual traits (i.e., cognitive ability and proactive personality) and entrepreneurial start-up intention. Fourth, 2D:4D ratio (a proxy measure for prenatal testosterone

exposure level) is a negative predictor of risk propensity. Further, there are two two-step mediations from 2D:4D ratio to both entrepreneurial start-up and take-over intentions, first via risk propensity, and then, through entrepreneurial self-efficacy. Fifth, observer reports of individual traits only yield modest incremental validity above and beyond self-reports of them in predicting entrepreneurial start-up and take-over intentions. I discuss the theoretical implications, practical implications, limitations, and future directions in the following sections.

Theoretical Implications

The present study empirically tested a model that links biological factor, individual traits, motivational processes, and entrepreneurial intentions. The findings from the current study yielded several important theoretical contributions to entrepreneurship literature.

First, results suggested that biological factor plays a role in influencing one's intentions to select into entrepreneurship. Decisions to engage in entrepreneurial activities may not be randomly determined in that they are influenced by a variety of factors including psychological traits (Nicolaou et al., 2008). Drawing on genetics literature, Nicolaou and Shane (2009) pointed out that genetic factors may predispose individuals to develop psychological attributes that influence one's tendency to engage in entrepreneurial activities, and thus, help them self-select into environment conducive to entrepreneurship. Genetic factors that passed from parents to children may result in intergenerational transmission of entrepreneurship (Nicolaou et al., 2008). The results from present study added to this impressive stream of literature concerning biological approach to entrepreneurship (e.g., Nicolaou et al., 2008; Nicolaou & Shane, 2009; Shane, 2010; Trahms et al., 2010; Unger et al., 2009; White et al., 2006), showing that 2D:4D ratio, as a biological marker for prenatal exposure to testosterone, negatively predicts one's psychological disposition – risk-propensity, which in turn influences both entrepreneurial start-up and take-over

intentions through the mechanism of entrepreneurial self-efficacy. Given that one's testosterone level is over 80% heritable (Meikle, Stringham, Bishop, & West, 1988), the findings from the current study provide some preliminary evidence for the intergenerational transmission of entrepreneurship (e.g., Nicolaou et al., 2008), meaning that genetic factors passed from parents influence their children's tendency to become entrepreneurs. The two-step mediation from 2D:4D ratio to entrepreneurial start-up and take-over intentions identified in the current study weaves psychology theory (e.g., risk propensity from individual difference literature and self-efficacy from social learning theory) with biology literature (e.g., prenatal exposure to testosterone) and introduce them to entrepreneurship research by revealing that the effect of prenatal exposure to testosterone as measured by 2D:4D ratio on entrepreneurial intentions operates indirectly through the development of one's individual traits and motivational processes. The current research upholds that introducing biology into entrepreneurship will be a fruitful avenue of research to help entrepreneurship scholars to gain a comprehensive understanding of why people engage in entrepreneurial activity.

Second, the present study proposed a new type of entrepreneurial intention – entrepreneurial take-over intention. After examining the psychometric property of this construct, I found that entrepreneurial take-over intention is a different construct from entrepreneurial start-up intention. This finding confirms Shook et al.'s (2003) argument which indicated that heterogeneity in individuals' possession of resources and risk attitude may lead to different types of intentions. The individuals who are risk averse and have sparse resources may choose to take over an existing firm rather than launch a new venture from scratch which typically requires more resources and involves more risks. Since taking over an existing business is a prevalent practice under the context of family business (Dumas, Dupuis, Richer, & St-Cyr, 1995; Miller,

Steier, & Le Breton-Miller, 2003; Stavrou, 1999), future research may investigate the factors (e.g., psychological traits) that influence one's intention to take over a family business.

Third, consistent with prior research (Rauch & Frese, 2007), I found that risk propensity and proactive personality positively predict both entrepreneurial start-up and take-over intentions. It confirms prior research showing that entrepreneurs are generally more risk-tolerant and inclined to scan the environment for entrepreneurial opportunities and change and impact the environment around them (Fuller Jr. & Marler, 2009; Stewart Jr. & Roth, 2001, 2004).

