A data-driven approach exploring the entrepreneurial-managerial spectrum

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Abstract

Entrepreneurs are responsible for starting new ventures, often with high risk and innovation, while managers oversee existing organizations, optimize operations, and achieve predefined goals. Although frequently seen as a dichotomy, entrepreneurs and managers share responsibilities for building and sustaining a business, and hence, this could also be studied as a spectrum. Previous research has individually examined specific aspects of entrepreneurial (vs managerial) work, but limited studies have examined their effects holistically. Using a wide range of survey instruments, we took an exploratory data-driven approach to explore the entrepreneurial-managerial spectrum. Exploratory factor analysis revealed five latent factors driving variance in our data: Negative Emotions, Fulfillment & Support, Creative Capacity, Collaborative Personality, and Decision-Making Avoidance & Hypervigilance. When explored as a traditional dichotomy, our results found that entrepreneurs scored lower than managers in Decision-Making Avoidance & Hypervigilance and Collaborative Personality. On the other hand, as a spectrum, data suggested an increase in Creative Capacity and a decrease in Decision-Making Avoidance & Hypervigilance with increasing entrepreneurial experience. Emotional health and career success remained similar across groups. Overall, we explored the complex profile of entrepreneurs and managers as a step towards understanding the dynamic and unique combination of personality, cognition, emotional health, and demographics across the entrepreneurial-managerial spectrum.

Introduction

Entrepreneurship and business ventures create novel value propositions by establishing new companies. In doing so, entrepreneurs provide products and services to large populations and generate economic value. Therefore, understanding how entrepreneurs can perform such actions is a very socially relevant topic. This provides a challenge, as entrepreneurs work in different complex environments, and entrepreneurship is not solely a result of any singular quality or characteristic [1,2,3,4]. Many possible factors influence entrepreneurship, including different experiences, abilities, social environments, and emotional health [5]. This has led to extensive research in specific domains but less in how they collectively define an individual entrepreneur. When researching entrepreneurship, entrepreneurs are often contrasted with the behavior of managing and organizing existing companies. Both entrepreneurs and managers perform activities related to building and sustaining a business [6,7,8,9]. Thus, the difference between these two groups is only sometimes so dichotomous. Through an exploratory data-driven approach, we aimed to capture the multifaceted profile of people across the Entrepreneurial-Managerial Spectrum (EMS) and shed light on the unique capacities of these individuals as a function of their entrepreneurial and managerial experiences.

There are several vital aspects to consider when establishing the multifaceted profile across the EMS. One major trait factor is personality - an average level of a person's behavior across varying situations and environments [15]. By this definition, personality generally remains stable over time. Personality may contribute to the decision of individuals to enter or exit entrepreneurship. Relevant aspects of personality that differentiate entrepreneurs from non-entrepreneurs may include agreeableness and conscientiousness, which are concerned respectively with altruism and discipline.

Similarly, another critical aspect of entrepreneurship is creativity. Creativity is related to an entrepreneur's personality but is also affected by their environment and is not fixed [16]. There is a rich literature on strategies for improving creativity [17,18,19,20,21], and it has been shown that harnessing improvisation and creativity is important to entrepreneurship [22,23]. Other aspects include age, sex and gender, life experiences, and education [10,11,12]. Research has also demonstrated differences based on work history[13, 14].

Prior work has also examined cognition and emotional wellness differences between entrepreneurs and managers. The situations arising from entrepreneurship result in specific trends in cognition. Entrepreneurial cognition has been defined as "the knowledge structures that people use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth" [24]. Entrepreneurs often deal with highly uncertain situations [25]. Unsurprisingly, entrepreneurs usually have cognitive capacities such as tolerance of ambiguity and openness to new experiences [6,9]. Entrepreneurs have also been shown to have specific unique characteristics relating to their decision-making and improvisation that differ from non-entrepreneurs. Entrepreneurial decision-making relies on heuristics and strategic decision-making [7,26,27]. Such cognitive biases can benefit entrepreneurs in specific circumstances [7]. Impulsivity and hyperfocus have also been linked to successful entrepreneurship [28,29 30].

However, entrepreneurs are sometimes more prone to overconfidence or representativeness errors [7,31] and other biases like the self-serving bias and planning fallacy [32]. Research has generally shown entrepreneurs to make decisions more impulsively, quickly, and confidently than non-entrepreneurs.

Emotional wellness is a dynamic aspect of entrepreneurship that holds significant importance. Entrepreneurs face unique difficulties that can affect their emotional health [33]. For example, entrepreneurs may experience economic stress [34], business failure [35], and anticipatory grief [36]. The resulting emotional distress can impact entrepreneurs in complex ways. Conversely, entrepreneurs have reported high levels of happiness and job satisfaction [37,38]. Entrepreneurs have high job autonomy, which can result in positive well-being outcomes [39]. To understand entrepreneurs' emotional health, it should be in the context of entrepreneurship's unique challenges and upsides, as this has the potential to interact with other aspects of their profile such as cognition and creativity.

While substantial work has been done individually on wellness, personality, and cognition, it needs to be more cohesive, and data driven. Studying the EMS by considering all these complex dynamics could provide a valuable lens to better understand which traits and aspects facilitate success as an entrepreneur or a manager. In this work, we studied the EMS using various instruments. This allowed us to examine the interaction between generally stable qualities like personality and more contextually dependent qualities like decision-making strategies. Based on the existing research, we expected entrepreneurs to have higher creativity and more impulsive decision-making.

We approached our inquiries using well-established measurements and techniques developed in psychology and neuroscience. We assessed participants using various survey instruments and tasks, including the NIH Toolkit, Melbourne Decision-Making Questionnaire, Alternative Uses Task, and more. This resulted in many variables across cognition, well-being, and personality dimensions. Following previous research, we performed an Exploratory Factor Analysis to find potential new combinations of related items[40]. This approach reduced the dimensionality of the data and helped us interpret the results in a cohesive manner. We further examined our different factors along several groupings of professional experience, including entrepreneurs' prior managerial expertise and managers' previous entrepreneurial experience. Our data-driven exploratory analysis enabled us to take a multifaceted perspective of people who engage in business venturing and managing activities.

