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Reaching the top

Differences between leading entrepreneurs and successful professional athletes

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BACHELOR END PROJECT

Reaching the top: Differences between leading entrepreneurs and successful professional athletes

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ABSTRACT

This research studies personality and emotional differences between leading entrepreneurs and athletes through their Twitter footprints using Welch t-tests. The study categorizes athletes and entrepreneurs based on their gender and further classifies athletes as practising team or individual sports. Fifty-one comparison variables are used, including 35 Big Five traits and 16 LIWC summary and emotional variables. A total of 144 people are included in the study (24 people for each category) with 1000 tweets to analyze each of them. The results suggest that there are considerable significant differences between each of the categories. These significant results are discussed and explained based on the previous research, and future research recommendations are given based on it.

Keywords: Top Athletes - Top Entrepreneurs - Big Five - Personality - LIWC - Digital Footprints - Text Analysis - Gender Differences - Athlete Entrepreneurship

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Chapter 1

Introduction

It is often considered that some of the top athletes can become entrepreneurs without much difficulty (Boyd, Harrison, and McNerny, 2021). Examples of these can be seen quite generally. Some modern-day athletes, including Michael Jordan, Serena Williams, and David Beckham, all became successful in their entrepreneurship careers alongside their sports careers (Cole, 2014 and Ratten, 2015). These and many more real-life examples suggest a link between successful pro athletes and entrepreneurs. Even though these real-life examples continue to increase, entrepreneurs become athletes, and the relation between entrepreneurship and athletes is an understudied subject in the literature (Ratten, 2015). Some studies show that the link between these two professions is caused by their personality similarities (Quast, 2016). Other studies that looked at the link between two different professions suggest that one of the most insightful ways to compare people from two different groups is by comparing their personality traits (Hisrich, Langan-Fox, and Grant, 2007). Hence, this study focuses on this link by analyzing top athletes' and entrepreneurs' personalities and emotional similarities and differences.

1.1 Literature Review

We conduct the literature review in various parts. We look at the methods of personality comparisons made between two groups and what is the most accessible and accurate way to gather personality insights. It also includes reviewing the research on the personality metric that we use. Then, we look at the previous research on the personality of professional athletes and the personality of the entrepreneurs to take into account earlier findings on this subject. Thus, the motivation for this part is that we look at the previous results, and with these findings, we fully define our research scope to build upon these studies and contribute effectively to the research field with discoveries.

1.1.1 Reviewing the Methods: Digital Footprints Analysis

Considering the previous research that conducted personality analyses, most of them are based on questionnaires, self-reports, and case studies (Obschonka, Fisch, and Boyd, 2017). Nonetheless, more recent studies, namely the study by Youyou, Kosinski, and Stillwell, 2015 have found that computer-based personality determination is more accurate than human-based assessment. The study found that analysis of digital footprints left on Facebook showed better accuracy in predicting personality than questionnaires given to the person's friends. Even more interestingly, the digital footprint analysis, even in some cases, outperformed self-assessment in predicting future behaviour. On top of that, various researches show that self-assessment for personality analysis is biased (Chung and Pennebaker, 2018).

People consistently and growingly leave digital footprints on social media platforms to reach

out to people and increase their popularity. It allows researchers to easily access the data with automated methods and use it to conduct new studies (Azucar, Marengo, and Settanni, 2018). Considering the shortcomings of human-based assessments and developments of increasingly accurate computer-based tools to analyze large amounts of data, sentiment analysis is done utilizing the digital footprints of athletes and entrepreneurs in this research. The sentiment analysis method that we use requires lots of personal text data. Twitter is one of the best platforms for this analysis as it contains text data. Research shows that this data is full of psychological data that can be used for a personality analysis (Park et al., 2015). Hence, this study will also use this immense amount of data available on Twitter to make the analysis with roughly 500 million tweets posted every day (Chintalapudi, Battineni, and Amenta, 2021).

1.1.2 Assessment Tools and Metrics for Digital Footprint Analysis

In the entrepreneurship research field, there has been an ongoing debate with critics pointing to various issues, including personality measures that were not explicitly developed for entrepreneurs (Robinson, Huefner, and Hunt, 1991). The main finding in this ongoing debate is that trying to measure too many traits and using inadequate statistical techniques results in weak links (Baum, Frese, and Baron, 2014 & Şahin, Karadağ, and Tuncer, 2019). In contrast, the Big Five personality insights showed a great promise in both entrepreneurship and psychology research (Ringwald et al., 2020 & Kerr, Kerr, Xu, et al., 2018). Thus, in recent years, many researchers and companies have used the Big Five as it is one of the most stable, reliable and insightful metrics (Cobb-Clark and Schurer, 2012). The success of the Big Five in predicting entrepreneurial mindset is proven in various meta-analytic studies (Zhao, Seibert, and Lumpkin, 2010 & Brandstätter, 2011). Also, it is successfully used in the analysis of Obschonka, Fisch, and Boyd, 2017 which influenced this study.

Hence, according to these findings, our study examines the Big Five as determinants of an individual's personality characteristics for the analysis. The Big Five model consists of five main segments, each with six underlying features, for a total of 35 personality traits (Tausczik and Pennebaker, 2010).