I also found a positive relationship between rebelliousness and entrepreneurial take-over intention. This empirical finding supports the discussions and viewpoints appeared in anecdotal stories and news magazines which indicate that entrepreneurs have anti-social and rule breaking tendencies and they are less conformistic and cooperative. Rebellious individuals tend to become entrepreneurs because rebelliousness is associated with need for autonomy and independence which are two essential psychological tendencies influence one's chance to be entrepreneurs. I further explored the complexity of the relationship between rebelliousness and entrepreneurial take-over intention by performing post hoc analyses. The results demonstrated an inverted U-shaped relationship between rebelliousness and entrepreneurial take-over intention. Since extremely rebellious individuals are aggressive and act impulsively (Finn & Frone, 2003; Susman et al., 1987), they are likely to find it unfavorable to take over an existing firm because they face challenges to get along with people and socialize themselves into a new organizational culture due to their high rebellious psychological tendency.

It is interesting to note that cognitive ability negatively predicts both entrepreneurial start-up and take-over intention, which is contrary to what I originally hypothesized. Prospect theory (Kahneman & Tversky, 1979) suggested that individuals are loss-averse and are inclined to

discard the possibility of a gain when it entails the potential for loss compared to one's current position. One will risk his/her financial status, career opportunities, family relationship, and psychic well-being by engaging in entrepreneurial activities (Brockhaus, 1980) because making money as an entrepreneur is uncertain and most ventures do not succeed (Shane, 2008). Smart people are therefore more inclined to work for someone else rather than risk their career by engaging in unpredictable entrepreneurial activities to pursue a low potential gain by undertaking a high potential loss (Kahneman & Tversky, 1979) because intelligent individuals can still be successful should they choose to work in an existing firm (Judge, Higgins, Thoresen, & Barrick, 1999; Ng, Eby, Sorensen, & Feldman, 2005). In sum, given all the risks (e.g., high failure rate) and uncertain returns associated with running a new venture (Shane, 2008), smart people is unlikely to become an entrepreneur due to low desirability of movement (March & Simon, 1958) to entrepreneurship. Thus, the empirical findings regarding the negative association between cognitive ability and entrepreneurial intentions from the current study lent some support to Shane's (2008) argument, indicating that entrepreneurs are not necessarily wise, insightful, and superior people.

Fourth, the present study sheds light on the complexity for the relationship between individual traits and entrepreneurial intentions. One of the key criticisms of trait-based approaches to entrepreneurship is a lack of clear theoretical logic (Gartner, 1989). The evidence regarding the validity of traits' (e.g., risk propensity) impact on entrepreneurship also tends to be contradictory (e.g., Miner & Raju, 2004; Stewart Jr. & Roth, 2001). To respond to Frese and Rauch's (2007) call, I identified two missing links between individual traits and entrepreneurial intentions, which are entrepreneurial self-efficacy and need for cognition.

Entrepreneurial self-efficacy mediates the relationships between EI, risk propensity, and proactive personality, and entrepreneurial start-up and take-over intentions, which suggests that enhancing one's confidence to be an entrepreneur through the mechanisms known to influence self-efficacy perception will affect one's intention to become entrepreneurs (Zhao et al., 2005). It is noted that although I did not detect a direct effect from EI to entrepreneurial intentions, EI indirectly influences both types of entrepreneurial intentions by operating through the mechanism of entrepreneurial self-efficacy. Entrepreneurship is an emotional journey and is clearly an emotional process due to extreme levels of uncertainty and risk involved (Baron, 2008; Cardon et al., 2012). This finding of full mediation corroborates the importance of emotion theory and social learning theory for the entrepreneurship field by showing that emotionally intelligent individuals are resilient and can better regulate their emotions to tackle aversive emotional arousal (Carmeli, 2003; Daus, & Ashkanasy, 2005; Sy et al., 2006). As such, they tend to have positive evaluation of their ability to engage in entrepreneurial activities (i.e., high entrepreneurial self-efficacy) because they feel competent to deal with the risks and stresses associated with launching a new venture and they are likely to persist even in the face of adversity (Humphrey, 2013a).