Methods

Data Collection

The study recruited participants by word of mouth, email listservs, and social media, including LinkedIn and Craigslist. Potential participants completed a screening questionnaire designed to identify relevant participants. The inclusion criteria comprised managers or entrepreneurs over the age of 18. We included managers who were part of an existing organization and currently managing a team of over two employees. Entrepreneurs included in this study were founders of

an organization with more than two employees. The Stanford Institutional Review Board approved the study procedures. All methods were performed in accordance with appropriate guidelines and regulations. All participants gave written informed consent prior to participation and were compensated at $20 per hour. We screened out participants who were not managing a team of over two or more or had not founded a company of two or more people. We attempted to verify the participants' jobs on LinkedIn. Data collection was completed online due to COVID-19.

The study includes 117 participants - 77 males and 40 females. 17 participants were removed due to incompleteness of the online assessment, resulting in 100 subjects. Data were deemed incomplete when the participant did not finish all nine online tasks. 69% of the 100 participants identified themselves as male and 31% as female. They had an age range of 20 to 50 years old. They reported their income out of ten groups ranging from less than $10,000 to over $200,000. Education levels included high school, bachelor's, master's, and Ph.D. Participants self-identified as one of the following races: African American, Asian/Pacific Islander/Asian Indian, Hispanic/Latino, White, or Multi-racial. **Table 1** shows the population data of included participants in the data analysis of the two groups of entrepreneurs and managers. Entrepreneurs started between 1 and 8 companies in their careers. Managers supervised between 2 and 1000 people. They had an average hierarchical position of 45 people away from the CEO of their company, a median hierarchical position of 10 people away from the CEO of their company, a range of 1 to 1000 people away from the CEO, and a 5% trimmed mean of 24 people away from the CEO. Of the 44 entrepreneurs, 35 had prior managerial experience. Of the 56 managers, 38 had previous entrepreneurial experience.

Survey Scoring

The data analysis followed the process of coding the different scores of each survey measurement, as outlined in **Table 2**. The Toronto Empathy answers were summed to derive totals according to the Toronto Empathy Questionnaire protocol [41]. The Melbourne Decision Making answers were split into four groups: buck-passing, hyper-vigilance, vigilance, and procrastination, and answers for each group were summed [42]. General Self-Efficacy scores were summed to derive a total [43]. The NEO Five-Factor Inventory scores were summed in each domain [44] and converted into t-scores using the provided t-tables. The Creative Achievements and Activities answers were split into Creative Activities and Creative Achievements, each separated into eight domains. Domain-specific scores were averaged or summed across each question, and domain-general scores were summed across each domain score [45]. NIH Toolbox instruments were used to collect the Emotion-Battery [46], and survey scores were calculated with the NIH Toolbox manual (www.nihtoolbox.org). Raw survey scores were converted into t-scores using the provided t-tables. The Alternative Uses Task [47] was scored by two independent raters along two dimensions of fluency and originality. Fluency was defined as the number of uses listed, and Originality was defined as the frequency of the use across participants (i.e., one divided by the number of times any participant listed the use). There was limited discrepancy

between what was considered both original and a 'use' by each rater. An intraclass correlation was performed to ensure good reliability between the two raters and found an intraclass coefficient of .7 for originality and .94 for fluency.

Data Analysis

Following the scoring, we employed an Exploratory Factor Analysis (EFA) to reveal latent factors in the dataset. We employed comparative analyses as a dichotomy (between Entrepreneurs and Managers) and across the Entrepreneurial-Managerial spectrum. The groups were defined based on the participant's responses to the Entrepreneur Manager Quotient, which established their experience in both entrepreneurship and management [48]. We also employed analyses based on the number of companies founded and differences in career success measured through income and self-rated success. We looked for any group differences in sex, race, age, income, and education. A chi-squared test of race and education between entrepreneur and manager groups showed significant differences between the two groups ($p=.05$, $\chi=9.4$ and $p=.015$, $\chi=10.4$, respectively). Thus, race and education were used as covariates for all later analyses. Sex, age, and income were not significantly different between the two groups.

Exploratory Factor Analysis (EFA)

We analyzed the data through an EFA to determine the underlying latent factors between numerous measured variables. We found latent factors that account for variation between the variables and drive differences across the EMS. The EFA also allowed us to reduce the data and avoid the problem of multiple comparisons. To test the appropriateness of an EFA, we first performed Bartlett's test for sphericity. This was significant ($p<.0001$), suggesting the correlation of our variables was different from zero. Then, we performed a Kaiser-Meyer-Olkin test to check sampling adequacy. We found the overall Measures of Sampling Adequacy (MSA) to be .76, suggesting a large enough sample size and enough variance for an EFA to be appropriate.

A Parallel Analysis computed with maximum likelihood extraction and oblique rotation determined that five to six factors had eigenvalues greater than those of chance (**Figure 1A**). We tested the five-factor model, which explained 48% of the variance with a strong loading of variables on all five factors. The loading values at ~0.5 and above were included in each factor, following the accepted guidelines and for the theoretical interpretation of the factors [49,50]. The five-factor model resulted in a root mean square of residuals of .064, a root mean squared error of approximations of .076 and a comparative fit index of .852. We also tested and compared a six-factor model, resulting in a model explaining 52% of the variance and an additional factor that only had two loading value above our threshold of 0.5. The six-factor model resulted in a root mean square of residuals of .053, a root mean squared error of approximations of .066, and a comparative fit index of .896. For simplicity we choose the five-factor model. Cronbach's alphas and factor loadings are reported in Results section.

Analysis of the difference between Entrepreneurs and Managers

We compared the resulting factors from the EFA between entrepreneurs and managers to identify the difference in cognitive capacity and behavior between the two groups, while controlling for covariates. Given any significant group differences, significance was determined with a Multivariate Analysis of Covariance (MANCOVA) using education and race as covariates. We corrected for multiple comparisons using the Benjamini-Hochberg method. When appropriate, we performed post hoc ANOVAs to examine group differences for each of the five factors.

Analysis of differences among the Entrepreneurial-Managerial Spectrum

We examined differences between levels of entrepreneurial/managerial experiences to understand differences in capacities and behaviors with experience. We quantified EMS using the Entrepreneur-Manager Quotient [48]. This questionnaire asks participants about their entrepreneurial experience, managerial experience, motivations, feelings of success, and position within their company. According to their responses to the quotient, participants were separated into four levels of experience: (1) entrepreneurs with no managerial experience, (2) entrepreneurs with managerial experience, (3) managers who were previously entrepreneurs, and (4) managers who were never entrepreneurs. We performed a MANCOVA to assess differences between the four levels of experience regarding the five factors from the EFA, with education and race as covariates and corrected using the Benjamini-Hochberg method. We then performed post hoc ANOVAs to examine group differences for each of the five factors.

