PERSISTENCE AND ENTREPRENEURIAL SUCCESS

by

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Abstract

OBJECTIVE: Use empirical evidence on founder traits and behavior to test

the hypothesis that persistence is a valuable attribute for entrepreneurs and analyze the

forms in which persistence is most impactful.

PARTICIPANTS AND PROCEDURES: A sample of 157 entrepreneurial founder-

owners completed an online questionnaire about the state of their business and past

business success, and a persistence behavior quiz, 63 of which also completed the TCI-

140 personality assessment measuring levels of trait persistence, and sub traits eagerness

of effort, work hardendness, ambition, and perfectionism. Results were analyzed to

determine correlations between persistence trait scores, persistence behavior, and

entrepreneurial success (past and present).

RESULTS: Persistence trait had a curvilinear relationship with entrepreneurial success,

where those with extreme persistence (scoring above 85% of the population) had less

success than those trending towards above average (60-80% of the population). The

dominating sub trait scores for successful entrepreneurs were eagerness of effort and

ambition while dominating sub trait scores for failed entrepreneurs were

work hardendness and ambition. The dominating trait combination eagerness of effort

and ambition were further correlated with a behavior tendency of goal persistence, while

the dominating trait combination of work hardendness and ambition

were correlated with response persistence. Goal persistence behavior was more common

in successful entrepreneurs while response persistence behavior was more common in

failed entrepreneurs.

CONCLUSIONS: Results should be investigated across a larger sample size to improve

confidence; however, if they hold true implications for entrepreneurs to foster goal

based persistence and be wary of the assumption that more persistence is always better or that work hardendness alone pays off.

Acknowledgements

Thank you to my supervisors Dan Coleman and Jeff McNally for your guidance, office chats, and patience in my slow progress. Thank you to the New Brunswick Innovation Foundation (NBIF) for allowing me to contact your portfolio companies as survey subjects. And finally thank you to my Dad for always being in my corner and pushing me to get this done with your perfunctory, incessant, fatherly nagging of "how is your thesis coming along, Heidi?"

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Introduction

Entrepreneurship and new firm creation is a high risk yet high potential return venture; entrepreneurs and shareholders can benefit from high returns on capital (often exceeding 10x returns), and introduction of new capital, resources, and products and services all serve to spur economic and technological development (Lowe & Ziedonas, 2002). Market entry success of new firms is low, with approximately 40% of high growth potential venture backed firms file for insolvency, and ~95% failing to reach projected return on investment (Gage, 2012). In this paper, we consider an entrepreneurial venture to be one that involves new market entry of new firms, as well as innovative and imitative entries into new markets by established firms (e.g., Kirzner, 1973; Wong & Autio, 2005).

There are many variables which have been found to influence the success of an entrepreneurial venture, including market segment, timing of entry, and entrepreneur psychological attributes, among others (Artinger & Powell, 2015). However, despite market opportunities, technological advances, favorable economic conditions, and available venture capital funding, no new firm can be created in the absence of focused and sustained entrepreneurial behavior; in short, new firms are created by humans, and humans are driven by personal and situational factors that affect individual social behavior (Shaver & Scott 1991; Shaver, 2003). Further to this concept, research suggests that underperforming firms can persist despite unfavorable market conditions if entrepreneurial human capital is effectively leveraged (DeTienne & Carson, 2008). This phenomenon has been well established through development of

the entrepreneurial venture threshold theory, which finds that firms differ in their threshold of performance, and that firm persistence of failure depends on the economic performance falling above or below that threshold (Gimeno, Volta, Cooper, & Woo, 1997).

This performance threshold is determined by many factors; however, one significant contributing factor is founder attributes. In response, a growing body of evidence exists that examines entrepreneurial psychology including subareas of personality, cognition, and attitude as they relate to entrepreneurial success (E.g. Omorede, Thorgren, & Wincent, 2015; Alvarez & Busenitz 2001; Baron 1998; Davidsson & Wiklund 2001; Wiklund et al. 2011). We want to expand on this growing body of literature to focus specifically on the extent to which persistence can make for a successful entrepreneur. Understanding persistence and its relation to entrepreneurial success as both a founder trait and a behavior will allow us to better predict and influence firm success by improving the preferential allocation of scarce funding and resources to entrepreneurs, and, improving entrepreneurial educational programs to develop persistence traits and behavior should it improve an entrepreneur's likelihood of success.

Personality and performance have been linked extensively in the literature (Omorede et al. 2015; Brandstätter, 2011; J. R., & Locke 2004; Alvarez & Busenitz 2001; Begley & Boyd, 1987). However, most research (to our knowledge) considers persistence as an outcome or a behavior resulting from an alternate trait, cognition, or attitude. For example, self-efficacy is a measure of the extent to which persons believe that they can organize and effectively execute actions to produce given outcomes. This

attribute has been linked extensively with achievement in many fields including academics, entrepreneurship, and sport (e.g. Fisk, 2003). Here, self-efficacy is considered a predictor of persistence, where persistence is a firm or obstinate continuance in a course of action in spite of difficulty or opposition (English Oxford Dictionary, 2017). Some research indicates that under challenging circumstances, individuals who are high in perseverance perform more adeptly, whereas individuals who fail to persevere not only perform inadequately, but also experience increased anxiety and negative affect (Sandelands, Brockner, & Glynn, 1988; Steinburg & Williams 2013). However, conflicting research has proposed both that; 1) no correlation exists between past failures and future success in entrepreneurial ventures (Gottschalk, Greene, Höwer, & Müller, 2014); or, 2) that performance persists (future success is best predicted by past success)(Gompers, Kovner, Lerner, & Scharfstein, 2010). This research is relevant because it will:

1. Use empirical evidence on founder traits and behavior to test the theory that persistence is a valuable attribute for entrepreneurs;

2. Analyze in which forms persistence is most impactful, and how it might be preferentially sought in individuals selected into accelerator programs, allocated funding, etc.; and,

  We propose a cross disciplinary approach to explore the relationship between persistence and entrepreneurial success by applying neurobiology and psychology approaches to measure entrepreneurial persistence traits, behavior, and the impact of these on firm success.

Persistence Defined

The temperament and character inventory is a set of tests designed by neurologist and psychologist Robert Cloninger to identify the intensity of and relationships between the seven basic personality dimensions of Temperament and Character, which interact to create the unique personality of an individual (Cloninger, Svrakic, & Przybeck, 1993). In the temperament and character inventory (TCI), persistence is defined as one of the four temperament traits. The others include novelty seeking, harm avoidance, and reward dependence, while character is defined by self directedness, self transcendence, and cooperation. Persistence trait is further broken down into four subcategories;

1. Eagerness of effort: the solidity, sincerity, energy, and conviction of the laudableness of the object sought, the characteristic of being excited and prepared to do something;

2. Work hardened: an increase in strength that comes from undergoing trials and stress;

3. Ambitious: desiring power, office, status, wealth, or some other distinction; and

4. Perfectionist: refusing to accept any standard that does not have all the required or desirable elements, qualities, or characteristics; ensuring something is as good as it is possible to be.

Persistence as measured in the TCI reflects a heritable bias in the maintenance of behavior despite frustration, fatigue, and intermittent reinforcement. It is observed as industriousness, determination, and perfectionism. Highly persistent people are hard-working, persevering, and ambitious overachievers who tend to intensify their effort in

response to anticipated reward and perceive frustration and fatigue as a personal challenge (Svrakic, Whitehead, Przybeck, & Cloninger, 1993, Cloninger et al. 1993, Mulder, Joyce, Sullivan, Bulik, & Carter, 1999; Hansenne, Delhez, & Cloninger, 2005; Siddiqi, Chockalingam, Cloninger, Lenze, & Cristencho, 2016).

Behavioral persistence is another name for the ability to maintain an effortful response over time or a form of attention involving the maintenance of attentional focus over time. Persistence can be measured as the time invested in staying on task or on goal. Unlike persistence traits, which are measures of an individual's temperament regardless of their activities, persistence behavior is a measure of the sustained action towards a goal or task. It is the action of persistence that ultimately results in a goal or task being achieved.

Wong (1995) completed many studies on persistence using rats as subjects (Wong, 1979; Wong, 1977). He identified two main types of behavioral persistence; response persistence and goal persistence. Response persistence refers to the habit of repeating the same response or approaching something in the same way, even when it is no longer appropriate. Goal persistence refers to a commitment and tenacity in pursuing a goal, by implementing different approaches if necessary. Response persistence can be self-defeating in the presence of an obstacle while goal persistence often pays off.

Thesis

This research will attempt to outline the relationship between persistence and entrepreneurial success by attempting to answer four broad questions:

1. Are persistence personality types correlated with entrepreneurial success? Specifically;

   a.   What are the correlations between persistence and persistence sub traits?

   b.   Does persistence personality vary between entrepreneurs and a control population?

   c.   Does the relative strength of trait persistence correlate with entrepreneur success?

   d.   What specific sub-persistence traits are most correlated with entrepreneurial success?

2. Are persistence personality types correlated with a behavior expression of persistence? Specifically;

   a.   Is persistence in personality correlated with different expressions of persistence in behavior (task vs. goal)?

   b.   Are there correlations between persistence sub traits and expression of persistence in behavior?

3. What persistence behaviors are most correlated with entrepreneur success? Specifically;

   a.   Is persistent behavior correlated with entrepreneurial success?

   b.   Can pivots be used to predict goal behavior and entrepreneurial success? (Where pivot was defined as a change in target market, product, or revenue model).

4. What do past failures tell us about entrepreneurs? Specifically:

a. Is there a correlation between past failure and future success in entrepreneurship?

Model

We applied a modified model of expectancy theory to test our predictions on entrepreneur persistence and entrepreneur success. The original expectancy theory of motivation explains how individual behavior can be motivated towards goal based outcomes if one believes that there is a relationship between effort and positive performance, and positive performance and achievement of desirable outcomes (Oliver, 1974). In this model there are three variables; expectancy, instrumentality, and valence. Expectancy is the belief that an effort will result in a performance, instrumentality is the belief that a reward will be given if the performance is met, and valence is the value place on the reward outcome. While criticisms exist

for Vroom's original expectancy theory (e.g. Graen, 1969;

Lawler,1971; Lawler & Porter, 1967; and Porter & Lawler, 1968), who point out that the model is overly simplistic, the overall architecture of the expectancy theory has been widely accepted and extensively referenced in academic literature (Lawler & Sutton, 1973, Montana & Charvnov, 2008). Vroom's expectancy theory proposes that behavior results from individual's conscious choices among a range of possible choices in order to maximize desired outcomes and minimize undesirable outcomes. The theory is based on the assumption that individual performance is based on individual factors like personality, knowledge, skills, and experiences and that effort, performance, and motivation are all linked. The key connection between the original expectancy theory,

and our application of this theory is framed around the model of associations individuals make towards expected outcomes, and the contribution they feel they can make towards those outcomes. We used this theory to explore how persistence in trait and behavior impacts an entrepreneur's expected outcome of business success.

In this study we are using the expectancy theory, not to determine motivation, but to determine variables of successful firm performance. In our modified theory we are using the personality trait of persistence to determine the expression of effort in persistence, and the expression of effort in persistence to determine overall firm performance. We are using this study to determine if personality traits impact the expectancy of an effort to result in a performance through the nature of effort expended (response vs. goal). Further we are using the bounds of expectancy theory to observe if expectancy of effort impacts the performance outcome.