Big Five personality analysis, however, when first came up by Donald Fiske in 1949, can only be done by pen and paper questionnaires (Fiske, 1994). Only after discovering the psychological aspects of language use do we discover to analyze the language to come up with these Big Five traits. One of the pioneers of this discovery, James W. Pennebaker, discovered certain psychological aspects of lexicon use and created a technology called Linguistic Inquiry and Word Count (LIWC), which analyses the sentence for a certain lexicon dictionary (Pennebaker, Mehl, and Niederhoffer, 2003). It has been used for decades by more than 20.000 academic articles (according to Google) and is considered to be the "gold standard" in psychological research (Gong, Shin, and Poellabauer, 2018). Developed by Pennebaker, Francis, and Booth, 2001, LIWC has seen several updates until 2022 to become one of the better text analysis tools (Boyd et al., 2022). Furthermore, what makes LIWC the best fit for this research is the elite capability to analyze function words. These function words (articles, pronouns, prepositions) add up to approximately 46% of the words of all text. Likewise, on Twitter, function words correspond to roughly the same percentage of words and can be effectively detected and analyzed using LIWC (Khazaei et al., 2016). With the high reliability and unique metrics it provides for Twitter text analysis, we decided to use LIWC for lexicon and emotional analysis. The emotion and lexicon analysis, in addition to the Big Five, make the analysis in this study more extensive and complete.

1.1.3 Top Professional Athletes and Entrepreneurs

One of the most cited studies in the entrepreneurship research field, the study of Zhao and Seibert, 2006, assumed that entrepreneurs have higher Conscientiousness, Openness, and Extraversion and lower Agreeableness and Neuroticism. This finding does not contradict other findings in entrepreneurship research. Interestingly, according to various researches, top athletes also show the same personalities (Khan, Ahmed, and Abid, 2016). Thus, the prior study in this field has theorized that top entrepreneurs and elite athletes have similar job profiles and personality attributes. Nevertheless, comprehensive empirical data on the link is lacking. The critical point is that there is very limited to non-existent research about how this two compare. So, it is vital to come up with new findings on their differences as the two professions showing the same personality traits, more or less than the average person, do not mean they would not significantly differ from each other.

One of the rare but relevant studies done in the context of comparing two professions, by Steinbrink, Berger, and Kuckertz, 2020 suggests that the personality traits of a professional athlete match the detected directions for entrepreneurial intention and success. The study, however, analyzed and compared athletes pursuing low-risk sports, athletes pursuing high-risk sports and non-athletes. The study used questionnaires to reach these groups. The research did not analyze an entrepreneur's personality but derived that using other papers. It combined their findings and the previous analysis. It again theorized that top athletes and entrepreneurs are "less neurotic, more extraverted, more conscientious, and record a higher risk propensity than members of the reference groups".

After finding out the differences that mainly affect risk propensity between low-risk and high-risk athletes, the study (of Steinbrink) suggests future studies on whether the athlete is pursuing a team sport or an individual sport. The study also acknowledged the sampling problems that have surfaced during the analysis. The issues were mainly because the sample mostly consisted of male athletes. There may be personality differences between gender itself which, if so, can discredit the study's findings. As revealed by other studies (Byrnes, Miller, and Schafer, 1999), the gender itself plays a role in personality differences. Learning from the results and boundaries of Steinbrink's study, we considered the limitations in this study, creating different groups for genders.

One of the limitations besides gender is the type of sport an athlete pursues. According to the analysis of Piepiora et al., 2019, the sports type determines an athlete's character. While the study found that all athletes have the same pattern of character traits in the Big Five analysis with "high conscientiousness and extraversion, average openness to experience and agreeableness", the type of sport can be predicted with neuroticism feature. This particular feature, however, is essential in predicting performance in sports as research shows that neuroticism and conscientiousness can predict roughly 23% of variance in NCAA Division 1 soccer team (Piedmont, Hill, and Blanco, 1999). Another related study by Ilyasi and Salehian, 2011 established Big Five personality differences between individual and team-sport athletes on extraversion, openness and conscientiousness traits. It was also confirmed by the study of Steca et al., 2018.

Lastly, the previous studies about how different entrepreneur groups differ from each other in terms of personality are found to be relatively understudied. A recently published literature review done by Salmony and Kanbach, 2021 shows that sub-types of entrepreneurs in terms of the Big Five may also somehow differ. The sub-groups that differ from general entrepreneurs are successful, agricultural, and technological entrepreneurs. However, this study's finding of

how successful entrepreneurs differ from general entrepreneurs is interesting. Successful entrepreneurs are found to be more conscientious and less neurotic than general entrepreneurs. Therefore, this finding means that our study's conclusions only cover top entrepreneurs and not all entrepreneurs. The other significant results of previous research show that male and female entrepreneurs have significantly different personalities (Bajwa, Shahzad, and Aslam, 2017), which we consider when building the research question.

1.2 Focus of the Study

The focus of this research is entirely related to the findings of the literature search because it is imperative to eliminate most biases and limitation possibilities that limit the relevance of this study. Our analysis consists of using the digital footprints of successful entrepreneurs and athletes to compare them in terms of personality using the Big Five analysis. Nonetheless, considering the limitations of the previous research, we categorized athletes and entrepreneurs. It does not only contribute to the accuracy of the analysis but will also explore new findings in the comparison of both professions.