Analysis of the difference in terms of the number of companies founded across all participants

We examined the relationship between the number of companies founded and the five factors of the EFA. We performed a MANCOVA with education and race as covariates to investigate the difference between participants who founded zero, one, two, or three+ companies, with companies founded defined by the Entrepreneur-Manager Quotient and study criteria. The number of companies founded was combined into a single group after three, as only a few founded more than three companies. We corrected p-values using the Benjamini-Hochberg method and when appropriate, we then performed post hoc ANOVAs to examine group differences for each of the five factors.

Analysis of the difference in terms of career success across all participants

The last analysis included the measurements of career success based on income and self-reported success. We performed a MANCOVA with education and race as covariates to investigate the effect of income and self-reported success on the five factors of the EFA. We corrected p-values using the Benjamini-Hochberg method and when appropriate, we then performed post hoc ANOVAs to examine group differences for each of the five factors.

Results

The analysis resulted in five factors from the EFA, allowing us to compare the groups as a dichotomy as well as a spectrum. Overall, our analyses revealed (1) significant differences between the two groups of Entrepreneurs and Managers, (2) significant differences in groups based on the level of entrepreneurial and managerial experience, and (3) no significant differences in Career Success.

Exploratory factor analysis results

The exploratory factor analysis resulted in five latent factors: Negative Emotions, Fulfillment & Support, Creative Capacity, Collaborative Personality, and Decision-Making Avoidance & Hypervigilance. **Figure 1** shows the scree plot and factor loadings of each factor of the exploratory factor analysis.

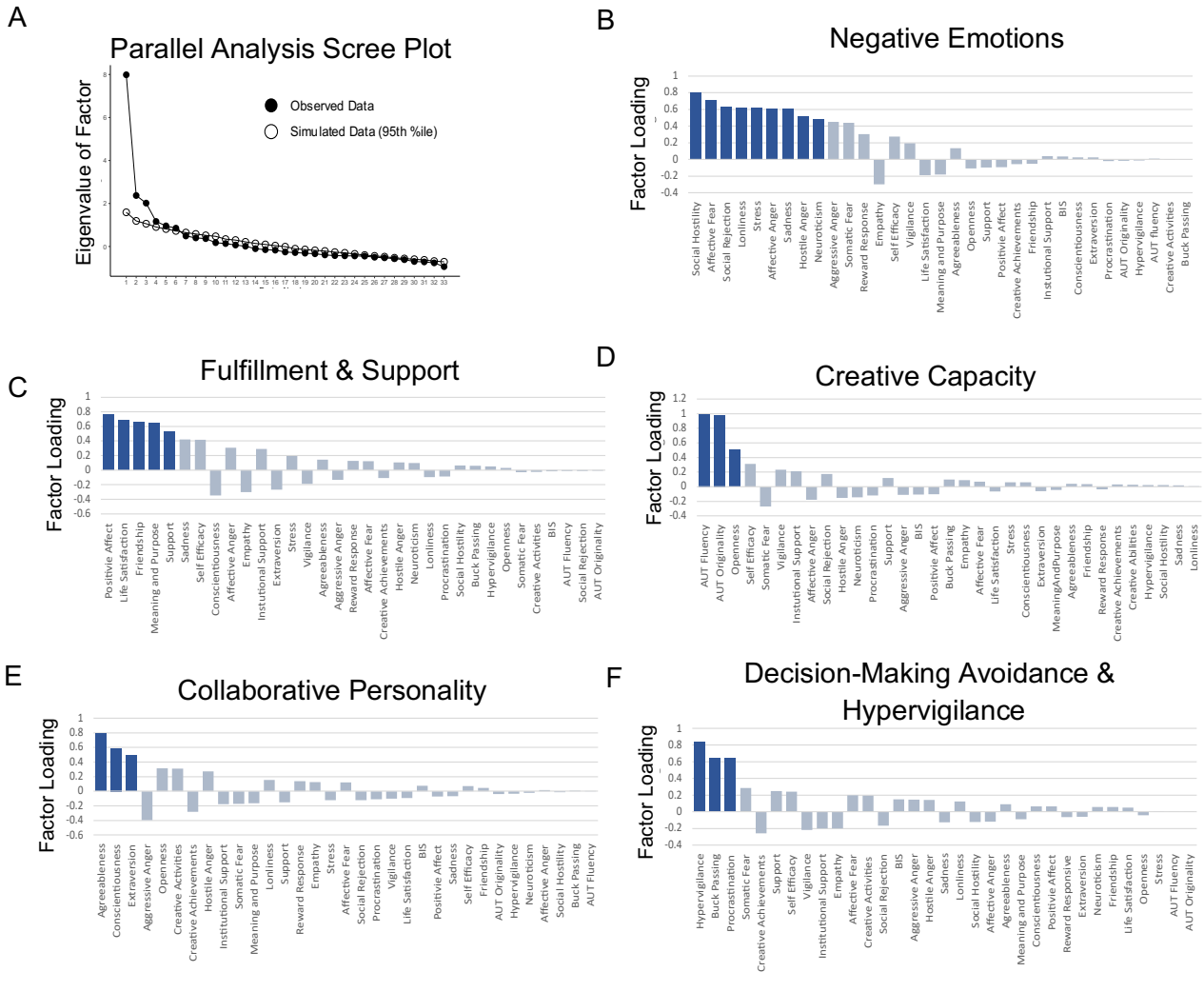

Figure 1. *Results of the Exploratory Factor Analysis. (A) A scree plot was used to determine the number of factors to retain. The dark line with filled circles shows the eigenvalues from the actual data. The gray*

line with empty circles represents the simulated and resampled data against which the actual data is compared. (B-F) Five latent factors were found in the exploratory factor analysis. Blue bars denote the variables comprising each factor, with height being the factor loading score. The label for each factor was determined based on the underlying factors with the highest loadings.