Figure 1 Modified expectancy theory of motivation applied to test persistence trait and behavior variables on the entrepreneurial success of an individual founder (Vroom, 1964).
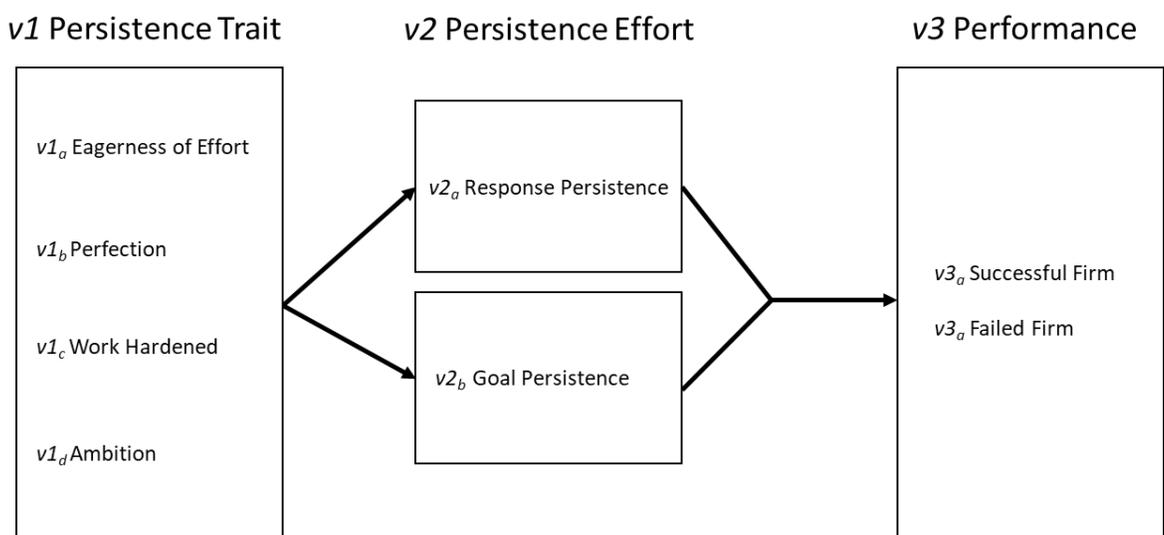
With respect to this model we hypothesize:

1. Extremely high levels of persistence trait will result in response based persistence, particularly for those with high scores of perfectionism and work hardendness,

2. Goal persistence will result in a higher level of entrepreneurial success while response persistence will result in a higher level of entrepreneurial failure due to escalation of commitment to a failing course of action (Staw, 1994),

3. Overall, persistence trait score will have a curvilinear relationship with entrepreneurial success, extreme levels of persistence will result in response persistence (commitment to a failing course of action), and result in higher levels of entrepreneurial failure, low persistence scores will result in premature firm abandonment, while moderately high levels of persistence will result in goal persistence and the highest level of entrepreneurial success,

Methods

Study Design

Persistence Trait

First we measured the level of persistence in the entrepreneur overall and by sub traits, eagerness of effort, perfection, work-hardenedness, and ambition according to Cloninger's TCI 140-R test, a test for classifying personality and temperament measures four characters (persistence, harm avoidance, novelty seeking, and reward dependence) and three temperaments (self directedness, cooperation, and self transcendence) using 140 likert scale multiple choice questions.

There were 20 questions for each dimension and 4 validity questions to test for inattention or carelessness. The TCI was developed from a theoretical perspective on how brain structure, brain organization, and environment interact throughout development to affect an individual's affective and behavioral responses (Cloninger, 2004). This test is routed in neurobiology, and has been widely applied (e.g. Le, Basiaux, Streel, Tecco, Hanak, Hansenne, Ansseau, Pelc, Verbanck & Dupont, Kluger, 2004; Laidlaw, Kruger, & Harrison, 1999; etc.). It is internationally accepted with numerous previous studies supporting the psychometric validity of the test (e.g. Miettunen, Lauronen, Kantojarvi, Veijola, & Joukamaa, 2008; Miettunen, Kantojarvi, Ekelund, Veijola, Karvonen, Peltonen, Jarvelin, Freimer, Lichtermann & Joukamaa, 2004).

Persistence Behavior (Effort)

Second, we measured the behavioral tendency of the entrepreneur to persist either in response or in goal using a quiz that measured subjects' performance on tasks versus their performance on the overarching goal.

Entrepreneurial Success

Ultimately we determined the correlation between persistence trait and sub trait levels, behavioral response, and the entrepreneurs' history and current state of entrepreneurial success. In this case we defined entrepreneurial success simply as having created a company that was profitable under their leadership.

Data Collection

This study examines the impact and interactions of entrepreneurial persistence temperament traits, entrepreneurial expression of persistence through behavior, and ultimate entrepreneurial success through the creation of a profitable firm. Survey data was collected from 157 entrepreneurial founders and 31 undergraduate students. Traits, behavior, and firm success were measured individually through the application of three different surveys/tests.

v1 – Entrepreneurial Persistence Temperament

Persistence traits were quantified using Cloninger's T-140 personality test, a test that measures persistence as one of four temperament traits, including novelty seeking, harm avoidance, and reward dependence. Persistence is quantified overall as well as by subcategories, ambition, perfectionism, work-hardenedness, and eagerness of effort (Table 1). Results were provided for the raw score, T-Score, and population percentile, based on Cloninger's database. Data was analyzed using the percentile score, which measures how a subject scores relative to the overall population sampled. Data were collected via the TCI personality test using 63 subjects (32 entrepreneurs and 31 undergraduate students).

v2 – Persistence Behavior (Effort)

Persistence behavior was broken down into a tendency for response persistence versus a tendency for goal persistence. Subjects were given a quiz with 10 questions taken from a GMAT practice exam. They were told prior to the test that their goal was

to complete the test in as short a time as possible. Subjects were told that the time scoring was calculated as follows:

- Time scoring is based on the full duration you spend on the test, however each question skipped will add 60 seconds to your time,

- You can choose to skip a question but you will otherwise not be automatically moved forward until you get it correct.

The longer a subject took on completing the test (i.e. the more time they spent working on individual questions) the greater the exhibit of response based behavior, while the shorter the subject took on completing the test (i.e. the less time spent working on any individual question) the greater the exhibit of goal based behavior. Data were collected via the quiz using 157 entrepreneurs.

v3 – Entrepreneurial Performance

Entrepreneurial performance was classified as either successful or failed using the simple definition that successful performance resulted when a firm was profitable under the founder's leadership (either at present or in the past), while failure resulted when a firm was not profitable, or filed for insolvency. Data were collected on 157 entrepreneurial founders capturing their current and past firm success (Appendix A). Entrepreneurs surveyed were considered successful if they met one of the two conditions where they:

1. Responded to the question of current profitability of firm with "Yes, Always", or "Mostly Yes", or

2. Claimed to have had a successful business in the past that became and maintained profitability under their leadership.

The remainder who responded to the question on current profitability of firm with "Not Yet", "Sometimes", or "We went bankrupt" were considered failed entrepreneurs if they had no history of having started success ventures. Given that most start-ups fail it was assumed that those entrepreneurs who were not currently profitable and had no history of profitable ventures would likely fail.

Analysis

Quantitative data was analyzed to determine the correlation between variables to answer

the questions of the thesis (Table 1).

Table 1 Data analysis framework for understanding the correlation between
entrepreneur persistence behavior, persistence trait, and venture success.

Question	Variable 1	Variable 2	Analysis Measure
1. Are persistence personality types correlated with entrepreneurial success?			
1a. What are the different drivers within persistence trait?	$v1$(Persistence Trait)	$v1_{a-d}$ (Persistence Sub-Trait)	Regression Analysis (R^2)
1b. Is there a difference in persistence traits between entrepreneurs and a control group?	$v1$(Student vs. Entrepreneur)	$v1_{a-d}$ (Persistence Sub-Trait)	One Way T-Test (p value)
1c. Can strength of persistence trait determine entrepreneurial success?	$v1$(Persistence Trait)	$v3$(Entrepreneurial Performance)	One Way T-Test (p value)
1d. Do subtraits of persistence vary in predicting outcome success?	$v1_{a-d}$ (Persistence Sub-Trait)	$v3$(Entrepreneurial Performance)	Regression Analysis (R^2)
2. Are persistence personality types correlated with a behavior expression of persistence?			
2a. Does persistence trait predict persistence in response vs. persistence in goal?	$v2$(Persistence Behavior)	$v1$ (Persistence Trait)	One Way T-Test(p value)
2b. Do subtraits of persistence vary in predicting behavior of persistence?	$v2$(Persistence Behavior)	$v1_{a-d}$(Persistence Sub-Trait)	Regression Analysis (R^2)
3. What persistence behaviors are most correlated with entrepreneur success?			
3a. Does persistence in task vs, goal predict outcome success?	$v2$(Persistence Behavior)	$v3$(Entrepreneurial Performance)	One Way T-Test(p value)
3b. Can pivots be used to predict persistence behavior?	$v2$(Persistence Behavior)	Number of pivots	One Way T-Test (p value)
3c. Do subtraits of persistence vary in predicting behavior of persistence.	$v2$(Persistence Behavior)	$v1_{a-d}$ (Persistence Sub-Trait)	Correlation (r value)
4. What do past failures tell us about entrepreneurs?			
4a. Does past failure point to future success?	$v3$(Past Failure)	$v3$ (Entrepreneurial Performance)	One Way T-Test (p value)

Results were analyzed in four separate sections addressing the core

thesis questions (Table 1).

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Analysis Part 1 - Are persistence personality types correlated with entrepreneurial success?

Regression analysis was completed between persistence trait and persistence sub traits to understand the correlations between sub traits. A one way T-test was completed to determine if the two populations (entrepreneurs, and students) were significantly different with the null hypothesis predicting there would be no difference between groups. T-Tests were then completed within the entrepreneur population to determine if statistically significant differences could be detected in persistence traits of entrepreneurs who:

- Had failed or were not yet successful and those who were successful,

- Had pivoted as a company, and those who had not pivoted, and

- Had previous failed ventures, and those who had previously successful ventures.

Analysis Part 2 - Are persistence personality types correlated with a behavior expression of persistence?

A regression analysis was completed between persistence traits and persistence behavior test results in terms of time score and number of questions skipped. A one way T-test was completed to analyze the difference in persistence traits between the top performing quartile (lowest 25% of time scores, showing more goal persistence behavior) and the bottom performing quartile (highest 25% of time scores, showing more response persistence behavior) populations the null hypothesis predicting there would be no difference between groups. Persistence traits were then analyzed by goal behavior and response behavior looking at:

- Relative strength of overall persistence trait relative to sub traits by persistence behavior; and

- Dominate sub traits by persistence behavior.

The goal persistence group included those who score <=720 seconds (the amount of time it would take to complete the quiz if one were to immediately skip all questions, plus a buffer of 2 minutes), and the response persistence group included those who scored >720 seconds.

Analysis Part 3 - Which persistence behaviors are most correlated with entrepreneur success?

Persistence behavior quiz results were correlated with entrepreneurial survey results to determine the relationship between entrepreneurial success and persistence behavior. A One-Way T-Test was used to determine the differences in times scores between successful and failed entrepreneurs. Results were further analyzed in terms of questions skipped, and goal vs. response persistence behavior by entrepreneurial performance. A regression analysis was completed for the relationship between time score and number of pivots the entrepreneur had completed to determine if a relationship exists between goal based persistence and entrepreneurial tendency to pivot. In this case pivots were defined as a significant change in product or market.

Analysis Part 4 - What do past failures tell us about entrepreneurs?

Finally, results were analyzed within the entrepreneurial performance survey to determine if there is a relationship between past success and current entrepreneurial success. A One-Way T-Test was completed to assess the significance of this relationship.

Results and Discussion

Part 1. Are persistence personality types correlated with entrepreneurial success?

Q1a: What are the correlations within persistence trait?