Categories of Top Professional Athletes
Male athletes pursuing team sports
Female athletes pursuing team sports
Male athletes pursuing individual sports
Female athletes pursuing individual sports

TABLE 1.1: Categories of top professional athletes that will be individually analyzed

Categories of Successful Entrepreneurs
Male entrepreneurs
Female entrepreneurs

TABLE 1.2: Categories of successful entrepreneurs that will be individually analyzed

Thus, the research question in this paper is **"What are the personality and emotionality differences between various groups of leading entrepreneurs and top professional athletes based on their digital footprints?"**

1.2.1 Scientific Relevance

In the entrepreneurship field of study, the comparison of athletes and entrepreneurs is a subject that has been rarely touched upon (Steinbrink, Berger, and Kuckertz, 2020). There are, nonetheless, various papers that analyze the personality of these two professions independently (without comparing) (Ex. Müller and Gappisch, 2005 & Khan, Ahmed, and Abid, 2016). However, most of the previous research conducted case studies or literature reviews with a limited sample and scope. This paper approaches this subject using breakthrough technologies and data science methods. Moreover, based on the previous research regarding this

subject, this paper further categorizes entrepreneurs and athletes using gender and type of sport (for athletes). It compares the sub-groups based on these categorizations to even more intensively explore the differences between entrepreneurs and athletes. Thus, this research answers the call of Steinbrink, Berger, and Kuckertz, 2020 and studies the comparison between top athletes and entrepreneurs by considering gender and type of sport to explore the new topics on this subject. It also adds more depth to the scientific field by further developing the problems faced in the study of Quast, 2016, which did case studies on this subject but with a limited sample size of athletes and entrepreneurs to increase the significance of the results. In other words, this research fills specific gaps mentioned in other related studies and contributes to the understudied subject of how the personalities of these two professions overlap.

1.2.2 Societal Relevance

Equally important, the research findings could potentially answer or get a step closer to answering questions society is facing. With more analysis of personalities between different professions and, more importantly, new information on sub-groups of these professions, the community would have access to accurate and more robust information. This would even be used in other discussions, for instance, the reason for these differences or similarities between entrepreneurs and athletes. Thus, the outcome of the research gives a better understanding to the society of the reasons why sportspeople become entrepreneurs often easy. However, the societal part of this question still needs to be further discussed to give more explicit answers; this study only provides objective results that could be further developed or based on understanding the dynamics of the process of why an athlete pursues an entrepreneurship career after retiring from sports.

Another important practical aspect is the results show how similar an athlete's personality and emotions are to entrepreneurs, which could help employers and athletes to better to have a better understanding of the fit in as an entrepreneur in later career options. In addition, personalities give crucial insights about career options according to personality-job fit theory (O'Reilly III, 1977). It could even help create programs that would provide an athlete with the education to pursue an entrepreneurship career much more quickly with more personality knowledge so that entrepreneurship would offer more suitable career options for the athletes.

Chapter 2

Methodology

The methodology of this research is inspired by the work of Obschonka, Fisch, and Boyd, 2017 which also used the Twitter footprints of top entrepreneurs and top managers to compare them in terms of personality characteristics. The study was successful in terms of findings, which inspires other studies like this to use the method as a reference and improve on it.

2.1 Language-based personality assessment tools

Language-based personality assessment tools available today allow us to utilize big chunks of data in a less time-consuming and more effective, accurate way (Obschonka, Fisch, and Boyd, 2017). Thus, this research uses these tools to perform a personality analysis. This study conducts two types of analyses based on the literature review; one is an emotional analysis, and the other is the Big Five Personality Analysis. We use separate programs to conduct these analyses.

2.1.1 Lexicon and emotion analysis: LIWC

Linguistic Inquiry and Word Count (LIWC) is software for quantitative text analysis (Pennebaker et al., 2015). It has been used for decades by more than 20.000 academic articles (according to Google) and is considered to be the "gold standard" in psychological research (Gong, Shin, and Poellabauer, 2018). Developed by Pennebaker, Francis, and Booth, 2001, LIWC has seen several updates until 2022 to become one of the better text analysis tools (Boyd et al., 2022). The elite capability to analyze function words makes LIWC the best fit for this research. These function words (articles, pronouns, prepositions) add up to approximately 46% of the words of all text. Furthermore, on Twitter, function words correspond to roughly the same percentage of words and can be effectively detected and analyzed using LIWC (Khazaei et al., 2016).

LIWC contains a dictionary with "12.000 words, word stems, phrases, and select emoticons". Each dictionary element can belong in one or numerous categories with a coefficient that estimates how strongly the element belongs in the category. The LIWC system analyzes the text with these categories and coefficients to assess psychological and social compositions (Boyd et al., 2022).

One of the concerns about using a computer-based analysis tool for this study was the ragged nature of tweets. Many abbreviations are used on Twitter; some do not mean anything in any dictionary as they are newly developed words on social media platforms. Moreover, approximately 14% of all English tweets contain hashtags, and a considerable amount is bilingual or does not mean anything according to the dictionary (Hong, Convertino, and Chi, 2011). It was a significant limitation for the studies that used LIWC for Twitter text analysis. However, the

newest version of LIWC (LIWC22) allows the tool also to analyze the "netspeak"¹ language that is used on Twitter without considerable limitations (Boyd et al., 2022). Considering these improvements and the overall quality of the tool, LIWC is a solid choice for language-based assessment tool in this research. LIWC22 can analyze the given text for more than 100 metrics. Even though all these metrics have important implications, most of them are out of the scope for this research as these metrics include too detailed linguistic features and an expanded dictionary. Therefore, we have selected 14 metrics for the LIWC analysis. 4 of these metrics are summary metrics that aggregate all of the LIWC metrics. The other ten metrics were chosen from the psychological processes category in LIWC. These metrics are selected because they show the emotional traits of the analyzed text, which is an excellent addition to this research. The selected 14 metrics are shown in Table 2.1 with their descriptions in LIWC. Additionally, we provided a correlation matrix for the variables in Table A.1.