Each factor relates to a different cognitive and social aspect of entrepreneurial and managerial activities: emotional and social health (positive and negative), personality, creativity, and decision-making. '***Negative Emotions***' comprises nine subscales relating to negative emotional states: social hostility, affective fear, social rejection, stress, loneliness, affective anger, sadness, neuroticism, and hostile anger (**Figure 1B**). The factor loadings reach between .81 and .51 with Cronbach's alpha of $\alpha = .90$ and explain 15% of the variance. '***Fulfillment and Support***' consists of five subscales relating to general life fulfillment and social support. Factor loadings reach from .77 to .52 with Cronbach's alpha of $\alpha = .86$. The factor explains 11% of the variance. This factor comprises positive affect, life satisfaction, meaning & purpose, friendship, and support (**Figure 1C**). '***Creative Capacity'*** includes three subscales relating to creativity and openness to ideas: the alternative uses fluency score, the alternative uses originality score, and NEO openness (**Figure 1D**). The factor loadings reach from .99 to .51 with Cronbach's alpha of $\alpha = .59$ and explain 8% of the variance. '***Collaborative Personality'*** comprises three subscales from the NEO personality test: agreeableness, conscientiousness, and extraversion (**Figure 1E**). The factor incorporates loadings between .79 and .49 with a Cronbach's alpha value of $\alpha = .75$, explaining 7% of the variance. '***Decision-Making Avoidance & Hypervigilance***' comprises three subscales from the Melbourne Decision Making Quotient. The factor incorporates factor loadings from .83 and .64 with Cronbach's alpha of $\alpha = .78$, explaining 7% of the variance. The factors include hypervigilance, buck-passing, and procrastination (**Figure 1F**).

Examining the dichotomy between entrepreneurs and managers

The comparative analysis of the five factors between the two groups, Entrepreneurs and Managers, resulted in statistically significant differences in Decision-Making Avoidance & Hypervigilance, and trending towards significant differences in Collaborative Personality, as illustrated in **Figure 2**.

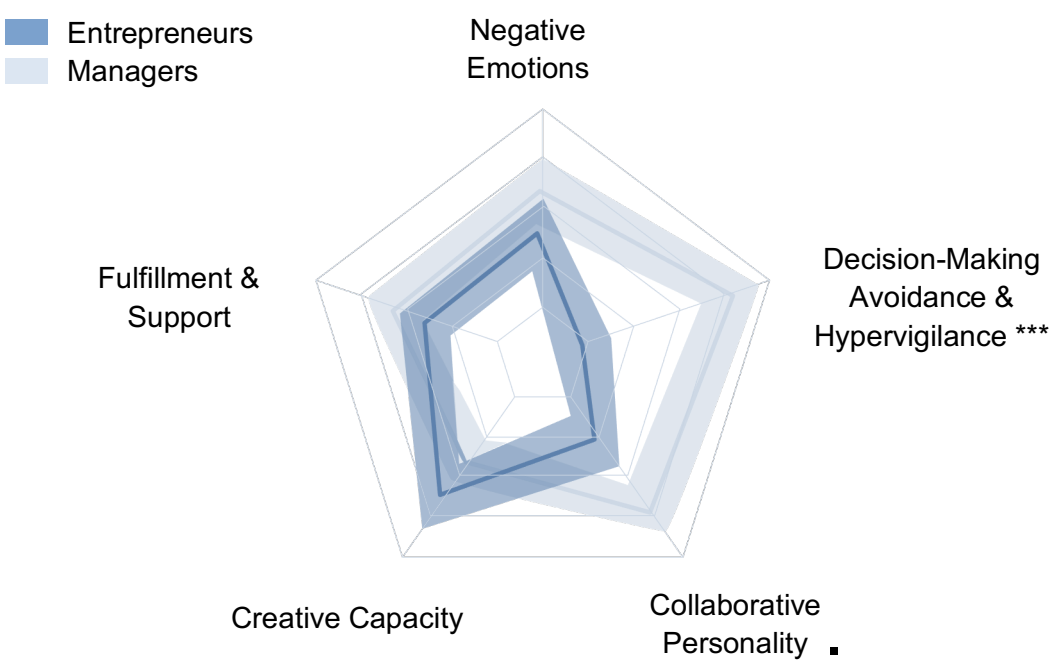

Figure 2. *Group Differences in Factors:* A radar plot of entrepreneurs and managers showing their average factor score for each of the five factors found in the exploratory factor analysis. Shaded regions show standard error. Entrepreneurs are indicated in dark blue and managers in light blue. $p < .1$; *** $p < .001$

The MANCOVA results showed significant differences between Entrepreneurs and Managers ($F=4.52$, adjusted $p=0.002$). Post Hoc ANOVAs showed that Entrepreneurs scored significantly lower than managers on Decision-Making Avoidance & Hypervigilance ($p < .001$, $F=12.39$). Collaborative Personality showed near significance ($p = .08$, $F=3.05$). Additionally, the analysis showed no significant differences in Creative Capacity, Negative Emotions, and Fulfillment & Support.

Examining differences across the Entrepreneurial-Managerial Spectrum

Our MANCOVA results revealed a difference based on the EMS ($F=2.57$, adjusted $p=0.002$). Post Hoc results showed that Creative Capacity and Decision-Making Avoidance & Hypervigilance vary significantly with entrepreneurial experience ($p=.021$, $F=3.38$ and $p = .002$, $F=5.0$, respectively). The data suggested non-linear differences in Creative Capacity across the EMS spectrum and an increase in Decision-Making Avoidance & Hypervigilance with decreased entrepreneurial experience, as shown in **Figure 3**. See **Supplemental Figure (A-C)** for non-significant score plots.