Overall persistence trait scores of subjects ranged from a low of falling in the bottom 8% of the population to a high of falling in the top 99% of the population (Figure 3). On average subjects scored above average in all persistence sub traits, with the lowest being eagerness of effort (top 57% of population) and highest being ambition (top 72% of population) (Table 2). However, subjects had a diverse spread of results in all sub traits; lowest scores fell in the bottom 10% of the population while highest scores fell in the top 90% of the population).
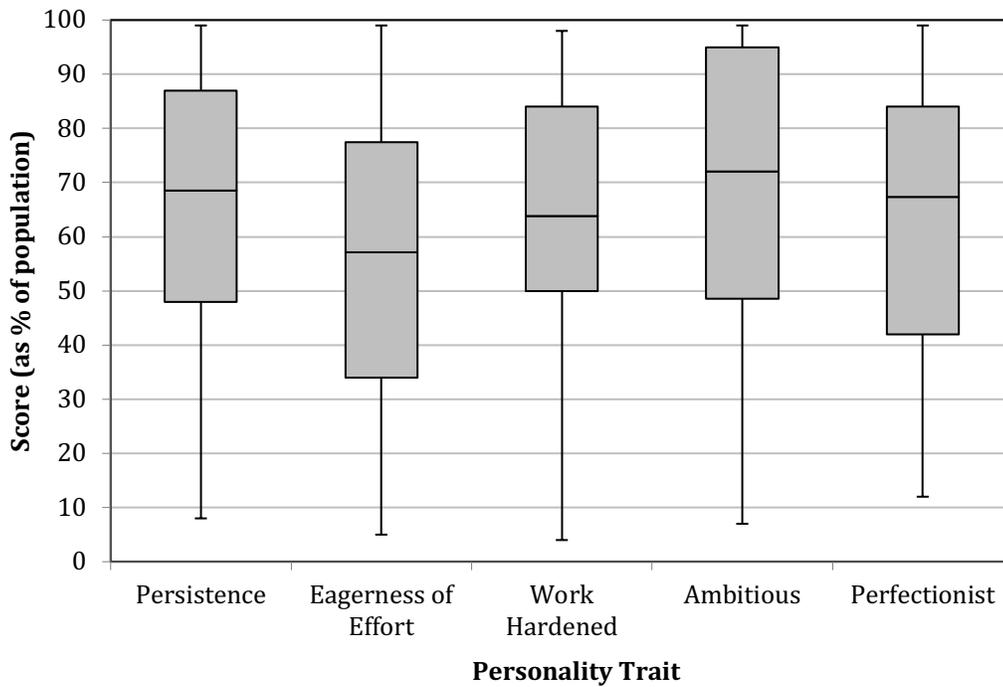
Figure 2 Box and whisker plot showing the spread of TCI persistence personality trait scores in survey subjects (n=63) (Cloninger, 1993).

Table 2 Mean, standard deviation standard error of sample set for TCI persistence personality trait scores in survey subjects(n=63)(Cloninger, 1993).

Measure	Persistence	Eagerness of Effort	Work Hardened	Ambitious	Perfectionist
Sample Mean	68.48	57.08	63.78	72.10	67.33
Student Sample Mean	56.77	49.13	54.55	59.35	59.58
Entrepreneur Sample Mean	79.81	64.78	72.72	84.44	74.84
SD	25.52	28.07	24.56	27.66	24.04
SE	3.22	3.54	3.09	3.48	3.03

Validity of the test could not be measured for this sample set as the raw results by question were not provided. However, literature points to a high internal reliability alpha of 0.84 for persistence overall, with moderately high internal reliability across the persistence subscales (Table 3).

Table 3 Internal validity of the TCI-140 from Zohar & Cloninger, 2011, measured using Cronbach's alpha.

Dimension	# of Questions	Reliability Estimate[1]	Scale Mean[2]	SD
Persistence	20	0.84	66.2/100	9.2
PS1 – Eagerness of Effort	5	0.63	17.3/25	3.1
PS2 – Work-Hardended	5	0.68	17.4/25	2.9
PS3-Ambition	5	0.67	15.8/25	3.0
PS4 - Perfectionism	5	0.7	15.5/25	3.4

[1] Internal reliability measure based on Cronbach's alpha.

[2] Shown as average score over highest possible score.

It is interesting to note that while all sub traits had an R^2 with overall persistence >0.5, there were very weak ties between different sub traits of persistence; most fall below a R^2 value of 0.3 (Table 4). The ambition sub trait was most highly correlated with overall persistence scores, with an R^2 value of 0.81 followed by perfectionism with an R^2 value of 0.66. Ambition was the most strongly correlated with sub traits across the board; R^2 values were 0.29, 0.39, and 0.48 for eagerness of effort, work hardenedness, and perfectionism respectively (Table 4).

Table 4 R2 value correlations between overall persistence trait score and persistence sub trait scores (n=63) (Cloninger, 1993).

R^2 Value	Overall Persistence	Eagerness Of Effort	Work Hardened	Ambitious	Perfectionist
Eagerness of Effort	**0.55**	x	x	x	x
Work Hardened	**0.60**	0.22	x	x	x
Ambitious	**0.81**	**0.29**	**0.39**	x	x
Perfectionist	**0.66**	0.22	**0.29**	**0.48**	x

Q1b. Is there a difference persistence traits between entrepreneurs and a control group?

Entrepreneurs consistently scored higher than students on average for all persistence traits, ranging from 15% higher (for perfection and work hardened) to 25% higher for ambition (One Way T-Test $p<0.01$)(Table 7)(Figure 3).
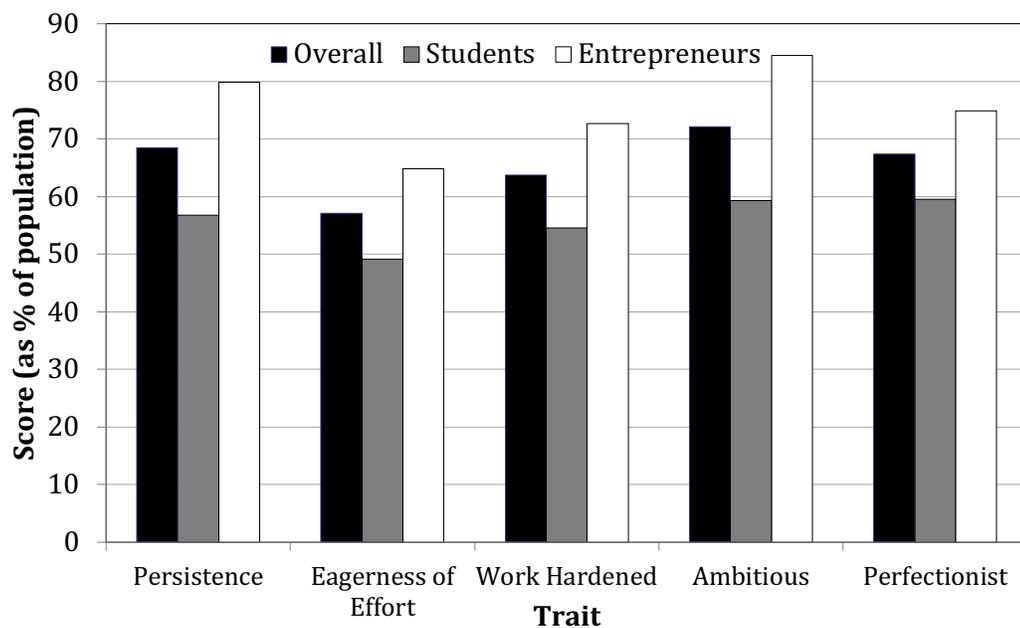
Figure 3 Average TCI Persistence trait and sub trait scores categorized by students, entrepreneurs, and overall results (Overall n=63, Students n=31, Entrepreneurs n=32) (Cloninger 1993).

Entrepreneur persistence scores had less spread than the overall sample, with the exception of eagerness of effort (Figure 4a and 4b). Ambition was both the highest score and the score with the least spread between upper and lower quartiles (Figure 4a). All traits scored on average above 50% of the population, with eagerness of effort the lowest at 64% and ambition the highest at 84%.
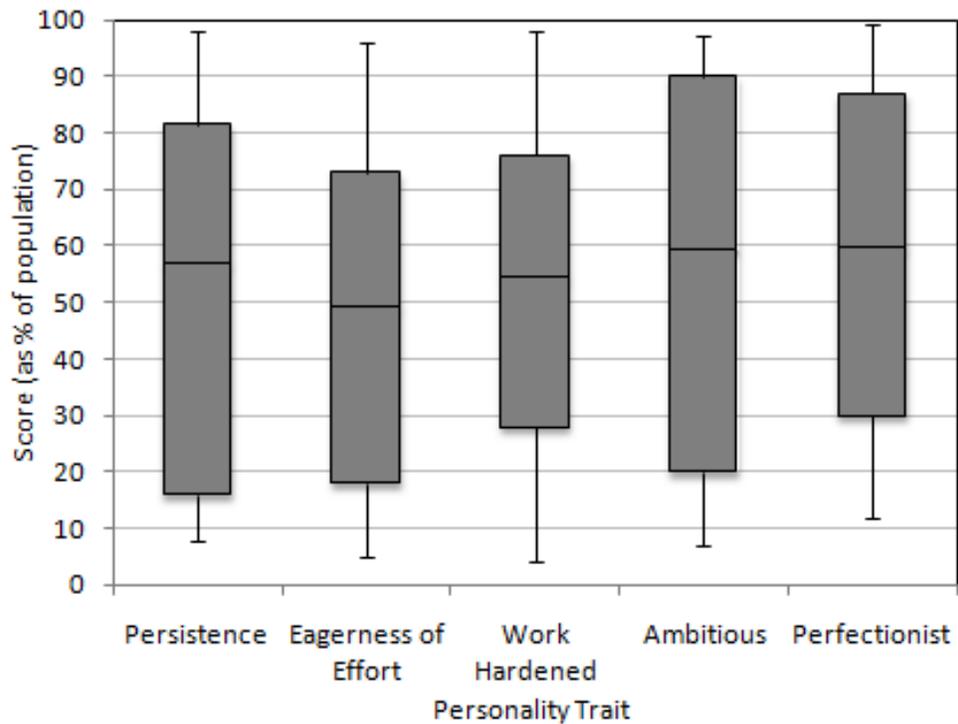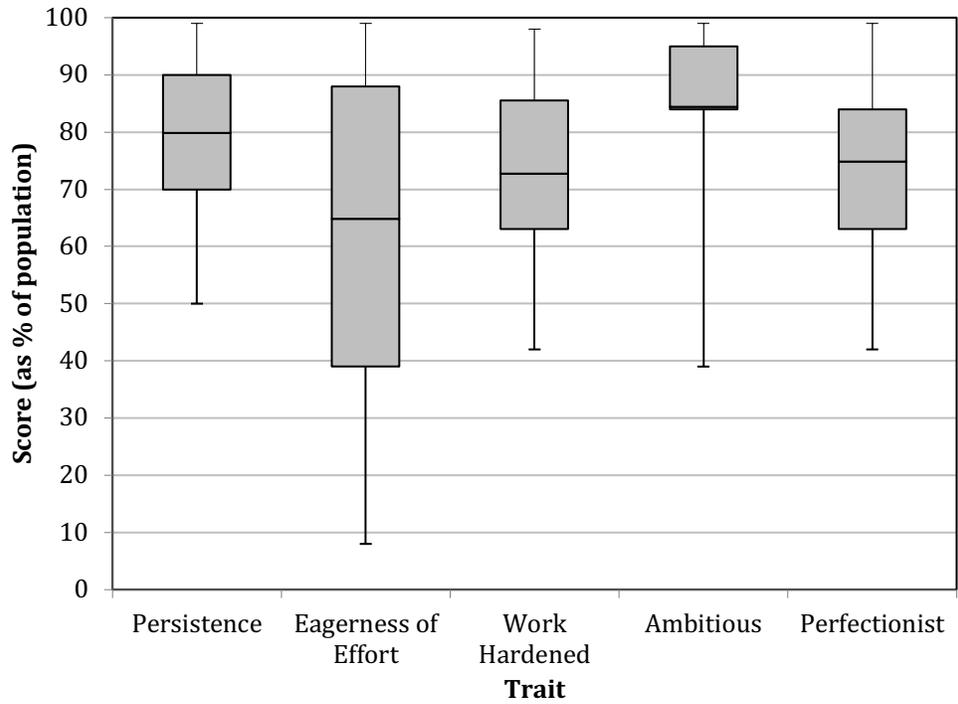
b.