Category	Abbrev.	Description/Most frequently used exemplars	Ref. Mean	Ref. SD
Summary Variables				
Analytical thinking	Analytic	Metric of logical, formal thinking	42.86	27.48
Clout	Clout	Language of leadership, status	49.10	28.36
Authentic	Authentic	Perceived honesty, genuineness	52.33	25.58
Emotional tone	Tone	Degree or positive (negative) tone	68.00	26.36
Psychological Processes				
Affect	Affect	good, well, new, love	8.96	4.48
Positive tone	tone_pos	good, well, new, love	6.05	4.52
Negative tone	tone_neg	bad, wrong, too much, hate	1.85	1.07
Emotion	emotion	good, love, happy, hope	3.02	2.13
Positive emotion	emo_pos	good, love, happy, hope	2.03	1.96
Negative emotion	emo_neg	bad, hate, hurt, tired	0.76	0.56
Anxiety	emo_anx	worry, fear, afraid, nervous	0.10	0.11
Anger	emo_anger	hate, mad, angry, frustr*	0.18	0.20
Sadness	emo_sad	:(, sad, disappoint, cry	0.17	0.23
Swear words	swear	shit, fuckin, fuck, damn	1.08	1.42

TABLE 2.1: Table of LIWC categories that are used in the analysis and their reference values for Twitter (Boyd et al., 2022)

2.1.2 Big Five Personality Analysis: Symanto

Symanto is a company that provides an API service that uses personal text to score them on psychological metrics. These specific measures were developed based on existing data and empirical research in psychology. The algorithms that Symanto use are all included in widely-used data science methods (Witten et al., 2011). Symanto is a group of AI researchers, data scientists, and psychologists who analyze vast quantities of text rapidly and correctly using sophisticated natural language processing and psycholinguistic algorithms. The API was used in various researches for social media analysis, including a successful emotional analysis of false information in social media and news articles and online learning (Chinea-Rios, Franco-Salvador, and Benajiba, 2020 & Ghanem, Rosso, and Rangel, 2020). Thus, with the ease of usage and the accuracy of the Symanto API, we can pursue the Big Five personality analysis.

¹Netspeak language: The jargon, abbreviations, and emoticons typically used by frequent internet users (CollinsDictionary, n.d.)

Symanto Big Five API gives scores for the Big Five (OCEAN) traits as well as six sub-traits for each Big Five trait. We compared the groups for each trait and sub-trait in the Big Five. These big five features include openness, extraversion, conscientiousness, agreeableness, and neuroticism. Each of these traits has six sub-traits. The descriptions of all these traits and sub-traits can be found in Table 2.2 and their correlation matrix can be found in Table A.2.

Trait	Definition
Extraversion	A disposition that is energized through social engagement and languishes or chafes in solitude, resulting in a personality that is gregarious, outgoing, and sociable.
Active	Engaged in action; characterized by energetic work, participation.
Assertive	Confidently aggressive or self-assured.
Cheerful	Characterized by or expressive of good spirits or cheerfulness.
Outgoing	Interested in and responsive to others; friendly; sociable.
Gregariousness	Fond of the company of others; sociable.
Excitement seeking	Seeking an excited state or condition.
Openness	The quality of being receptive to new ideas, opinions, or arguments; open-mindedness.
Adventurous	Inclined or willing to engage in adventures; enjoying adventures.
Artistic	Of, like, or thought of as characteristic of an artist.
Imaginative	Having exceptional powers of imagination.
Intellectual	Possessing or showing intellect or mental capacity, especially to a high degree.
Challenge authority	To challenge a person or body of persons in whom authority is vested.
Emotionally aware	Knowing when feelings are present in one's self and others.
Conscientiousness	Governed by conscience; controlled by or done according to one's inner sense of what is right; principled.
Cautious	Showing, using, or characterized by caution.
Disciplined	Having or exhibiting discipline; rigorous.
Dutiful	Performing the duties expected or required of one; characterized by doing one's duty.
Achievement strive	To make strenuous efforts toward any goal.
Self efficacy	A person's belief that they can be successful when carrying out a particular task.
Orderliness	The quality of being well arranged or organized.
Neuroticism	The state of having symptoms characteristic of neurosis, which is a relatively mild personality disorder typified by excessive anxiety or indecision and a degree of interpersonal maladjustment.
Melancholy	A gloomy state of mind, especially when habitual or prolonged.
Self conscious	Conscious of oneself or one's own being.
Stress prone	Having a natural inclination or tendency to physical, mental, or emotional strain or tension.
Prone to worry	Having a natural inclination or tendency to torment oneself with or suffer from disturbing thoughts.
Fiery	Easily angered or provoked.
Immoderation	Lack of moderation.
Agreeableness	The state or condition of being pleasing or likeable.
Cooperative	Working or acting together willingly for a common purpose or benefit.
Trusting	Inclined to trust; confiding; trustful.
Altruism	The principle or practice of unselfish concern for or devotion to the welfare of others.
Modesty	The quality of being modest; freedom from vanity, boastfulness, etc..
Sympathy	Agreement in feelings or emotions between people or on the part of one person toward another, especially as based on similar tastes, shared understanding, etc.
Uncompromising	Not admitting of compromise or adjustment of differences; making no concessions; inaccessible to flexible bargaining; unyielding.

TABLE 2.2: Table of Symanto Big Five traits and their descriptions (descriptions are obtained from Dictionary.com, 2022 and CambridgeDictionary, 2022)

2.2 The Samples

As for this research, we used the tweets from top athletes and entrepreneurs; after defining a "successful" person. When it comes to determining who a "successful" person is, wealth is a reliable and objective metric that is widely used. For athletes, we also used performance and popularity to distinguish top people. Therefore, according to the available wealth, popularity, and performance data, we made our sample from both groups (entrepreneurs and athletes). One of the crucial issues when selecting people from the lists is that some can be seen as athletes and entrepreneurs. Most of those people are athletes turned entrepreneurs or even both athlete-entrepreneurs. This study nevertheless, purely focuses on discovering the similarities between the groups. There is a slight chance that there could potentially be a tone change, especially on Twitter, after an athlete becomes an entrepreneur. Thereupon, we decided not to take a person if he did both professions at some time in their life. We have defined a sample of twenty-four people for each of our six categories. Thus, we analyzed the Tweets of 144 people in this study.