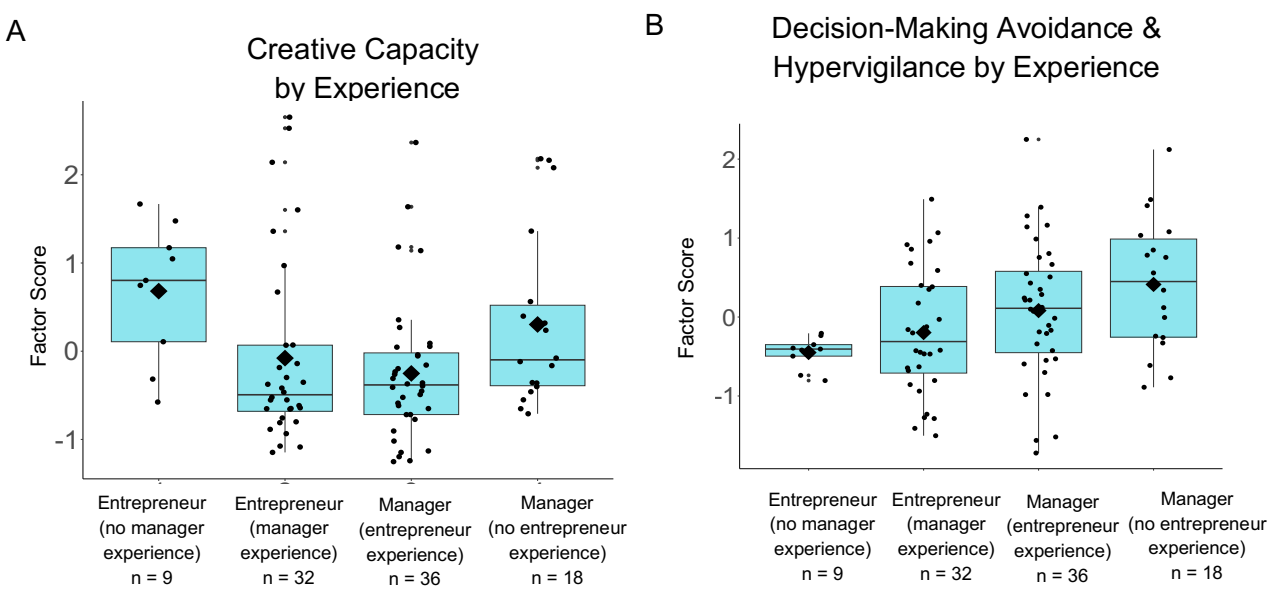

Figure 3. *Score plots of Entrepreneur-Manger spectrum: Significant differences between factors and entrepreneurial experience (A) Creative Capacity (B) Decision-Making Avoidance & Hypervigilance. Box plots with data overlaid showing the median and distribution of the significant factor scores grouped by entrepreneurial and managerial experience. Large dots denote the mean.*

Examining differences across the total number of companies founded across all participants

Our MANCOVA results revealed a significant difference based on the number of companies founded (F=5.37, adjusted p=0.002). Post Hoc results indicated significant differences in Collaborative Personality (p = .021, F=5.6) and Decision-Making Avoidance & Hypervigilance (p=.002, F=10.3) based on the total number of companies participants founded. Both factors tend to decrease with more companies founded, as shown in **Figure 4.** See **Supplemental Figure (D-F)** for non-significant score plots.

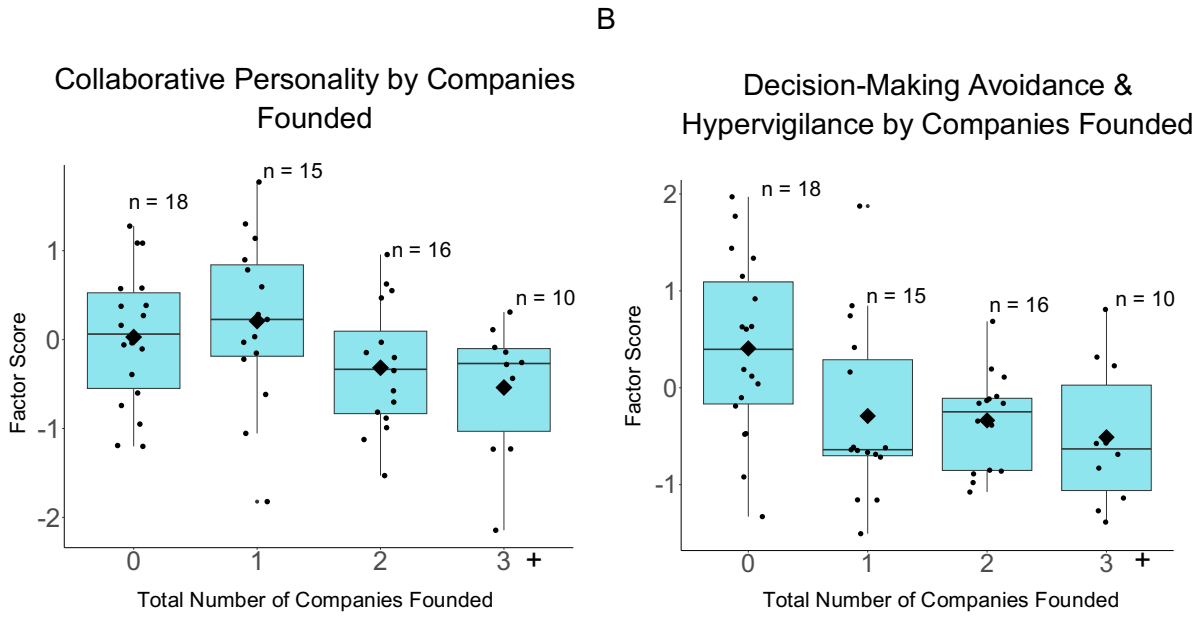

Figure 4. *Score plots of Companies Founded: Significant correlations between factors and the total number of companies founded. (A) Collaborative Personality (B) Decision-Making Avoidance & Hypervigilance. Box plots with data overlaid showing the median and distribution of the factor scores grouped by the number of companies founded: 0, 1, 2, 3, or more. Large dots denote the mean.*

Examining differences in terms of career success across all participants

Our MANCOVA results revealed no significant differences in latent factors based on career success as measured by income and self-reported success. Similarly, the analysis of group differences in Entrepreneurs' and Managers' career success also resulted in no significant differences between groups. The size of the company and the number of people supervised were also insignificant between groups.

Discussion

This study explored the multifaceted profiles of entrepreneurs and managers as a dichotomy and a spectrum. We did this by including a variety of well-established surveys on self-identified entrepreneurs and managers. Using an exploratory factor analysis, we found five latent factors underlying our data: Decision-Making Avoidance & Hypervigilance, Collaborative Personality, Creative Capacity, Negative Emotions, and Fulfillment & Support. We also measured career success through self-reported success and income. We have three main results from the exploratory factor analysis. (1) Entrepreneurs scored lower on Decision-Making Avoidance & Hypervigilance, and Collaborative Personality than managers. (2) Decision-Making Avoidance & Hypervigilance, Collaborative Personality, and Creative Capacity varied across the EMS and

(3) Negative Emotions, Fulfillment & Support, and Career Success remained indifferent to the EMS.