Figure 4 Box and whisker plot showing the spread of TCI persistence personality trait and sub trait scores in a) entrepreneur survey subjects (n=32) and b) student survey subjects (n=31)(Cloninger, 1993).

Different correlation patterns emerge within persistence trait and sub trait results when the sample is isolated to entrepreneur data. Entrepreneurs had lower correlations between persistence sub traits than was observed for the overall sample (Table 5). This could largely be attributed to a smaller sample size resulting in higher levels of error. However, entrepreneurial sub trait correlation scores were relatively lower on traits eagerness of effort and work hardenedness, ($R^2=0.33$, $R^2=0.46$), and relatively higher on correlations between ambition and perfectionism in overall persistence scores ($R^2=0.73$, $R^2=0.47$). Ambition maintained a higher correlation with perfection ($R^2=0.36$), with the second highest correlation existing between perfectionism and work hardenedness ($R^2 = 0.18$). Correlations were lowest for eagerness of effort, with virtually no relationship existing between eagerness of effort and work hardenedness, or perfectionism.

Table 5 R2 value correlations between overall persistence trait score and persistence sub trait scores in entrepreneurs (n=32)(Cloninger, 1993).

R^2 Value	**Overall Persistence**	Eagerness of Effort	Work Hardened	Ambitious	Perfectionist
Eagerness of Effort	**0.47**	x	x	x	x
Work Hardened	**0.33**	0.04	x	x	x
Ambitious	**0.73**	**0.13**	**0.16**	x	x
Perfectionist	**0.46**	0.02	0.18	**0.36**	x

Persistence trait scores were significantly different between entrepreneur and student samples for overall persistence as well as sub traits work hardenedness, ambition, and perfectionism (Table 6)(One-Way T-Test $p<0.01$, $p<0.01$, $p<0.01$, and $p<0.01$). No

statistical differences were noted within the entrepreneurial population with the exception of work hardened sub trait and perfectionist sub trait (Table 6).

Table 6 R2 value correlations between overall persistence trait score and persistence sub trait scores in entrepreneurs (n=32)(Cloninger, 1993).

Sample Groups			Persistence		Eagerness of Effort		Work Hardened		Ambitious		Perfectionist	
Students	Entrepreneurs	Mean	**57**	**80**	49	65	**54**	**72**	**59**	**84**	**60**	**75**
(n=31)	(n=32)	P value	**<0.01**		0.13		**<0.01**		**<0.01**		**<0.01**	
Cashflow+[1]	Cashflow –	Mean	79	80	71	62	**62**	**77**	85	84	72	76
(n = 10)	(n=22)	P value	0.39		0.17		**0.02**		0.42		0.33	
Pivots[2]	No Pivots	Mean	82	78	68	60	75	71	85	87	**79**	**68**
(n=21)	(n=11)	P value	0.27		0.43		0.30		0.40		**0.04**	
Successful[3]	Failed	Mean	78	81	66	63	70	75	81	87	76	73
(n=17)	(n=15)	P value	0.30		0.37		0.23		0.15		0.34	

[1] Sample groups defined as Cash Flow + included entrepreneurs that responded "Yes, Always" and "Mostly Yes" to the question "Is your firm currently profitable?". Sample groups defined as Cash Flow – included entrepreneurs that responded "Sometimes" and "Not Yet" to the same question.

[2] Sample groups for Pivots included entrepreneurs who have pivoted >= 1 time with their current venture, while No Pivots had 0 pivots during their time with their current venture.

[3] Successful firms were defined as those that were either cash flow positive or had a successful business venture in the past. Failed were those who were cash flow negative and had no past business successes.

Q1c. Is strength of persistence trait correlated with entrepreneurial success? And Q1d. Are there correlations between persistence sub traits and entrepreneurial success?

Cash flow positive subjects were unexpectedly found to have a significantly lower work hardened score than cash flow negative subjects (One Way T-Test, p=0.02)(Table 6). This could be explained by the fact that these entrepreneurs are currently involved in a

profitable company and that they are continuing with this company precisely because it is profitable; they have little appetite to begin again, or had little appetite in the past to persist in working on firms that were not profitable. Notably this trend did not extend to entrepreneurs who are classified as currently in a cash flow positive business who also had a successful business in the past (One-Way T-Test p=0.3)(Table 6).

This subset included entrepreneurs who are currently in a cash flow positive business with a history of successful past ventures, had a higher work hardenedness score. When they were included in the statistical analysis (cash flow positive subjects vs. cash flow negative subjects) there was no longer a significant difference in work hardenedness scores between groups. Another interesting finding was that subjects who had pivoted had a significantly higher score on perfectionist trait than those who had not pivoted (One Way T-Test $p<0.01$). This could be explained by entrepreneurs with a higher perfection score needing to iterate their product/market more often to result in a better "more perfect" fit.

Subjects with unsuccessful firms had higher average persistence trait scores across all sub types, however no significant differences were noted between successful and unsuccessful firm groups. Admittedly this sample set is too small to draw many conclusions on its own; however the existence of significant differences between sample sets in some results is encouraging and suggests that more data should be collected to further analyze the relationship between persistence sub traits and entrepreneurial results.

Part 2. Are persistence personality types correlated with a behavior expression of persistence?

Average time to complete the persistence quiz was 17 minutes and 23 seconds, the shortest times were under 1 minute and the longest time was 42 minutes and 46 seconds. Results were very spread with a standard deviation of 10 minutes and 7 seconds (Figure 5). Thirty percent of respondents completed the test in under 8 minutes (or 720 seconds, the cutoff time for goal based persistence behavior). Therefore 30% of respondents were considered to have a goal persistence behavior tendency while 70% of respondents were considered to have a response persistence behavior tendency.
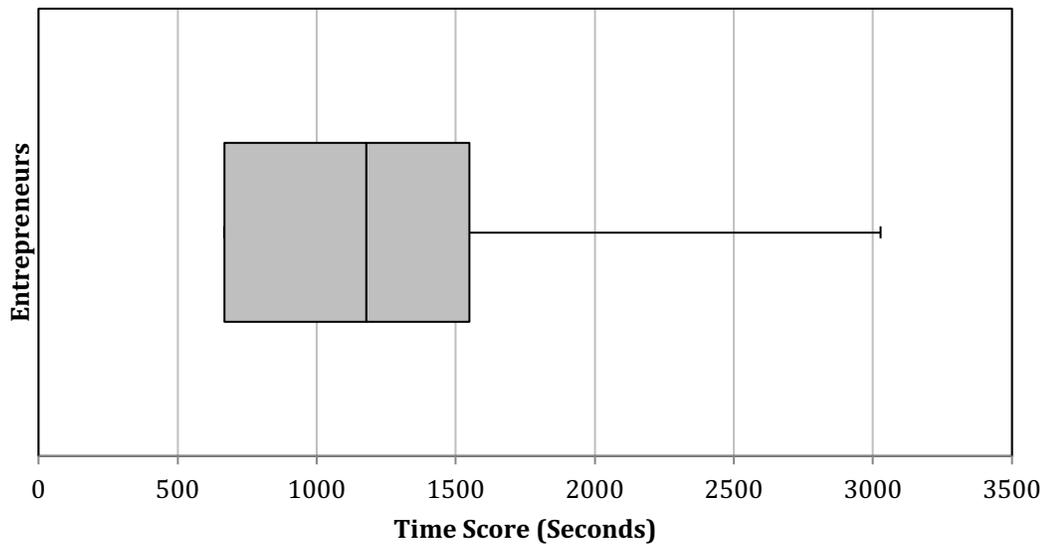
Figure 5 Box and whisker plot showing the spread of persistence behavior quiz scores in entrepreneur survey subjects (n=32) (Cloninger, 1993). Subjects scoring <=720 seconds were considered to have goal persistence behavior, while those scoring >720 seconds were considered to have response persistence behavior.

Q2a: Is persistence personality correlated with persistence behavior type?

Very low correlations were found between persistence attributes and persistence

behavior quiz results including the time score on tests and the number of questions

skipped (Table 5).

Table 7 Simple two-variable regression analysis plotting TCI persistence traits by persistence behavior quiz performance metrics of time score and number of questions skipped (n=32)(Cloninger 1993). Slope refers to whether the relationship between variables positive or negative.

Parameter	Persistence	Eagerness of Effort	Work Hardened	Ambition	Perfection	SD[1]
Time Score	**0.17**	0.01	**0.33**	0.05	**-0.02**	**-0.18**
# Questions Skipped	**-0.17**	**-0.13**	-0.12	-0.04	**0.06**	**0.09**

[1] SD refers to standard deviation, which was the measure of standard deviation across persistence sub traits for each individual survey response.

However, results do still reveal some interesting trends. One such trend is the positive

correlation between time score and persistence and the negative correlation between

questions skipped and persistence traits. Recall that longer time scores and fewer

questions skipped indicate a response persistence behavior tendency (Wong, 1995),

while shorter time scores and fewer questions skipped indicate a goal persistence

behavior tendency. Meaning, the higher the persistent personality trait scores the longer

they spent on the quiz and the fewer questions they skipped. An exception to this trend

was the perfectionism personality sub trait; higher perfectionism scores were correlated

with a decrease in test time. This result could be counterintuitive if one expected those

with higher levels of perfectionism to be more attached to getting individual questions

right, however if the subjects (correctly) view "perfection" to be completing the test in a

short time than these results are logical. An argument that could be made for this trend

is that those with high perfectionism were more attached to achieving a high score and

thus more likely to skip a question. The overall number of questions

skipped had a positive correlation with the perfection trait, indicating that the

negative correlation between perfectionism and test score could be attributed to skipping

more questions.

Persistence Personality by Persistence Behavior

Personality traits were compared between those classified as goal persistent (time score

<= 720 seconds) and those classified as response persistent (time score >720 seconds).

No significant differences in personality sub traits were found in the One-Way T-Test

between these two groups. However, three trends can be observed:

1. Subjects with the lowest time scores trended more towards average in

their personality sub trait (towards top 60%-70% of the population) than to extremes

(top 90% of population),

2. Subjects with lower time scores tended to have more variation across sub traits,

3. The two highest scoring sub traits by individual were notably different between

goal and response based persistence behavior groups (Table 7).

Goal Persistence is Exhibited When Persistence Traits are Less Extreme and More

Variable

Lower scores on persistence traits results in higher goal persistence behavior, this

finding was statistically significant across all subtypes (One-Way T-Test, p <0.05, Table

7). It is important to note that lower scores for the goal behavior group relative to the response behavior group does not mean lower scores relative to the general population. Entrepreneurs with goal persistence behavior ranked in the top 70% of the population for persistence (ranging from a low of 56% in eagerness of effort to a high of 77% in ambition). However, they showed less extreme sub trait values than their response behavior counterparts who ranked on average in the top 90% of the population for persistence (ranging from 79% in eagerness of effort to 91% in ambition)(Table 7). The greatest difference can be seen for the work hardened persistence sub trait where response behavior subjects scored 25% higher on average than goal behavior subjects (Table 7).