2.2.1 Top Male Entrepreneurs

To distinguish top male entrepreneurs, we looked at the Forbes list of wealthiest entrepreneurs under 40 years (Forbes, 2016). The reason to add young entrepreneurs is that most athletes are also young; they are 31.2 years old on average. The age of the two groups being vastly different could cause biases in this study as some studies show that older people scored higher inconsistency scores (Roberts and DelVecchio, 2000). Out of these 40 top young entrepreneurs, 38 were male, and only 16 of them have active Twitter accounts. Thus, we added more people to our sample from the Forbes 400 list (Forbes, 2021b). Among these 400 wealthiest people, we picked the eight youngest entrepreneurs who are active Twitter users. Thus, we created our 24 male entrepreneurs sample from the Forbes lists.

2.2.2 Top Female Entrepreneurs

To create a sample of 24 female entrepreneurs, we used the top 15 entrepreneurs list from Dan Western (Western, 2022). Additionally to complete the sample, we handpicked female entrepreneurs from Forbes 400 list (Forbes, 2021b).

2.2.3 Top Male Professional Athletes Pursuing Team Sports

We first draw the sample from the Forbes list of highest-paid athletes (Forbes, 2021a). The advantage of using this list is that they are active athletes as of 2021, so few of them have entrepreneurial careers alongside. Out of 45 athletes, 17 had active Twitter accounts. Therefore, to complete the sample, we used TheRichest Top 100 Richest Athletes list (TheRichest, 2022). We handpicked the athletes who did not pursue an entrepreneurship career. Consequently, we got our sample of 24 top male athletes pursuing team sports.

2.2.4 Top Female Professional Athletes Pursuing Team Sports

For creating the sample of top female professional athletes pursuing team sports, we used the ranking of women basketball players by two references (TheFamousPeople, 2022) & Jezreel, 2021). We used the top female footballers ranking (Laverty, 2021). Nevertheless, these include athletes from football and basketball primarily. We also selected some people from the "Sports Illustrated's Fittest 50" (Illustrated, 2022) to make the sample more diverse.

2.2.5 Top Male Professional Athletes Pursuing Individual Sports

We created the sample for top male professional athletes pursuing individual sports by first adding people from the "Sports Illustrated's Fittest 50" list, which contains athletes from different individual sports (Illustrated, 2022). Moreover, we used official athleticism world rankings (Athletics, 2022), world golf rankings (Sports, 2022) and world tennis rankings (ESPN, 2022) to draw a sample of 24 individual male athletes. Thus, most of the athletes on these samples pursue tennis, golf or athleticism.

2.2.6 Top Female Professional Athletes Pursuing Individual Sports

We drew the sample for professional female athletes in individual sports using "Sports Illustrated's Fittest 50" (Illustrated, 2022), female world tennis rankings (Tennis, 2022), Forbes Top 100 richest athletes list (KNIGHT and BIRNBAUM, 2021).

2.3 Analysis Process

2.3.1 Preparing the data

Twitter accounts from the six categories (mentioned in section 2.2) were identified. Using the 'Snscraper' library in Python, 1000 tweets from each account were pulled from Twitter. If the tweet does not end with one, they were put together with a point ('.'). Also, the query that pulled the tweets required all tweets to be written in English since we need that to be consistent. The dates of these tweets ranged from 2010 to 2022. Tweets from different accounts were put in a separate text file. Text files from the same categories were stored in the same folder. Then each text file was cleaned with the data cleaning methods mentioned in section 2.3.2. The LIWC22 application then analyzes the cleaned text files. Each category was put in separately. LIWC then gave a score for each text file based on 14 selected components (Table 2.1). Same text files were used in the Symanto API for the Big Five personality analysis. The only difference is that the Symanto API does not accept '.txt' files; thus, the files were converted into 'array' type using Python. Symanto API analyzed these arrays and gave scores on 30 sub-components and the 5 Big Five components. The sub-components make up the overall Big Five scores.

2.3.2 Data Cleaning

We decided to do three significant cleanings for our raw 144.000 tweet dataset. We assumed that the lexicon analysis would not be as accurate if we did not conduct some important cleanings. The LIWC analysis needs to keep a clean sentence structure. It is common to use "retweets" and "quote retweets" on Twitter. These retweets count as regular tweets when pulling data from Twitter. However, a retweet is indeed a shared tweet of another user. Since it is not written by the user we examine, it could have biases if we do not eliminate them before the analysis. Thus, firstly, we cleaned all the tweets with "retweets" and "quote retweets". Secondly, we cleaned all the tweets with mentions. A tweet with mention is a tweet containing another user's username anywhere in the body of a tweet (Twitter, 2022). In most tweets, Twitter users tend to place mentions in different places of a sentence that would not be acceptable in a typical sentence structure. Also, the users are often not people but companies or other entities, which again means the sentence structure could be different each time a mention is used. There is no way to categorize that.

The other necessary cleaning we made is cleaning the tweets with URLs. They sometimes mess up the sentence structure, which is very important for our LIWC lexicon analysis. Also, URLs usually do not add anything to a sentence, and on Twitter, the shared pictures in a tweet appear as an URL. It means there are often tweets with just an URL which again does not mean anything for our analysis.