Our initial finding addressed the differences between entrepreneurs and managers as a dichotomy. These results indicate a potential difference in how entrepreneurs approach decision-making compared to managers. This is based on three decision-coping patterns identified in the Melbourne Decision Making Questionnaire: hypervigilance, buck-passing, and procrastination [42]. These three subscales of our decision-making factor conveyed anxiety towards decision-making and impulsivity, avoiding responsibility for decisions and leaving decisions to others, and indecisiveness towards decisions. The fourth coping pattern, vigilance, was not significantly loaded onto this factor, consistent with findings where vigilance is conceptually distinct from the other coping patterns. The Melbourne Decision Making Questionnaire framed questions regarding one's general preferences and feelings towards decision-making rather than one's ability to make decisions in one's current occupation. This is important as entrepreneurs generally have more freedom to make decisions unilaterally than managers. Our results suggested that entrepreneurs feel less negatively about making decisions, are less likely to pass the responsibility of making decisions onto others and are more inclined to make decisions. Entrepreneurs also have differences (trending towards significance) in their collaborativeness, measured across the personality domains of agreeableness, conscientiousness, and extraversion [44]. These personality domains are, on average, stable over time among adults and unrelated to life events [51]. There may be a selection effect where people with certain personality traits enter entrepreneurship, contributing to our decision-making differences.

As part of our EMS analysis, we looked more closely at the individual's prior work experiences. Our findings showed significant differences in groups based on a spectrum of entrepreneurial and managerial experience: entrepreneurs with prior managerial experience, entrepreneurs without prior managerial experience, managers with prior entrepreneurial experience, and managers without prior entrepreneurial experience. Significant differences suggested lower Decision-Making Avoidance & Hypervigilance scores with more entrepreneurial and less managerial experience. Creative Capacity was also different across the EMS spectrum. Creative capacity factor contained Alternate Uses Task and the NEO personality openness score. NEO openness has been previously associated with creativity, and creativity has been identified as an important aspect of entrepreneurship [52,53,54].

Additionally, Decision-Making Avoidance & Hypervigilance are higher for those entrepreneurs with prior management experience, which further suggests that differences in Decision-Making Avoidance & Hypervigilance can arise irrespective of potential constraints on their ability to make decisions unilaterally. Prior experience as a manager and working in a hierarchical structure could engrain one with decision-making avoidance or hypervigilant characteristics. These results imply that decision-making tendencies may relate to an individual's professional experiences. Supporting this explanation, participants who founded more companies generally scored lower on Decision-Making Avoidance & Hypervigilance and Collaborative Personality. It is possible that practicing making decisions in entrepreneurship may lower one's

hesitancy toward decision-making. Future longitudinal studies can track the effects of such experiences.

Lastly, our results also demonstrated similarities between entrepreneurs and managers. There were no significant differences in Negative Emotions or Fulfillment & Support between any groupings. There were also no significant differences in career success between the groupings for any of the five factors. The uncertainty of entrepreneurship presents unique challenges that have the potential to impact entrepreneurs' well-being negatively [55]. However, certain stressors have less of a negative impact on entrepreneurs' well-being compared to non-entrepreneurs [56], and entrepreneurial experience moderates how individuals perceive stressors [57]. Our results support the idea that entrepreneurs are better able to handle the stressors of their situations, resulting in no overall negative impact on their well-being - as measured through the factors of Negative Emotions and Fulfillment & Support, which includes measures of personal and social fulfillment, support, and life satisfaction. It is possible the stress management skills that seem to be needed to cope with the difficulties of entrepreneurship could be broadened and shared with others. Future longitudinal research with a larger sample size could examine how entrepreneurs' well-being changes over time and how this relates to their decision-making strategies, creativity, and personality.

Our findings form a perspective on the EMS that emphasizes a dynamic combination of different qualities and cognitions. The small sample size is a limitation, but our results are consistent with existing research indicating the potential importance of experience and environment to successful entrepreneurs. This is supported by work that attempts to improve certain aspects of entrepreneurship through practice. For example, what is known as a metacognitive perspective enhances the ability to adapt cognitively and can improve decision-making and creativity [58]. Metacognition improves through training and can enhance an individual's adaptability, creativity, and communication in various contexts [59,60,61,62]. Creative enhancement is also possible through a design-thinking-based Creative Capacity Building Program that has been shown to lead to longitudinal changes in brain activity associated with spontaneous improvisation [18]. In addition to training, an optimal environment can improve entrepreneurial cognition. Environmental and situational factors like good role models, resources, and freedom from criticism have influenced creativity in people [63,64,65]. Maximizing these factors could foster entrepreneurship.

One main limitation of our study is the relatively small sample size. Many of our entrepreneurs had previous managerial experience, and vice versa. Many managers were previously entrepreneurs. Future work could collect more samples of entrepreneurs and managers without conflicting experience to serve as a larger comparison. This would also allow us to look more specifically at questions such as how much personality selection affects compared to work experience influences one's decision to become an entrepreneur. Another study limitation is the dominance of self-report measures in comparison to less biased results like cognitive testing. Nevertheless, we believe our results are an important exploratory step for interesting future directions of research.

Our exploratory factor analysis approach revealed our dataset's underlying structure, comprising various psychological instruments. We studied the overall profile of a sample of entrepreneurs, including their environment and prior work experience. An entrepreneur's cognitive capacity and behavior are multifaceted, and it is beneficial to develop a holistic profile of entrepreneurs. Our study reflects the complex prior research on entrepreneurs and aims to be a step towards understanding the intersection of these different aspects of entrepreneurs. Future studies could test the validity of a new scale for our factors, and studies with a large sample size could be used to replicate and enhance our findings. Overall, understanding the complex profile of entrepreneurship benefits by exploring the combinations of optimal environments, experiences, traits, and cognitive capacities.