Table 8 Comparison of top goal performing quartile (top 25% of time scores) and top task performing quartile (bottom 25% of time scores) showing average TCI trait value, mode dominant sub trait and mode lowest sub trait as well as statistical significant using a One-Way T-Test p=0.05 (n=32) (Cloninger 1993).

Top Quartile	Persistence	Eagerness of Effort	Work Hardened	Ambitious	Perfectionist	Dominant Sub trait	Weakest Sub trait	SD[1]
Goal[2]	70	56	65	77	67	3	24	16
Response[3]	90	79	90	91	81	2	1	8
Difference	20	23	25	14	14	X	X	8
p value[1]	**<0.01**	**0.02**	**<0.01**	**0.05**	**0.04**	**<0.01**	**0.01**	N/A

[1]SD= Average standard deviation across persistence personality sub traits for each respondent.
[2]Lowest 25% of time scores. [3]Highest 25% of time scores.
[4]Bold values show statistically significant differences.

Goal Persistence is Exhibited When Persistence Traits are More Variable

A higher level of standard deviation among sub traits was found in goal persistence behavior (Table 7)(Figure 6). Average standard deviation among sub traits for entrepreneurs with goal persistence behavior was twice as high as their

response persistence behavior counterparts at 16% deviation and 8% deviation

respectively (Table 7).
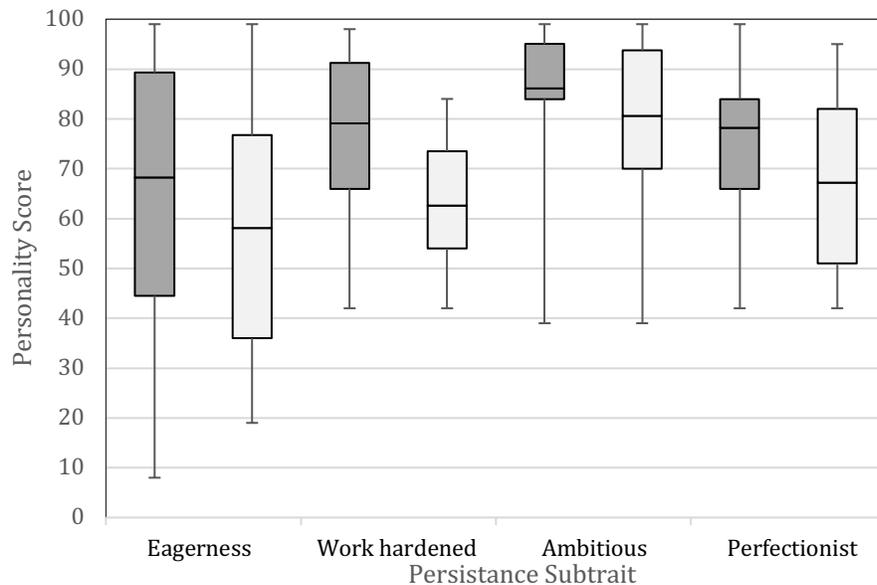
Figure 6 Box and whisker plot of top goal performing quartile (top 25% of time scores) and top task performing quartile (bottom 25% of time scores) showing spread of persistence sub traits from the TCI-140 test (Cloninger 1993). Dark boxes show lowest performing quartile (response persistence tendency) while light boxes show top performing quartiles (goal persistence tendency).

Goal persistent respondents were more heavily weighted by low sub trait scores, with

overall persistence personality trait scoring in the 3rd or 4th position of the 5 traits

(overall, eagerness of effort, work hardedness, ambition, and perfectionism) 89% of

the time (Figure 7). This trend reveals that goal based persistence had fewer or less

extreme high scores in personality trait and were more likely to have one or two low

scores on sub traits that pulled the overall persistence score down. This is consistent

with the overall lower scores shown by goal behavior respondents as well as the greater

standard deviation across subtypes. In contrast task persistence behavior respondents

had overall persistence traits that were pulled up by extreme high scores with overall

persistence personality trait scoring in the 1st (tied for 1st) or 2nd position of the 5 traits 79% of the time (Figure 6).
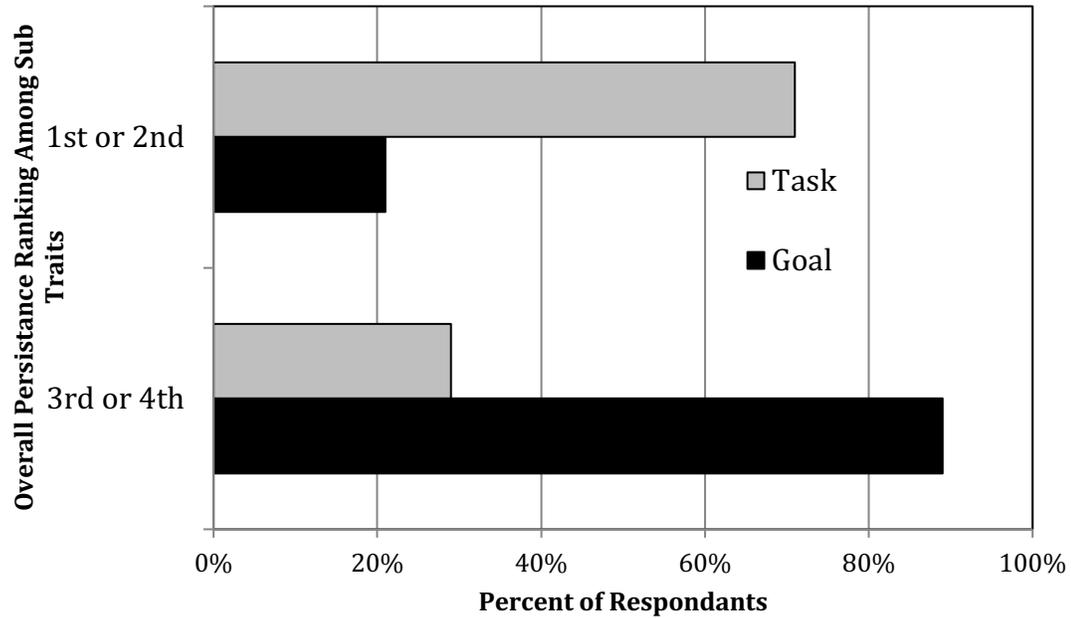
Figure 7 Overall TCI persistence personality trait score ranked by its relative position among the four sub traits (n=32).

Q2 b. Are there correlations between persistence sub traits and expression of persistence in behavior?

Persistence Behavior Points to Different Dominant Persistence Sub traits

Those with higher goal tendencies were more likely to have eagerness of effort and ambition as their top two traits while those with higher response persistence were more likely to have work hardendness and ambitious as their top two traits. Forty-four percent of goal persistence subjects had the combination of eagerness of effort and ambitious as their dominant sub traits while 38% of response persistence subjects had the combination of ambitious and work hardendness as their dominant sub traits (Table 8).

Table 9 Goal persistence and response persistence behavior tendencies as a percentage of each top ranking sub trait grouping. I.e. the two highest sub trait scores define the dominant sub trait personality type (n=32) (Cloninger 1993). Goal persistence was defined as test scores <=720 seconds while response persistence was those test scores >720 seconds.

Highest Scoring Sub Traits	Lowest Scoring Sub Traits	Goal	Response
Eager + Ambitious	**Work Hardened + Perfect**	**44%**	19%
Eager + Perfect	Work Hardened + Ambitious	0%	0%
Eager + Work Hardened	Ambitious + Perfect	0%	0%
Work Hardened + Ambitious	**Eager + Perfect**	**11%**	**38%**
Work Hardened + Perfect	Eager + Ambitious	22%	10%
Ambitious + Perfect	Eager + Work Hardened	22%	33%
	Total	100%	100%

Results suggest that a trend towards moderately above average levels of persistence is more indicative of goal based persistence than extreme high levels of persistence. The high level of work hardened behavior coupled with ambition was correlated with tendency to response based persistence. It could be that an entrepreneur with ambition focuses on a task (a response), and their work hardened sub trait urges them not to "quit", in contrast, eagerness of effort coupled with ambition could result in more flexible behavior but still the drive to complete the goal. However, a more notable trend resulting from this analysis is that persistence is lower overall, and that persistence score is more weighted by lower sub trait values for those exhibiting higher goal based persistence behavior, meaning extreme levels of persistence can lead to rigidity in persistence and less tendency to be flexible in the pursuit of a goal.

Part 3. Which persistence behaviors are most correlated with entrepreneur success?

One hundred and fifty seven entrepreneurs completed tests 2 and 3. Twenty-five percent of respondents were categorized as "Failed" based on their lack of past success and their current cash flow negative status (Figure 8). Seventy-five percent were classified as "Successful", which was further broken down by those who were currently in cash flow positive going-concern ventures (42%), and those that had a history of successful ventures but are not yet cash flow positive in their current venture.
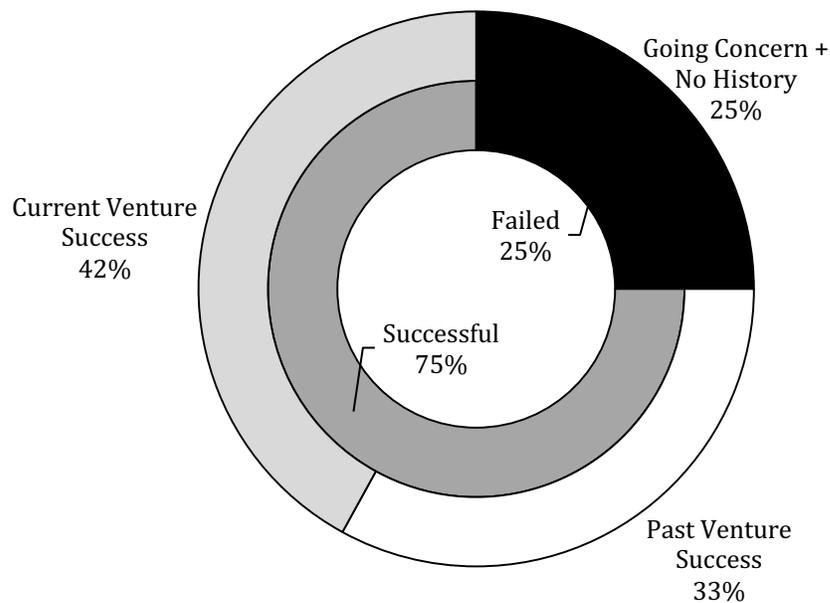
Figure 8 Breakdown of persistence test survey respondents by category. Failed entrepreneurs where those who are currently cash flow negative and have no history of success, successful entrepreneurs include those that are either currently going concern, or those that have a history of successful ventures but are currently not yet cash flow positive (n=157).

The majority of survey respondents had a tendency towards response persistence behavior (68% of respondents scored >=720 seconds), with approximately a third showing goal persistence behavior (32% scored =< 720 seconds), this ratio for the larger

sample set is in keeping with the ratio for the smaller sample set of entrepreneurs who completed the TCI personality test (Figure 9).
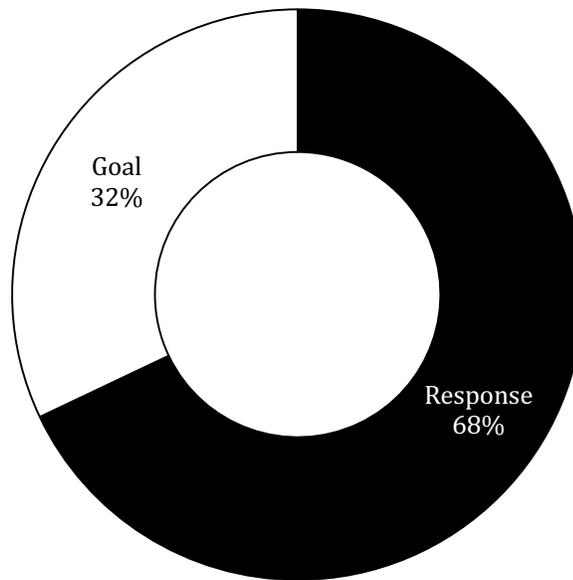
Figure 9 Breakdown of persistence test survey by persistence behavior type where goal behavior included test scores <=720 seconds and response behavior included test scores >720 seconds (n=157).