2.3.3 Compared groups

In this study, we aim to uncover the similarities and differences between two main groups: entrepreneurs and athletes. It means that for the analysis; it is redundant to discover differences between all groups². Thus, we divided our analysis into four comparisons to achieve the goal of this study. They are:

- Male Entrepreneurs vs Male Athletes Pursuing Team Sports
- Male Entrepreneurs vs Male Athletes Pursuing Individual Sports
- Female Entrepreneurs vs Female Athletes Pursuing Team Sports
- Female Entrepreneurs vs Female Athletes Pursuing Individual Sports

2.3.4 Comparison Method: Welsch t-test

To compare the groups mentioned in the section above, we decided to use one of the most accurate and widely-used methods: the two-sample t-test (Posten, 1984). There were two popular ways to execute these two sampled t-tests: the Welsch t-test and the other is the Student's t-test. According to previous research, Student's t-test performed slightly better when the sample under equal variance and normality assumptions. Nonetheless, when these assumptions do not hold, the Welsch t-test outperformed the Student's t-test (Zimmerman and Zumbo, 1993). Furthermore, a more recent study (Delacre, Lakens, and Leys, 2017) reveals that in psychology, assuming variance equality and using the Student's t-test significantly increases the likelihood of Type I error.

Our language-based assessment tools, LIWC in particular, score different values for different categories. Thus, it requires calculations for each category to prove the equal variance assumption. Also, it is highly possible for at least one of the 14 LIWC categories analyzed in this study not to meet the equal variance criteria. Thus, we decided to use the Welsch t-test under the unequal variance assumption to be more cautious with the accuracy of the results.

There are also important points to discuss, considering the results of this study. Firstly, the most important subject to discuss is the validity and accuracy of the results. Other related studies namely Obschonka, Fisch, and Boyd, 2017, used 90% confidence interval ($p < 0.1$) for validating difference between groups. In scientific literature, the required confidence interval (p-value) to reject a null hypothesis for t-tests is a subject that is extensively discussed (Simundic et al., 2008). The recent debates on the t-test show that more researchers tend to accept a p-value of 0.05 as the threshold for significance and reject the null hypothesis (Dahiru, 2008). However, the study by Cesana, 2018 argues that it can differ based on the analysis. Thus,

²Other groups namely: "Male Entrepreneurs vs Female Entrepreneurs", "Male Athletes Pursuing Team Sports vs Female Athletes Pursuing Team Sports", "Male Athletes Pursuing Individual Sports vs Female Athletes Pursuing Individual Sports", "Male Athletes Pursuing Team Sports vs Male Athletes Pursuing Individual Sports", "Female Athletes Pursuing Team Sports vs Female Athletes Pursuing Individual Sports" are also compared using t-tests. To request the results, please send an email to the author.

in this results section, we only provided the findings with more than 90% significance but also pointed out the significance levels of the results by giving stars (*) based on their significance.

Chapter 3

Results

3.1 LIWC Results

3.1.1 Male Groups

Categories	(0) Male Entrepreneur (N = 24)		(1) Male Athlete (TS) (N = 24)		(2) Male Athlete (IS) (N = 24)		p: (1)-(0)	p: (2)-(0)
	Mean	SD	Mean	SD	Mean	SD		
Analytic	66.802	15.388	60.444	17.436	61.603	21.687	0.187	0.344
Clout	61.772	20.258	69.907	11.249	54.892	14.957	0.094*	0.188
Authentic	47.8	11.221	66.058	9.999	70.091	11.064	0.0***	0.001***
Tone	74.85	23.414	90.602	10.971	87.167	18.407	0.005***	0.049**
Affect	7.003	3.631	9.03	1.6	8.509	1.517	0.018**	0.07*
Pos. Tone	5.523	2.896	7.395	1.888	7.09	2.066	0.011**	0.037**
Neg. Tone	1.35	1.09	1.303	0.44	1.141	0.627	0.847	0.422
Emotion	2.268	1.657	3.242	1.126	2.728	0.668	0.022**	0.216
Pos. Emotion	1.699	1.28	2.586	1.151	2.219	0.819	0.015**	0.102
Neg. Emotion	0.465	0.482	0.459	0.176	0.359	0.229	0.953	0.334
Anxiety	0.078	0.126	0.07	0.047	0.049	0.034	0.787	0.291
Anger	0.077	0.07	0.12	0.09	0.075	0.087	0.068*	0.942
Sadness	0.153	0.384	0.07	0.037	0.077	0.051	0.301	0.342
Swear	0.045	0.061	0.192	0.269	0.155	0.273	0.015**	0.067*

* p < 0.10

** p < 0.05

*** p < 0.01

TS = Team Sport

IS = Individual Sport

TABLE 3.1: Group differences between Male Entrepreneurs, Male Athletes Pursuing Team Sports and Male Athletes Pursuing Individual Sports (LIWC)

Male Entrepreneurs vs Male Athletes (Team Sports)

In Table 3.1 a drastic difference between team sport athletes and entrepreneurs belonging to the same binary gender group (male) could be seen, where they differ in 9 out of 14 variables. Here 2 of the variables have a difference with more than 99% significance (Authentic and Tone), 5 of them have between 99% and 95% (Affect, Positive Tone, Emotion, Positive Emotion and Swear Words), and lastly 1 criterion differs with a rate of significance between 90% and 99% (Clout). These significances are marked in the table with three, two and one stars, respectively,

next to the p values. The most significant difference between the mean values could be observed for the Tone variable (74.85 for male entrepreneurs and 90.602 for male athletes), with Authentic being a close second with a margin of 18.258, where both variables yield a p-value far smaller than 0.01. High p values, thus, similar mean values, i.e. smallest margins between mean values, could be seen for certain variables, such as Negative Tone, Negative Emotion and Anxiety. Since these also have a normal standard deviation, we can say that these attributes do not differ in both groups. Out of them, the greatest p-value could be seen for Negative Emotion, being close to 1.0 with a margin of only 0.006 between the mean values (0.465 for male entrepreneurs and 0.459 for male athletes). For the Sadness variable, the standard deviations for the two groups differ immensely (more than ten times), showing outliers in the Male Entrepreneur group. Also, with this much difference in standard deviation, it is not wise to reach any conclusions on this.