As for risk propensity, I found that risk-loving individuals generally feel confident to handle risky situations and accordingly have a greater sense of control over outcomes of becoming an entrepreneur; hence, they are more inclined to engage in entrepreneurial activities due to their high risk tolerance (Sitkin & Weingart, 1995; Zhao et al., 2005). Since proactive individuals are prone to identify opportunities, exploit them, and make meaningful changes toward the environment throughout their life (e.g., Bateman & Crant, 1993; Fuller Jr. & Marler, 2009), proactive individuals having all these tendencies that are critical for successful

entrepreneurship should foster a positive evaluation of their capacity to initiate a new venture (high entrepreneurial self-efficacy), thus leading them to have higher entrepreneurial intentions. It is further noted that proactive personality is shown to be a great predictor of both motivational processes and entrepreneurial intentions relative to other traits tested in the current study. For instance, the predictive validity of proactive personality is similar to (in some cases even larger than) risk propensity – the “hallmark of the entrepreneurial personality” (Stewart & Roth, 2001; Zhao et al., 2010). In light of its promising predictive validity, future research should further explore proactive personality in entrepreneurship research to gain a clear understanding of entrepreneurial processes.

It is noted that cognitive ability and rebelliousness were not related to entrepreneurial self-efficacy. As for cognitive ability, I hypothesized that it should positively relate to entrepreneurial self-efficacy because intelligent individuals may have more task-related experience and absorb more task-related knowledge (Bandura, 1997) due to their learning capacity. Nevertheless, it is also possible that the more information, knowledge, and experience intelligent individuals gain, the more they may know about the risky, uncertain, and complex natures of entrepreneurship. As such, some smart individuals may not necessarily feel self-efficacious of launching a business venture due to their clear understanding of the complexity and challenges associated with entrepreneurial processes. As for rebelliousness, I hypothesized that it should positively relate to entrepreneurial self-efficacy because rebellious individuals, due to their need for autonomy and independence as well as their desire to change and impact environment, should have higher entrepreneurial self-efficacy because of their perceived feasibility of being an entrepreneur. Yet, being rebellious may be a necessary but not a sufficient condition for being a successful entrepreneur because running a business, under most

circumstances, will require the coordination, communication, and cooperation between founder(s) and stakeholders (e.g., employees and investors). Entrepreneurs sometimes even need to give up the total control of their enterprise due to the involvement from investors (Wasserman, 2008). Therefore, some rebellious individuals, due to their unruly and anti-social tendencies, may not find it quite feasible for them to be an entrepreneur (i.e., low entrepreneurial self-efficacy) due to aforementioned reasons. Nonetheless, these are clearly conjectures and future studies should replicate the current study to explore the underlying issues.

Need for cognition, as an intrinsic motivation to undertake effortful cognitive endeavors (Cacioppo et al., 1996), serves an important link between proactive personality and cognitive ability and entrepreneurial start-up intention. The first contribution from this mediation path is the relationship between need for cognition and entrepreneurial start-up intention. Individuals high in need for cognition seek and enjoy cognitively effortful activities and conditions; thus, they are prone to expand efforts on information processing and acquisition, reasoning, and problem solving, which makes them more knowledgeable of the information and circumstances around them (Cacioppo et al., 1996). This finding suggests that entrepreneurs are reasoned risk takers because of their intrinsic motivation to engage in aforementioned effortful cognitive endeavors before they make decisions. In addition, the results do not support a positive link between need for cognition and entrepreneurial take-over intention. Taking over an existing firm may require less cognitive efforts than starting up a firm because the former one requires individuals to focus more on socialization and adaptation into an existing firm whereas the latter one requires individuals to focus more on thinking, reasoning, information processing, and decision making to recognize, implement, and exploit opportunities (which demands more cognitive endeavors). As such, from fit perspectives, individuals high in need for cognition

should be more prone to choose to start up a firm rather than take over a firm because starting up a firm involves more cognitively complex tasks and activities which fit the individuals high in need for cognition.