Q3a. Is persistence behavior correlated with entrepreneurial success?
Results show:

- Successful entrepreneurs had lower time scores than failed entrepreneurs,

- Goal persistence behavior is significantly correlated with higher rates of entrepreneurial success,

- Successful entrepreneurs skipped fewer questions overall but had a shorter time score.

Successful Entrepreneurs Had Lower Time Scores than Failed Entrepreneurs

Successful entrepreneurs had test scores averaging 944 seconds, while failed entrepreneurs were ~22% higher averaging 1164 seconds. Successful entrepreneurs

showed less spread in time score results with 50% of results falling within 632 seconds and 1118 seconds, a spread of 500 seconds, while 50% of failed entrepreneurs times score results fell between 732 seconds and 1493 seconds, a spread of 750 seconds (Figure 10).

Figure 10 Time scores for persistence behavior quiz broken down by entrepreneurs classified as successful and failed (n=157).

Goal persistence behavior is significantly correlated with higher rates of entrepreneurial success

Results showed that those entrepreneurs classified as successful had significantly shorter test scores than those classified as failed (one way T-Test, p=0.0065)(Table 9). Further, persistence behavior type showed significant differences in entrepreneurial success, entrepreneurs with goal persistence had a 16% rate of failure while entrepreneurs with response persistence had a 30% rate of failure (Figure 11).

Table 10 Average time score for persistence behavior test broken down by successful and unsuccessful entrepreneurs (n=157). P value was based on a One-Way T-Test with an alpha value of 0.05. Successful entrepreneurs were classified as those with a successful past successful past business venture, or those who are currently in a going concern company (n=117). Failed entrepreneurs were classified as those with no past business successes and who are not currently in a going concern company (n=39).

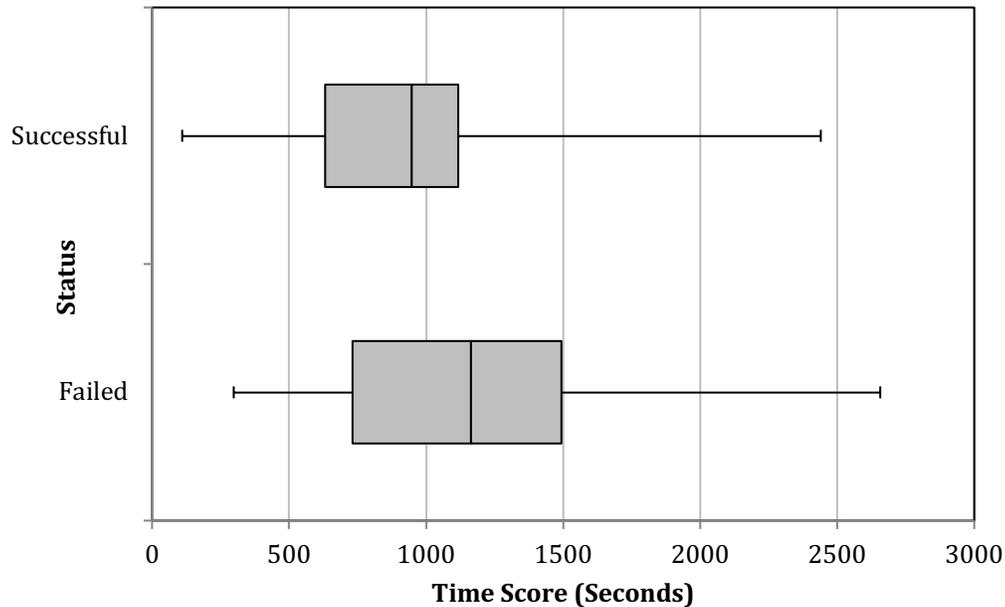| Classification	Average Score (Seconds)
Successful	947
Failed	1164
P value	**<0.01**
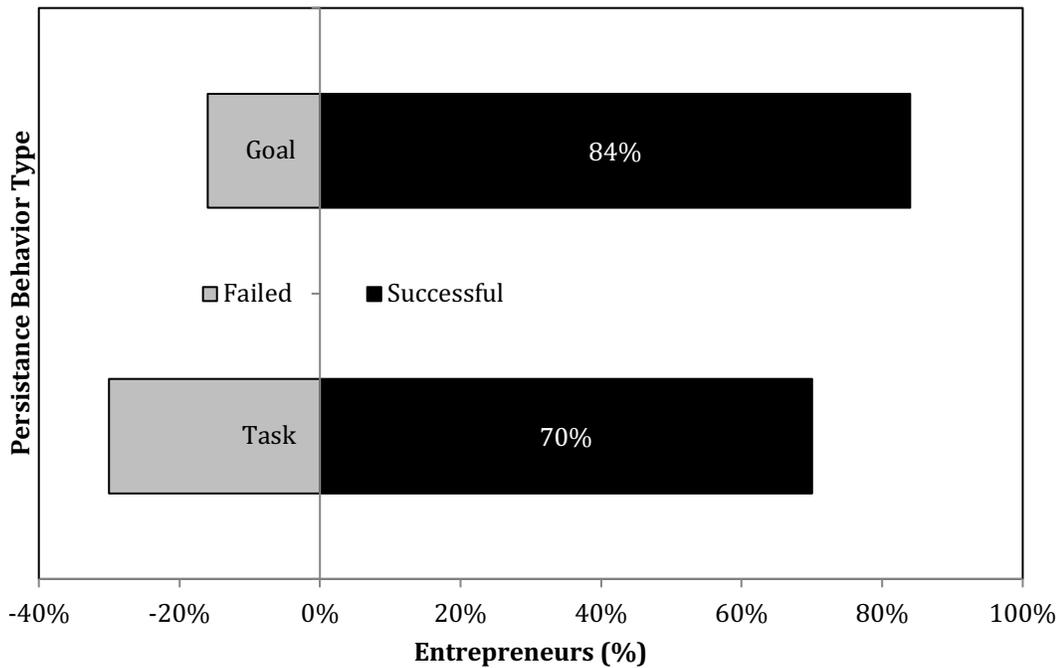
Figure 11 Time scores for persistence behavior quiz broken down by entrepreneurs classified as successful and failed (n=157). Goal persistence has a statistically significant lower rate of failure than task persistence (One-Way T-Test p<0.02).

Successful entrepreneurs skipped fewer questions but in a shorter amount of time

Failed entrepreneurs had the highest overall time scores and the highest average number

of questions skipped, skipping 4.6 questions on average while entrepreneurs

with past success skipped 3.6 questions on average (Table 10).

Table 11 Average time score for persistence behavior test broken down by successful and unsuccessful entrepreneurs. (n=157). Successful entrepreneurs were classified as those with a successful past business venture, or those who are currently in a going company (n=117). Failed entrepreneurs were classified as those with no past business successes and who are not currently in a going concern company (n=39).

Measure Names	# Questions Skipped	Time Score	Goal Persistence
Failed	4.6	1163	20%
Currently Successful	4.0	951	31%
Past Success	3.6	948	44%

This is an interesting result as it shows failed entrepreneurs are more likely to skip

questions but take much longer to do so (average time per answered question was 215

seconds, compared to 148 seconds for successful entrepreneurs). This trend reveals that

successful entrepreneurs were less likely to skip overall, but took less time to decide to

do so, indicating a high level of goal persistence, based on the respondents' analysis

of whether they could they answer the question in a shorter amount of time then the 60

second penalty for skipping.

Q3b. Are pivots a good measure of persistence behavior?

An entrepreneur's history of pivots had an extremely weak correlation with time scores,

with the regression value trending towards 0 (Figure 12). Further, no significant

difference in number of pivots was noted between goal persistence respondents and response persistent respondents.
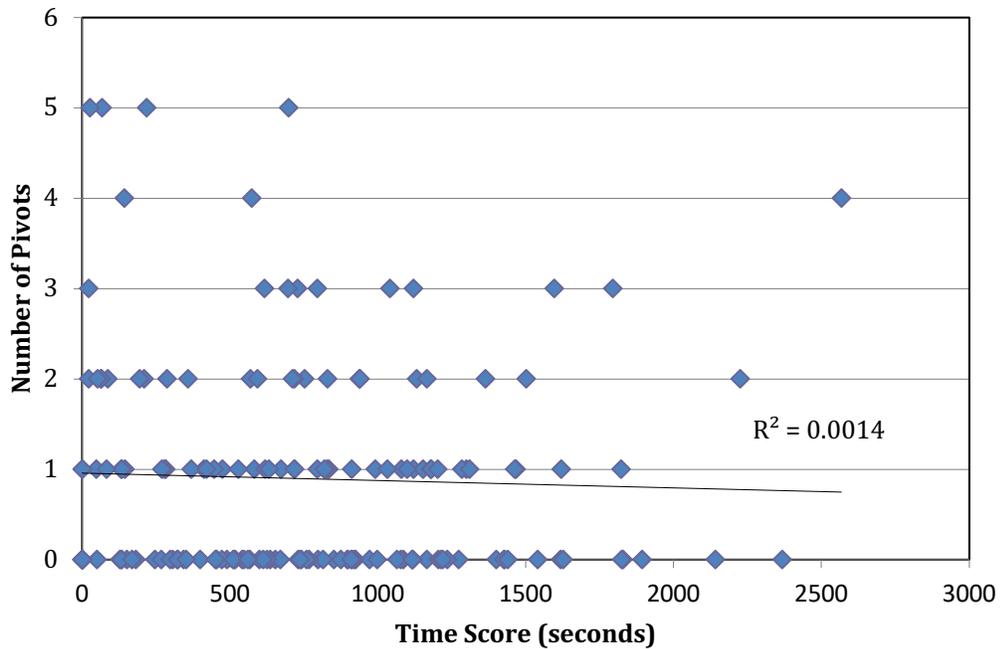
Figure 12 Number of pivots in current venture by time score on persistence behavior quiz (n=157), where pivot was defined as a significant change in market or product.

However, failed entrepreneurs reported a significantly higher number of pivots than successful entrepreneurs (One-Way T-Test, $p < 0.05$). The higher level of pivots among failed entrepreneurs may be a dependent variable; however, firms with success likely need to pivot less as they already have successfully addressed their product market fit. This idea is supported by the fact that there is no significant difference in average pivots between failed entrepreneurs and successful entrepreneurs that have experienced past business failures.

Part 4. In entrepreneurial pursuits, does past failure indicate future success?