Male Entrepreneurs vs Male Athletes (Individual Sports)

When looking at Table 3.1, it could be observed that athletes and entrepreneurs belonging to the same binary gender group (in this case, male) differ in only 3 of the 14 variables with 95% confidence (Authentic, Tone, Positive Tone). By looking at the obtained p values from their comparison, it can be said that 1 of the five variables shows a significant difference with more than 99% (Authentic), two more than 95% (Tone, Positive Tone), and two more than 90% (Affect, Swear Words) confidence, which is indicated by three, two and one stars (*) respectively. The most drastic difference appears for the Authentic variable, where the mean value for male entrepreneurs (47.8) differs from the mean value of male athletes (70.091) by a margin of 22.291, yielding a p-value far smaller than 0,01. The mean value for male entrepreneurs is (0.077), and (0.075) for male athletes shows the smallest margin (0.002) and therefore yields the largest p-value (0.942) of all the 14 variables. Additionally, the Positive Emotion variable yields a p-value of 0.102, which is considered insignificant. Still, the value is very close to a 90% confidence, which might suggest that with a larger sample size, the variable can yield a more significant p-value, helping with more accurate determination.

3.1.2 Female Groups

Categories	(0) Female Entrepreneur (N = 24)		(1) Female Athlete (TS) (N = 24)		(2) Female Athlete (IS) (N = 24)		p: (1)-(0)	p: (2)-(0)
	Mean	SD	Mean	SD	Mean	SD		
Analytic	72.09	11.237	57.31	19.863	55.862	22.004	0.003***	0.003***
Clout	79.52	15.755	79.141	10.528	54.987	18.127	0.922	0.0***
Authentic	44.918	13.659	57.255	11.484	70.017	11.08	0.001***	0.0***
Tone	93.556	7.952	96.388	5.65	92.133	14.018	0.162	0.668
Affect	8.139	1.763	10.21	2.217	9.558	2.125	0.001***	0.016**
Pos. Tone	7.261	1.832	8.979	2.299	8.144	2.478	0.006***	0.168
Neg. Tone	0.715	0.446	1.01	0.281	1.181	0.665	0.009***	0.007***
Emotion	2.886	0.883	3.955	1.063	3.785	1.425	0.0***	0.012**
Pos. Emotion	2.405	0.83	3.402	1.035	3.16	1.451	0.001***	0.033**
Neg. Emotion	0.315	0.208	0.379	0.169	0.451	0.275	0.247	0.059*
Anxiety	0.095	0.094	0.066	0.052	0.091	0.065	0.203	0.887
Anger	0.045	0.031	0.076	0.046	0.089	0.07	0.008***	0.008***
Sadness	0.057	0.042	0.094	0.07	0.102	0.065	0.034**	0.008***
Swear	0.042	0.06	0.075	0.075	0.108	0.212	0.105	0.158

* p < 0.10

** p < 0.05

*** p < 0.01

TS = Team Sport

IS = Individual Sport

TABLE 3.2: Group differences between Female Entrepreneurs and Female Athletes Pursuing Team Sports (LIWC)

Female Entrepreneurs vs Athletes (Team Sports)

When Table 3.2 is considered, it can be observed that athletes and entrepreneurs belonging to the same binary gender group (in this case, female) differ in 9 of the 14 variables. The mean values for each criterion and the obtained p values from their comparison show that 8 out of 9 differing variables contrast by more than 99% (Authentic, Analytic, Affection, Positive Tone, Negative Tone, Emotion, Positive Emotion, Anger) and 1 out of 9 by more than 95% (Sadness), which are indicated by three and two stars (*) respectively. The most radical difference is observed in the Emotion variable, where the mean value of female entrepreneurs (2.886) differs from the mean value of female athletes (3.995) by a margin of 1,109, which translates to a p-value much smaller than 0.001. Similar drastic differences are observed in Authentic, Affect, and Positive Emotion variables, which all yield p values smaller than 0.01 and in Positive Tone with a p-value of 0.006, along with Negative Tone and Anger with p values of 0.009 and 0.008, respectively, where female athletes seem to express these properties more than female entrepreneurs. While these variables differ with high significance between groups, the Clout variable shows significant similarity, with its p-value being close to 1 (0.922).

Female Entrepreneurs vs Athletes (Individual Sports)

Table 3.2 is a comparison between entrepreneurs and athletes (Individual sports) of the female gender group, with a substantial difference in 10 out of 14 variables. Out of these ten variables, 6 of them (Analytic, Clout, Authentic, Negative Tone, Anger and Sadness) show a difference with 99% or more significance (p-value smaller than 0.01), out of which the largest

difference could be observed for Authentic, and Clout both p values are smaller than 0.001. Other variables with differences are 3 with 95% or greater significance (Affect, Emotion and Positive Emotion), 1 with a rate of significance between 90% and 95% (Negative Emotion), which are indicated with two stars for >95%, and 1 star for >90%. Additionally, the Anxiety variable, with a p-value of 0.887, assuredly does not differ between the two groups. The swear Words variable, since its standard deviation varies too much between two groups (more than 3.5x difference), is not captured perfectly in this analysis. A bigger sample size is needed to capture is more accurately.