Another related contribution is the identification of the link (i.e., need for cognition) between cognitive ability and proactive personality and entrepreneurial start-up intention. This finding suggests that intelligent individuals possess larger conservation of cognitive resources, and as such, they should enjoy effortful thinking and complex tasks according to fit theory, which in turn influences their intention to become entrepreneurs. In a similar vein, proactive individuals have high learning orientation and creativity, which positively relates to need for cognition (Cacioppo et al., 1984; Dollinger, 2003). Hence, the full mediation identified in the current study suggested that proactive individuals are prone to initiate a new venture because they enjoy all of the cognitively effortful/complex activities and learning processes associated with launching a new business venture. This finding adds to the entrepreneurial learning literature (e.g., Politis, 2005; Young & Sexton, 2003) by demonstrating that individual trait, such as need for cognition, is a factor that influences one to undertake entrepreneurial learning, and as such, increases one's probability to recognize and exploit an opportunity and become an entrepreneur.

Fifth, drawing on the psychology literature, I tested whether observer rating of individual traits contributes incremental validity above and beyond self-reported rating of them. According to socioanalytic theory (Hogan, 1991), self-reported and observer ratings of individual traits has clear distinction, with the former represents consistent styles of self-presentation rather than underlying traits, whereas the latter refers to one's reputation based on their public behavioral actions that were displayed over time; as such, observer ratings of individual traits are less

susceptible to self-deception and impression management and should be more accurate predictors of outcomes than self-reports (Hogan, 1996; Oh et al., 2011; Zimmerman et al., 2010). On the other hand, observer reports may have lower validity than self-reports because (1) observers may have limited opportunities to observe a target person's behaviors and some traits are private to a target person and less observable to observers; and (2) observers may also minimize their response scores of socially undesirable traits for a target person (Oh et al., 2011).

The results from current study appear to paint a mixed picture. For instance, when the dependent variable is entrepreneurial start-up intention, only observer rating of risk propensity contributed significant incremental validity above and beyond self-reports of risk propensity. Observer reports of EI, proactive personality, and rebelliousness just contributed marginally significant incremental validity above and beyond self-reports of them. When dependent variable is entrepreneurial take-over intention, only observer reports of rebelliousness yielded significant incremental validity above and beyond self-reports of it. Observer reports of risk propensity contributed marginally significant incremental validity, whereas observer reports of both EI and proactive personality fail to contribute any incremental validity. Relative weight analyses indicate that observer reports of both risk propensity and rebelliousness demonstrate either roughly equal or larger relative importance than self-reports of them in predicting entrepreneurial intentions. However, in the cases of EI and proactive personality, the relative importance of observer reports of them is far less than that of self-reports of them. In light of small incremental validity contributed by observer reports of individual traits (ΔR^2 ranges from .00 to .02) and mixed results as suggested by analyses, I concluded that the contributions made by observer reports of individual traits in predicting entrepreneurial intentions is modest at best according to the results from the present study. However, this line of investigation will require further

exploration given that only four traits were examined in the current study and the conclusion may not hold the same for some other traits.

Practical Implications

The results from the present study yield some implications for the individuals who intend to start up a business as well as the ones who have already launched a new venture. For instance, one may self assess their psychological traits and utilize that information to evaluate the desirability of their career choices and/or to choose the business partners who can compensate for their weakness (Rauch & Frese, 2007). To get an objective assessment of one's psychological traits, one may also invite the individuals who are familiar with them (e.g., parents, siblings, spouse, and best friends) to evaluate one's psychological traits and consider this information along with self-assessment results to make more thoughtful occupational and/or strategic decisions. In addition, one may measure their 2D:4D ratio and compare their ratios with reference norms to assess their risk-loving tendencies as well as some other traits relevant to entrepreneurship to appraise the desirability of their occupational choices.

The present study indicated that entrepreneurial self-efficacy influences one's intentions to become entrepreneurs and plays a mediating role in the relationship between psychological traits and entrepreneurial intentions. This finding has implications for educators because students can improve their entrepreneurial self-efficacy by taking entrepreneurship education (Wilson, Kickul, & Marlino, 2007). There are four factors that influence one's self-efficacy perception (a) performance accomplishments; (b) vicarious experience; (c) verbal persuasion; and (d) emotional arousal (Bandura, 1977b). For instance, educators may incorporate experiential learning component into the entrepreneurship education curriculum so that students may enhance their entrepreneurial self-efficacy by successfully running a virtual or even a real venture (i.e.,

enhancing entrepreneurial self-efficacy through performance accomplishments). Educators may also enhance students' entrepreneurial self-efficacy by highlighting the advantages of starting one's own firm (e.g., becoming one's own boss, flexible work schedule, and life style, etc.) and inviting (successful) entrepreneurs to share their business venturing experience with students (i.e., enhancing entrepreneurial self-efficacy through verbal persuasion) (Schlaegel & Koenig, 2014).