510 ***Table 1.*** *Sample size and demographic data*

	Entrepreneurs	Managers
Total	44	56
Male	34	35
Female	10	21
Asian	9	6
African American	9	24
Hispanic / Latino	3	0
White	20	23
Multi-racial	1	2
Prefer not to answer	2	1
Average Age	33 years	35 years
Income Group	Less than $10,000 = 3	Less than $10,000 = 1
	$10,001-$20,999 = 5	$10,001-$20,999 = 0
	$21,000-$30,999 = 1	$21,000-$30,999 = 5
	$31,000-$50,999 = 4	$31,000-$50,999 = 6
	$51,000-$75,999 = 5	$51,000-$75,999 = 5
	$76,000-$100,999 = 8	$76,000-$100,999 = 20
	$101,000-$125,999 = 8	$101,000-$125,999 = 8
	$126,000-$150,999 = 4	$126,000-$150,999 = 3
	$151,000-$200,000 = 2	$151,000-$200,000 = 4
	Over $200,000 = 2	Over $200,000 = 3
	Prefer not to answer = 2	Prefer not to answer = 1
Level of Education	High School = 4	High School = 3
	Bachelors = 25	Bachelors = 17
	Masters = 13	Masters = 25
	PhD = 2	PhD = 11

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513 ***Table 2.*** *Cognitive capacities, behaviors, and Entrepreneur-Manager spectrum assessments*

Assessment	Measurement
Entrepreneur Manager Quotient	A survey to determine where an individual lies on a spectrum from entrepreneur to manager.
Toronto Empathy	A representation of empathy as primarily an emotional process and component of social cognition. High empathy means accurately perceiving the emotional state of another person. Higher scores indicate higher empathy.
Melbourne Decision Making	Asks from 0-2 how true a series of statements are in each of the four categories: ● Procrastination: feeling pressured and pessimistic about decision-making ● Hypervigilance: delaying decision-making ● Buck-passing: avoiding decisions and leaving decision-making to others ● Vigilance: the consideration of information and alternatives
NEO Five-factor inventory	A measure of five domains of personality: ● Neuroticism: emotional instability ● Extraversion: sociability, emotionally expressive ● Agreeableness: altruism, kindness, cooperativeness ● Openness: curiosity, creativity ● Conscientiousness: thoughtful, good impulse control, preparedness
Inventory of Creative Activities and Achievements (ICAA)	Asks to report creative activities (CAct) and achievements (ICAA) (CAch). The inventory contains eight different domains (literature, music, art/craft, creative cooking, sports, visual art, performing art, and science) and 3 questions for each of these domains. ● CAct: the number of times an activity has been carried out ● CAch: the level of achievement
Reward Responsiveness	● Reward Responsiveness (RR): measures sensitivity to rewards independent of punishment ● Behavioral inhibition system (BIS): measures responses to anxiety cues in the environment

General Self-efficacy Scale (GSE)	Measures confidence in one's ability to cope, solve problems and accomplish goals. Scored from 'not true' to 'exactly true. A higher score indicates more self-efficacy.
Alternative Uses Test (AUT)	Participants have two minutes to come up with as many uses different from the common use for six common objects. Scored across two domains: ● Fluency: how many uses participants list ● Originality: how unique these uses are
NIH-Toolbox Emotion Battery	Questions on emotional health are answered on five- or seven-point Likert scales. Measured across multiple subdomains: ● Positive Affect, General Life Satisfaction, Emotional Support, Friendship, Loneliness, Perceived Rejection, Perceived Hostility, Sadness, Perceived Stress, Somatic Fear, Affective Fear, Aggressive Anger, Affective Anger, Hostile Anger, Meaning and Purpose, and Instrumental Support.

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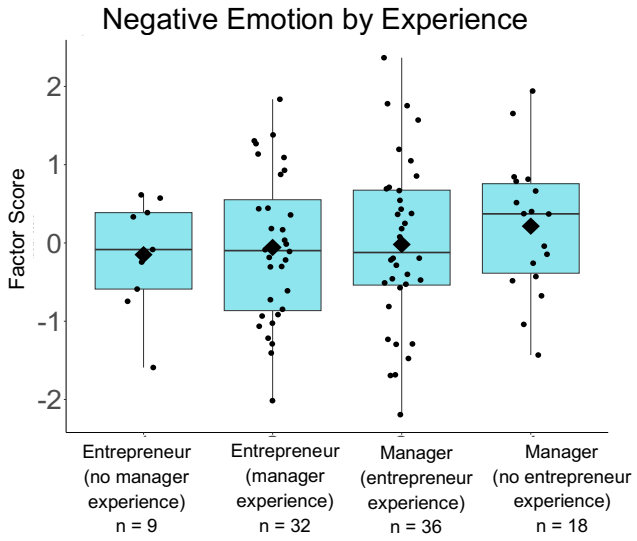
Data Availability

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request and IRB approval.

Supplemental Figures

A



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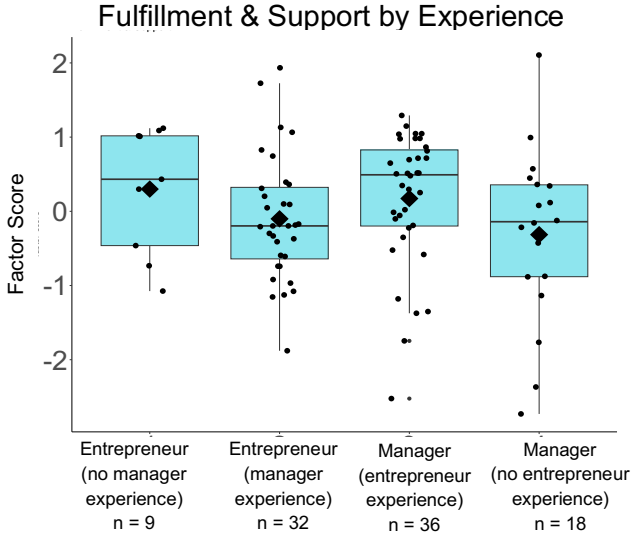