Twenty-five entrepreneurs claimed to have a past business failure, or approximately 20% of entrepreneurs surveyed. Proportionally, most of these failures were cited by entrepreneurs who were categorized as currently cash flow negative, but with past business success (50% of this subgroup had past failures, Figure 13). In contrast, 15% of currently successful subjeccts with a history of success cited past failures, while currently successful firms with no history of success cited the lowest past failure rate of 8%.
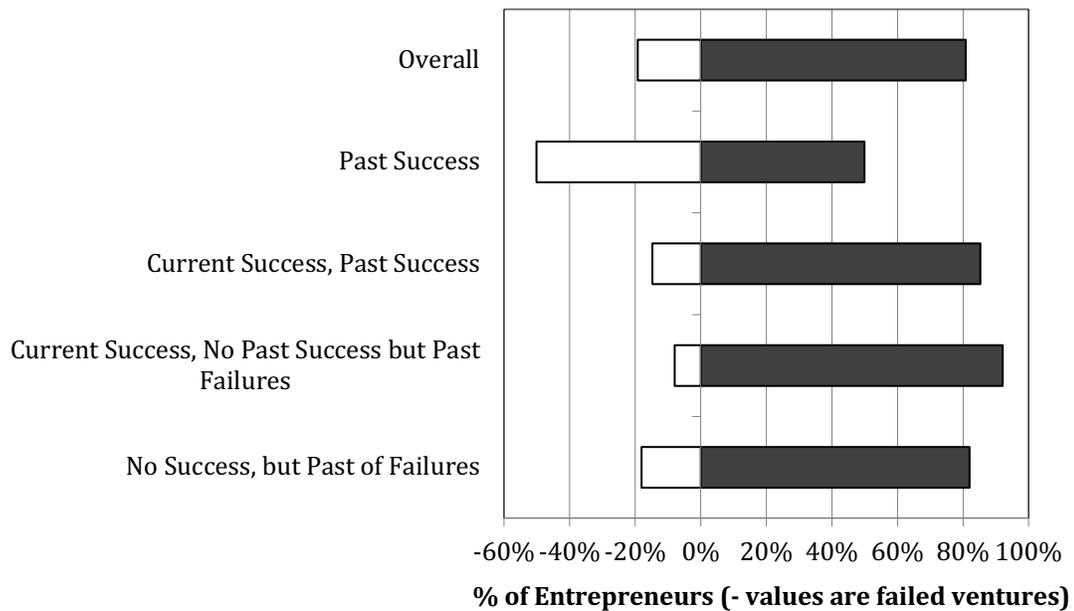
Figure 13 Failure rate as a percent of entrepreneurial subtype (n=157).

Statistical analysis shows that successful entrepreneurs have a significantly lower past failure rate than those entrepreneurs classified as failed (One-Way T-Test, $p < 0.1$, Table 10). However, a stronger difference was noticed between entrepreneurs on their first successful venture (no history of success) and entrepreneurs with a history of successful ventures, the latter of which had over 3x the failure rate (One Way T-Test, $p < 0.05$).

Table 12 Average number of failed ventures experienced by entrepreneurs and statistical significance of difference (One Way T-Test, p<0.1). Failed entrepreneurs where those who are currently cash flow negative and have no history of success, successful entrepreneurs include those that are either currently going concern, or those that have a history of successful ventures but are currently not yet cash flow positive (n=157).

	Successful	Failed	p value
Mean Failed Ventures	0.23	0.44	0.08

	First Successful Venture	Past Successful	
Mean Failed Ventures	0.12	0.39	<0.02

These results suggest that there may be other underlying factors impacting results. For example, the nature of the venture an entrepreneur is engaged in (e.g. SME vs. venture capital) would likely impact past failure rate. Or, simply the willingness to move on to a new venture (as shown by entrepreneurs who have moved past their first successful venture) carries with it an inherent risk of failure. Overall, general trends suggest that failure persists and is not indicative of future success, but also that it does not preclude future success, i.e. simply having past business failures does not indicate you have more chance of succeeding (or failing) in the future. This finding is consistent with findings in recent literature (e.g. Gompers, Kovner, Lerner, & Scharfstein, 2010). It is possible that the relationship between past failure and future success can be related to the nature of persistence behavior, 41% of those with past successful and failed ventures had goal persistence as opposed to the 32% representation of goal persistence in the overall sample population. However this difference is not statistically significant and the theory needs to be explored with a larger sample set to prove or disprove.

General Discussion

Contribution to Model

This research explored a specific application of the expectancy theory within the bounds of persistence trait and behavior as modifiers of expectancy and effort in performance and outcome. We found that persistence characteristics (traits) impact entrepreneurial effort in performance in a curvilinear way, and that persistence behavior can influence different outcomes depending on whether behavior was persistent in response or persistent in goal. These findings add to the expectancy theory as they suggest that expectancy of behavior leading to outcome is shaped by individual characteristics or traits (in this case persistence, although there could be others), and that not all behavior (performance) directed towards outcome will be beneficial and that how an individual pursues an outcome matters.

Study Limitations and Future Research Recommendations

The greatest and most obvious critique of this thesis is the low confidence in results due to the small sample size; one could be more confident in results that were observed if the sample size was larger, and further results and trends may have been lost in the variation of the small sample size data. Thus, a recommendation coming out of this research is to continue exploring the relationship between persistence personality, behavior, and entrepreneurial success to see if new trends emerge, or current findings are maintained with a larger sample size. However, despite the small sample size, significant results were found in a number analysis across a wide range of entrepreneurs, indicating this study had sufficient power.

In addition to the small sample size a critique can be made on the limitations of the population sampled for a number of reasons. Sample subjects completing the TCI were New Brunswick based entrepreneurs and consisted of a small set of entrepreneurs backed by the New Brunswick Innovation Fund (a SEED and Series A stage provincially mandated venture capital firm). NBIF and the entrepreneurs they finance are not indicative of the overall venture capital community, indeed no one venture capital firm could be, as each firm tends to specialize towards a particular stage of development or market segment. Therefore, it is suffice to say that limitations exist in the sample selected and any interpolations drawn from the data to apply to the larger entrepreneurial community would be unfounded. Further, the entrepreneurs sampled in the persistence goal quiz were not stratified by nature of entrepreneurship, as they consisted of a group of , and significant difference may arise between those entrepreneurs pursuing large scale, venture capital backed, start ups, compared to those pursing a small business or micro business. It is possible that within the entrepreneurial community very different traits and behaviors arise across entrepreneurial categories. The final critique of sample selection exists for the comparison on entrepreneurs to a student population as a control group. The limitations here are obvious as an undergraduate business student control group is not reflective of the overall population. Our justification for the sample selected is purely pragmatic. These entrepreneurs and students were the most readily available and representative set that we could access in the short time period and limited budget available for this thesis.

Another flaw may exist in the measure of persistence behavior. The method for measuring persistence behavior was a GMAT style test. A subject's ability to quickly

answer a question may be tied to their intellect, a parameter that was not measured in this study, thus results could be biased based on the relative level on intellect of subjects, above and beyond their tendency for goal persistence

or response persistence. Test results could be affected by overall intelligence, which would impact test scores and may also be correlated with entrepreneurial success. The goal based quiz was chosen based on the need to conduct the survey online, however, we believe that a better test to measure behavior persistence could be formulated for future studies.

Finally, a critique arises from the method of data collection. The survey was distributed online and relied on voluntary respondents. Thus surveys (most notably the persistence behavior quiz) were done in the subject's own time, and as a result, times could be skewed by life events. We recommend having respondents complete the surveys in person if possible. However, a common challenge in research on entrepreneurs is the difficulty in recruiting and getting time from busy founders.

Further knowledge could be gained from this research by breaking down the types of success into SME ventures and high capital ventures as results may differ across subsets of entrepreneurs depending on the nature of the industry and scale of the venture. One final recommendation is to complete an analysis of a "control" population, to compare a wider range of persistence personality scores (particularly low scores) with persistence behavior.

Conclusion

We set out to determine the relationships between persistence traits, persistence behavior, and entrepreneurial success. Overall findings have been summarized for each research question below.

Q1. Are persistence personality types correlated with entrepreneurial success?

Q1a. Do correlations exist within the persistence trait?

Survey respondents were above average in persistence personality trait across all subtypes. The sub trait ambition appears to be the greatest driver of persistence ($R^2 = 0.8$) followed by perfection ($R^2 = 0.7$). Very little correlation existed among sub traits, ambition showed the greatest correlations across all sub traits with perfectionism, work hardenedness, and eagerness of effort respectively ($R^2 = 0.5$, $R^2 = 0.4$, $R^2 = 0.3$).

Q1b. Is there a difference in persistence traits between entrepreneurs and a control group?

Entrepreneurs had significantly higher persistence trait scores overall and across sub traits (One-Way T-Test, $p <= 0.05$), except for eagerness of effort. Ambition and perfectionism were still highly correlated with overall persistence scores ($R^2 = 0.7$ and 0.5 respectively).

Q1c. Is strength of persistence trait related to entrepreneurial success? &

Q1d. Are there correlations between persistence sub traits an entrepreneurial success?

Successful entrepreneurs had lower average persistence scores in personality across all sub traits, relative to failed entrepreneurs, particularly in work hardenedness (One-Way T-Test, p = 0.02). However, in general results were not statistically significant and more research is warranted. General findings show that entrepreneurs with extreme levels of persistence (in the top 85% of the population) have lower rates of success than those entrepreneurs who scored in the upper average of persistence. This points to a bell curve in which persistence is an advantage up to a point, after which it becomes a disadvantage; however, to further test this theory more entrepreneurs scoring below 50% of the population would need to be studied (if such a population even exists).

Q2. Are persistence personality traits correlated with expression of persistence behavior?

Q2a. Does persistence trait predict persistence in response vs. persistence in goal?
Entrepreneurs exhibiting goal persistence had above average levels of persistence (top 70% of population), but were statistically lower than response persistence entrepreneurs (who scored in the top 90% of population) (One-Way T-Test, p<0.01).

Q2b. Do sub traits in persistence vary in predicting behavior response?
Entrepreneurs with goal persistence behavior had more variation across sub traits than those with response persistence behavior (One-Way T-Test p=0.02) and had lower levels of persistence across all sub traits. Overall eagerness of effort and ambition were the two dominant subtypes in entrepreneurs with the top performing times, in contrast the bottom performing entrepreneurs had less variation across sub traits, were more extreme in expression, and had work hardenedness and ambition as the

dominant sub traits. It appears that ambition is a key parameter of persistence in entrepreneurs, however more flexible entrepreneurs were more influenced by their eagerness of expression of persistence while more rigid entrepreneurs were more influenced by their work hardened personality (One-Way T-Test p=0.02 and p<0.01).

Q3. What persistence behaviors are most correlated with entrepreneurial success?

Q3a. Does persistence in response vs. goal predict outcome success?

Shorter time scores (more goal based persistence behavior) was higher in successful entrepreneurs than failed entrepreneurs (One-Way T-Test, p<0.01). Further, successful entrepreneurs skipped fewer questions and had a lower time score, showing their ability to quickly assess whether skipping the question, or answering it would result in a faster time score.

Q3b. Can pivots be used to predict persistence behavior?

Pivots were not strongly correlated with persistence behavior and no significant differences were noted in the data. Pivots were therefore not found to be a good predictor of goal based persistence.

Q4. What do past failures tell us about entrepreneurs?

Past failure was not reliably found to be a predictor of future success and was not associated with either failed entrepreneurs or successful entrepreneurs. While successful entrepreneurs had lower rates of past failure than failed entrepreneurs (One-Way T-Test, p = 0.08), this difference was actually greater within the successful entrepreneur group;

entrepreneurs who were on their first successful venture had lower failure rates than those who had experienced success before (One-Way T-Test, p =0.02). While it is possible that past failure can predict future success depending on the persistence behavior tendency shown, these results were not statistically significant and more research would need to be conducted.

Implications

If the findings of this study are indicative of the true relationship between persistence personality, persistence behavior, and entrepreneurial success, then there are several important take-aways to be discussed. The first being, persistence in personality may not be as important as it is generally regarded to be. Above average levels of persistence are important, but extreme levels of persistence appear to be harmful, resulting in higher levels of response persistence and greater rates of entrepreneurial failure. It appears that the difference between work hardenedness as a sub trait and eagerness of effort as a sub trait is an important one. Eagerness of effort refers to the general excitement in pursuit, while work hardenedness refers more to an appetite to work hard. Founder programs may want to guide entrepreneurs to pursue businesses that they have a high eagerness of effort towards, ones they believe in, and that they think are important. This eagerness combined with ambition appears to be more likely to result in entrepreneurial success than general work hardendness.