Limitations and Future Directions

First, the current study is based on cross-sectional design; as such, I cannot rule out the possibility of reverse causality (or reciprocal causation). This limitation particularly applies to mediation analyses because mediation indicates a specific causal direction (Colquitt et al., 2007). To tackle this methodological limitation, future studies may use longitudinal design and perform advanced statistical analyses, such as latent growth modeling (Bliese & Ployhart, 2002), to derive robust causal inferences.

Second limitation relates to the use of entrepreneurial intention as an outcome variable in the current study. Before entrepreneurial intentions are translated into actual venture creation, there exist a series of complex activities according to theory and empirical evidence (Ajzen, 1991; Zhao et al., 2005). Therefore, future research should perform longitudinal studies to test the links among intention, opportunity search behaviors, and subsequent venture creation to investigate the complexities within venture creation processes (Shook et al., 2003). In addition, future research may also investigate how these individual-level variables influences firm-level outcomes (Trahms et al., 2010), such as entrepreneurial orientation (Rauch, Wiklund, Lumpkin, & Frese, 2009), strategic flexibility (Nadkarni & Herrmann, 2010), and venture performance. For example, given that 2D:4D ratio predicts risk propensity and risk-loving entrepreneurs should

lead their venture to be entrepreneurially oriented, risk propensity may mediate the relationship between 2D:4D ratio and entrepreneurial orientation. The research linking individual level traits to firm level outcomes has been proven to be a fruitful avenue of research by prior findings (e.g., Hmieleski & Baron, 2009; Wales, Patel, & Lumpkin, 2013). The present study further expands the scope of existing research literature and suggests that biological factors, such as 2D:4D ratio, may also have a potential to predict firm level outcomes (e.g., Trahms et al., 2010), which is a promising topic that requires further exploration.

Third, given that the current study found some evidence in terms of the difference between entrepreneurial start-up intention and entrepreneurial take-over intention, future studies may also develop a new entrepreneurial self-efficacy measure – entrepreneurial self-efficacy for taking over an existing venture – to match individuals’ different entrepreneurial intentions (start-up intention versus take-over intention).

Fourth, 2D:4D ratio is still a proxy measure of prenatal testosterone exposure level; thus, future research may apply more precise measurement method, such as hormone measurement (van der Loos et al., 2013), to replicate current study to see whether same pattern of results occur. Since prenatal testosterone exposure influences one’s psychological tendency and consequently selection into entrepreneurship via brain development (Manning, 2002; Manning & Fink, 2008; Trahms et al., 2010), entrepreneurship research should benefit from applying methods and techniques from neuroscience to gain a clear understanding of the complexity of entrepreneurial processes (Nicolaou & Shane, 2014). For instance, entrepreneurship scholars can use neuroscience techniques to investigate how genetic differences affect the function, structure, and wiring of the brain to influence entrepreneurial activities and decision making (Nicolaou & Shane, 2014; Toga & Thompson, 2005).

In conclusion, in line with prior research (e.g., Rauch & Frese, 2007; Zhao et al., 2010), the results from the present study yield support for the role of psychological traits in entrepreneurship research and also shed light on the processes through which psychological traits influence entrepreneurial start-up and take-over intentions. The current study provides some preliminary evidence for the biological approach to entrepreneurship. From methodological standpoint, I found that the use of observer rating of individual traits modestly improves the prediction of entrepreneurial intentions relative to self-reported rating of them. In sum, both biology and psychology of entrepreneurship (Frese & Gielnik, 2014; Nicolaou & Shane, 2013) are the areas that warrant ongoing research to promote the advancement of the field of entrepreneurship.

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Vita

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