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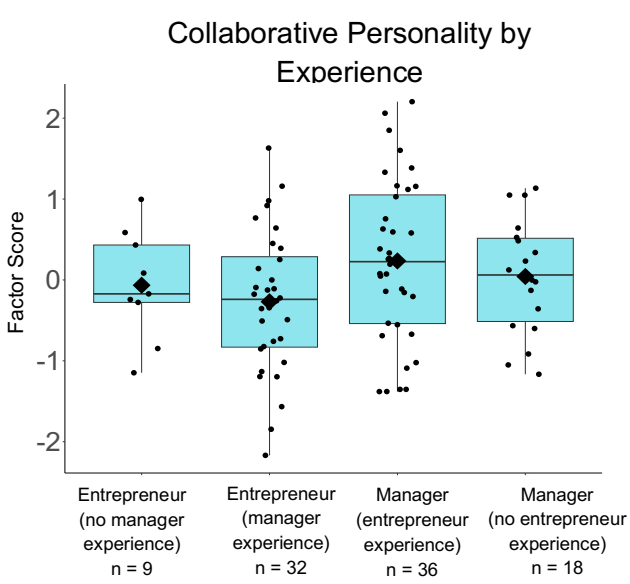

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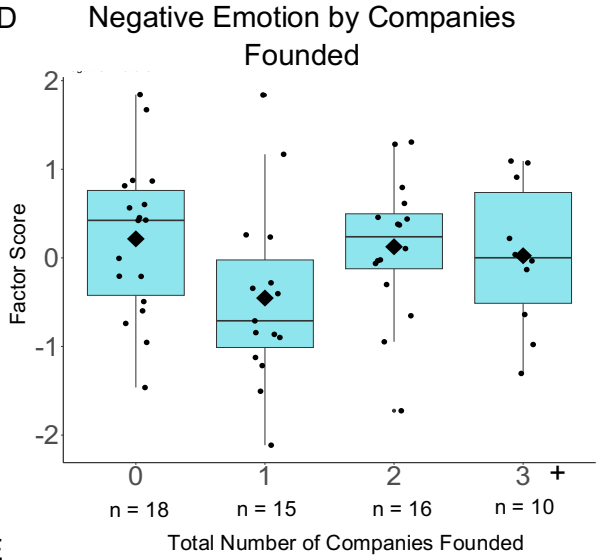

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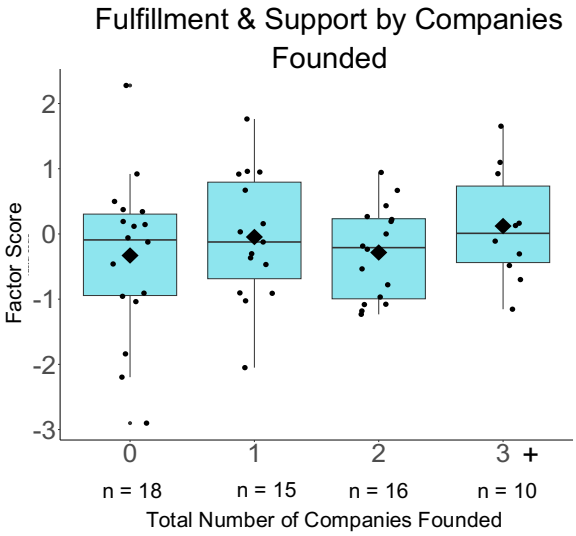

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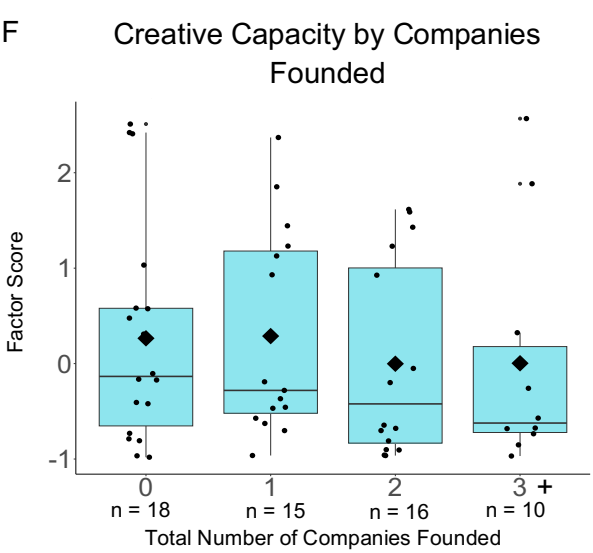

Supplemental Figure. *Score plots of Entrepreneur-Manger spectrum (A-C): Differences (not significant) between factors and entrepreneurial experience (A) Negative Emotion (B) Fulfillment & Support (C) Collaborative Personality. Score plots of Companies Founded (D-F): Significant correlations between factors and the total number of companies founded. (A) Negative Emotion (B) Fulfillment & Support (C) Creative Capacity. Box plots with data overlaid showing the median and distribution of the significant factor scores grouped by entrepreneurial and managerial experience (A-C) and the number of companies founded: 0, 1, 2, 3, or more (D-F). Large dots denote the mean.*

Supplemental Table 1. *Significant post hoc ANOVA results comparing entrepreneurs and managers*

	DF	Sum Sq	Mean Sq	F Value	P Value
Collaborative Personality	1	2.413	2.41254	3.0526	0.08398
Education	1	1.398	1.39752	1.7683	0.18692
Race	1	1.466	1.46600	1.8549	0.17657
Decision-Making Avoidance & Hypervigilance	1	8.105	8.1049	12.3916	0.0006759
Education	1	1.856	1.8559	2.8375	0.0955160
Race	1	0.028	0.0279	0.0426	0.8368756

Supplemental Table 2. *Significant post hoc ANOVA results of the Entrepreneur-Manager-Spectrum*

	DF	Sum Sq	Mean Sq	F Value	P Value
Creative Capacity	3	8.881	2.9602	3.3895	0.02148
Education	1	4.794	4.7943	5.4896	0.02136
Race	1	1.420	1.4205	1.6265	0.20551
Decision-Making Avoidance & Hypervigilance	3	9.732	3.2439	4.9982	0.002996
Education	1	0.296	0.2962	0.4564	0.501074
Race	1	1.718	1.7179	2.6469	0.107287

Supplemental Table 3. *Significant post hoc ANOVA results of the number of companies founded*

	DF	Sum Sq	Mean Sq	F Value	P Value
Collaborative Personality	3	2.9766	2.9766	5.6390	0.021080
Education	1	1.0640	1.0640	2.0157	0.161326
Race	1	6.0305	6.0305	11.4245	0.001339
Decision-Making Avoidance & Hypervigilance	3	6.196	6.1962	10.6376	0.001906
Education	1	3.519	3.5187	6.0408	0.017158
Race	1	0.427	0.4268	0.7328	0.395701