Second, ambition was a high scoring trait for both failed and successful entrepreneurs; however, it was lower in the successful entrepreneur group (81% of population vs. 87% of population). Knowing that ambition is an important driver in persistence should cause entrepreneurs to not shy away from an ambitious motivation

for pursuing a business, again, the important moderator here is that they should have an eagerness to pursue it in addition to ambitious aspirations.

Third, goal based persistence tactics should be developed in entrepreneurs. Persistence behavior can be more easily trained than changes in personality. Thus, entrepreneurs should be developed to pursue challenges with flexibility, and foster a goal based persistence rather than a response-based persistence. It is important to realize that this does not necessarily mean more pivots in a business idea, but rather a more calculated analysis of the problems being faced, and the best courses of action required to address or sidestep the problem.

Bibliography

Baron, R. (1998). Cognitive mechanisms in entrepreneurship: Why and when entrepreneurs think differently than other people. Journal of Business Venturing. 11(4), 275-294.

Baum, J. R., & Locke, E. A. (2004). The relationship of entrepreneurial traits, skill, and motivation to subsequent venture growth. Journal of Applied Psychology, 89(4), 587–598.

Begley, T. M., & Boyd, D. P. (1987). Psychological characteristics associated with performance in entrepreneurial firms and smaller businesses. Journal of Business Venturing, 2(1), 79–93.

Brandstätter, H. (2011). Personality aspects of entrepreneurship: a look at five meta-analyses. Personality and Individual Differences, 51(3), 222–230.

Patel, Pankaj C., and Sherry M. B. Thatcher. (2014) Sticking It Out: Individual Attributes and Persistence in Self-Employment Pankaj C. Patel Ball State University Sherry M. B. Thatcher Journal of Management: 40(7), 1932–1979.

Cardon & Kirk (2015). Entrepreneurial Passion as Mediator of the Self-Efficacy to Persistence Relationship. Entrepreneurship 39(5), 1027-1050.

Cloninger, C.R.; Svrakic, DM; Przybeck, TR (1993). A psychobiological model of temperament and character. Archives of General Psychiatry. **50** (12), 975–90.

Cloninger, C. R. (2012). Healthy personality development and well-being. World Psychiatry, 11 103–104.

DeTienne, Dawn R. and Cardon, Melissa S. (2008). Entrepreneurial Exit Strategies: The Impact of Human Capital. Babson College Entrepreneurship Research Conference (BCERC) 2006 Paper; Frontiers of Entrepreneurship Research 2006. Available at SSRN: https://ssrn.com/abstract=1310922 or http://dx.doi.org/10.2139/ssrn.1310922

Fisk, William. (2003). Persistence and Success. Cradles of Conscience: Ohio's Independent Colleges and Universities 324.

Gage, D. (2012). The venture capital secret: 3 out of 4 start-ups fail. Wall Street Journal, 20.

Gottschalk, Sandra; Greene, Francis J.; Höwer, Daniel; Müller, Bettina (2014) : If you don't succeed, should you try again? The role of entrepreneurial experience in venture survival, ZEW Discussion Papers, No. 14-009, http://nbn-resolving.de/urn:nbn:de:bsz:180-madoc-358758

Graen, G. Instrumentality theory of work motivation: Some experimental results and suggested modifications. Journal oJ Applied Psychology Monograph, 1969(53), 1-25.

Gropers, P., A. Kovner, J. Lerner, D. Scharfstien. (2010). Performance Persistence in Entrepreneurship. Journal of Financial Economics. 96 18-32.

Hansenne, M., Delhez, M., & Cloninger, C. R. (2005). Psychometric properties of the Temperament and Character Inventory–Revised (TCI–R) in a Belgian sample. Journal of personality assessment, 85(1), 40-49.

Holland, Daniel V.; Shepherd, Dean A. (2013). Entrepreneurship: Theory & Practice. 37 (2), p331-358.

Javier Gimeno, Timothy B. Folta, Arnold C. Cooper and Carolyn Y.
Woo. (1997). Survival of the Fittest? Entrepreneurial Human Capital and the Persistence of Underperforming Firms. Administrative Science Quarterly. 42(4) 750-783.

Kluger, M. T., Laidlaw, T. M., Kruger, N., & Harrison, M. J. (1999). Personality traits of anaesthetists and physicians: an evaluation using the Cloninger Temperament and Character Inventory (TCI-125). Anaesthesia, 54(10) 926-935.

Le, B. O., Basiaux, P., Streel, E., Tecco, J., Hanak, C., Hansenne, M., Ansseau, M., Dupont, S. (2004). Personality profile and drug of choice; a multivariate analysis using Cloninger's TCI on heroin addicts, alcoholics, and a random population group. Drug and Alcohol Dependence, 73(2) 175-182.

Ler, E. E.(1971) Pay and organizational effectiveness: A psychological view. New York: McGraw-Hill.

Lawler, E. E., Porter, L. W.(1967) Antecedent attitudes of effective managerial performance. Organizational Behavior and Human Performance, 2, 122-142.

Lowe, R. A., & Ziedonis, A. A. (2006). Over optimism and the performance of entrepreneurial firms. Management science, 52(2), 173-186.

Miettunen, J., Kantojärvi, L., Ekelund, J., Veijola, J., Karvonen, J.T., Peltonen, L., Järvelin, M.-R., Freimer, N., Lichtermann, D., Joukamaa, M., (2004). A large population cohort provides normative data for investigation of temperament. Acta Psychiatrica Scandinavica 110, 150–157.

Miettunen, J., E. Lauronen, L. Kantojarvi, J. Veijola, M. Joukamaa. (2008). Correlations between Cloninger's temperament dimensions – A meta-analysis. Psychiatry Research 106(144) 106-114.

Montana, Patrick J, Charnov, Bruce H.(2008). Management – 4th edition – Barron's Educational Series, Inc. ISBN 978-0-7641-3931-4.

Mulder, R. T., Joyce, P. R., Sullivan, P. F., Bulik, C. M., & Carter, F. A. (1999). The relationship among three models of personality psychopathology: DSM-III-R personality disorder, TCI scores and DSQ defenses. Psychological Medicine, *29*(4), 943-951.

Persistence. (1) In Oxford Dictionaries. Retrieved from https://en.oxforddictionaries.com/definition/persistence.

Sandelands, L. E., Brockner, J., & Glynn, M. A. (1988). If at first you don't succeed, try, try again: Effects of persistence-performance contingencies, ego involvement, and self-esteem on task persistence. Journal of Applied Psychology*, 73(2), 208-216.

Shaver, K. G. (2003). The social psychology of entrepreneurial behavior. In Z. J. Acs & D. B. Audretsch (Eds.), Handbook of entrepreneurship research (pp. 331–357). New York: Springer.

Shaver, K. G., & Scott, L. R. (1991). Person, process, choice: The psychology of new venture creation. Entrepreneurship: Theory and Practice, 16(2): 23–45.

Siddiqi SH1, Chockalingam R, Cloninger CR, Lenze EJ, Cristancho P. (2016) Use of the Temperament and Character Inventory to Predict Response to Repetitive Transcranial Magnetic Stimulation for Major Depression. J Psychiatr Pract. (2016) 22(3):193-202.

Staw, B. M. (1976). Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action. Organizational behavior and human performance, 16(1), 27-44.

Steinburg, M.L. and Williams J. (2013). State, but not trait, measures of persistence are related to negative affect. Journal on Studies of Alcohol and Drugs,74(4), 584-588.

Svrakic, D. M., Whitehead, C., Przybeck, T. R., & Cloninger, C. R. (1993). Differential diagnosis of personality disorders by the seven-factor model of temperament and character. Archives of general psychiatry, 50(12), 991-999.

Oliver, R. (1974). Expectancy is the probability that the individual assigns to work effort being followed by a given level of achieved task performance. Expectancy Theory Predictions of Salesmen's Performance. Journal of Marketing Research 11, 243-253.

Omorede A, Thorgren, S. & Wincent, J. (2015). Entrepreneurial Psychology: a review. Int Entrep Manag Journal 11:743–768.

Porter, L. W., & Lawler, E. E. Managerial attitudes and performance. Homewood, IL: Irwin, 1968.

Gimeno, J., Folta, T., Cooper, A., Woo, C., (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. Administrative Science Quarterly 42, 750–783.

Wong, P. T. (1995a). A stage model of coping with frustration stress. In R. Wong (Ed.), Biological perspectives on motivated activities (pp. 339-378). Norwood, NJ: Ablex Publishing Corporation.

Wong, P. T. P. (1995b). Coping with frustrative stress: A behavioral and cognitive analysis. In R. Wong (Ed.), Biological perspective on motivated and cognitive activities (pp. 339-378). New York, NY: Ablex Publishing.

Zohar, A. H., & Cloninger, C. R. (2011). The psychometric properties of the TCI-140 in Hebrew. European Journal of Psychological Assessment, 27(2), 73-80.

Appendix A

Survey questions used in data collection.

1. Questions and response options in collecting data for entrepreneurial performance variable.

1. Industry Domain (Open Entry)

2. Primary Customers (Multiple Choice)

    A. Business to Business (B2B)

    B. Direct to Consumers (B2C)

    C. Both Equally

3. Incorporation Year (Open Entry)

4. Number of Founders (1,2,3, etc.) (Open Entry)

5. Is the company profitable? (Multiple Choice)

    A. Yes, Always

    B. Mostly Yes

    C. Sometimes

    D. Not Yet

    E. We Went Bankrupt

6. How are you/did you finance this venture? (Multiple Choice)

    A. Venture Capital

    B. Self Financing

    C. Bank Loans

    D. Angel Investors

E. Government Grants and Bursaries

7. How large is/was your organization (# of Employees)? (Open Entry)

8. What was/is your average annual revenue? (Multiple Choice)

    A. <100,000

    B. 100,000 to <500,000

    C. 500,000 to <1,000,000

    D. 1,000,000 to <2,000,000

    E. 2,000,000 to <5,000,000

    F. 5,000,000 to <10,000,000

    G. 10,000,000 to <50,000,000

    H. >50,000,000

9. Your Gender (Multiple Choice)

    A. Male

    B. Female

    C. Prefer not to say.

10. What is your age? (Multiple Choice)

    A. 18 to 24

    B. 25 to 34

    C. 35 to 44

    D. 45 to 54

    E. 55 to 64

    F. 65 to 74

    G. 75 or older

11. What is the highest level of education you have completed?

12. Program of Study (Multiple Choice)

    A. Engineering

    B. Computer Science

    C. Arts

    D. Business Administration

    E. Nursing

    F. Law

    G. Sciences

    H. Kinesiology

    I. Natural Resources

    J. Other (please specify)

13. Previous Job Title (What were you doing before you were a founder

in this company?) (Open Entry)

14. How many successful ventures have you had prior to this one? (Open Entry)

15. What markets were these in? (Open Entry)

16. How many failed ventures have your founded or been a part of?

(never profitable, bankrupt, or otherwise discontinued)? (Open Entry)

17. What markets were these "failed" ventures in? (Open Entry)

18. With your current venture, how many significant pivots have you

had? (Open Entry)

19. Please rank your motivation for pursuing this business. Where 1 is the highest and 6

is the lowest. (Ordinal Scale 1-6)

A. Passionate about the product

B. Passionate about the industry

C. Personal profile and status

D. Making a significant financial return

E. Pure love of entrepreneurship

F. Other

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