3.2 Big Five Results

3.2.1 Male Groups

Traits	(0) Male Entrepreneur (N = 24)		(1) Male Athlete (TS) (N = 24)		(2) Male Athlete (IS) (N = 24)		p: (1)-(0)	p: (2)-(0)
	Mean	SD	Mean	SD	Mean	SD		
Extraversion	0.535	0.014	0.548	0.014	0.545	0.018	0.003***	0.039**
Active	0.549	0.012	0.553	0.014	0.551	0.014	0.241	0.625
Assertive	0.555	0.017	0.554	0.024	0.548	0.023	0.817	0.226
Cheerful	0.539	0.015	0.546	0.026	0.548	0.024	0.306	0.137
Outgoing	0.547	0.016	0.55	0.015	0.555	0.017	0.602	0.102
Gregariousness	0.553	0.022	0.566	0.017	0.561	0.02	0.021**	0.205
Excitement seeking	0.531	0.017	0.55	0.018	0.546	0.02	0.0***	0.008***
Openness	0.542	0.011	0.523	0.01	0.529	0.015	0.0***	0.001***
Adventurous	0.54	0.023	0.543	0.013	0.541	0.013	0.629	0.841
Artistic	0.541	0.019	0.542	0.02	0.544	0.019	0.818	0.588
Imaginative	0.542	0.017	0.548	0.016	0.546	0.011	0.199	0.317
Intellectual	0.545	0.013	0.545	0.007	0.544	0.011	0.924	0.934
Challenge authority	0.542	0.01	0.537	0.012	0.537	0.013	0.163	0.209
Emotionally aware	0.542	0.01	0.545	0.007	0.542	0.008	0.234	0.975
Conscientiousness	0.552	0.018	0.556	0.021	0.556	0.015	0.432	0.359
Cautious	0.556	0.016	0.552	0.012	0.556	0.015	0.331	0.933
Disciplined	0.54	0.01	0.541	0.019	0.544	0.009	0.735	0.11
Dutiful	0.547	0.018	0.548	0.029	0.548	0.015	0.885	0.874
Achievement strive	0.555	0.014	0.596	0.031	0.592	0.054	0.0***	0.003***
Self efficacy	0.555	0.025	0.578	0.032	0.574	0.02	0.009***	0.007***
Orderliness	0.546	0.013	0.541	0.016	0.547	0.017	0.25	0.757
Neuroticism	0.399	0.01	0.391	0.011	0.394	0.011	0.011**	0.12
Melancholy	0.394	0.013	0.391	0.018	0.386	0.017	0.547	0.092*
Self conscious	0.397	0.011	0.389	0.017	0.395	0.017	0.055*	0.606
Stress prone	0.404	0.012	0.399	0.012	0.403	0.016	0.167	0.798
Prone to worry	0.402	0.015	0.415	0.017	0.416	0.021	0.005***	0.011**
Fiery	0.398	0.011	0.415	0.022	0.404	0.02	0.001***	0.219
Immoderation	0.383	0.016	0.402	0.014	0.397	0.017	0.0***	0.006***
Agreeableness	0.532	0.018	0.519	0.02	0.523	0.018	0.023**	0.108
Cooperative	0.555	0.023	0.533	0.033	0.543	0.019	0.011**	0.06*
Trusting	0.538	0.022	0.553	0.019	0.55	0.02	0.013**	0.054*
Altruism	0.552	0.033	0.546	0.027	0.55	0.027	0.503	0.837
Modesty	0.529	0.016	0.537	0.03	0.538	0.014	0.252	0.065*
Sympathy	0.539	0.022	0.529	0.024	0.532	0.023	0.114	0.301
Uncompromising	0.547	0.021	0.528	0.014	0.536	0.016	0.001***	0.041**

* p < 0.10

** p < 0.05

*** p < 0.01

TS = Team Sport

IS = Individual Sport

TABLE 3.3: Big Five Personality group differences between Male Entrepreneurs, Male Athletes Pursuing Team Sports and Male Athletes Pursuing Individual Sports (Symanto)

Male Entrepreneurs vs Male Athletes (Team Sports)

Looking at Table 3.3, top male entrepreneurs and male athletes pursuing teams sports differ significantly ($p < 0.05$) in four out of five Big Five traits (Extraversion, Openness, Conscientiousness, Neuroticism, Agreeableness). The most significant differences are in Extraversion and Openness traits; both differ with 99% significance ($p < 0.01$). Additionally, male entrepreneurs have higher Openness, Neuroticism and Agreeableness and lower Extraversion compared to male athletes.

Considering the sub-traits, for Extraversion, two sub-traits have significant differences, which are gregariousness ($p < 0.05$) and excitement seeking ($p < 0.01$), both higher in male athletes pursuing team sports. For Openness sub-traits, there is no significant difference. For Conscientiousness sub-traits, achievement strive and self-efficacy are substantial differences both with 99% confidence (both higher in athletes pursuing individual sports). For Neuroticism sub-traits, immoderation, fiery, and prone to worry are significantly higher in athletes pursuing individual sports with 99% confidence, and self-consciousness is higher in male entrepreneurs with 90% confidence. Lastly, for Agreeableness sub-traits, uncompromising ($p < 0.01$) and cooperative ($p < 0.05$) are significantly higher in male entrepreneurs, while trusting ($p < 0.05$) is significantly lower compared to male athletes pursuing individual sports.

Male Entrepreneurs vs Male Athletes (Individual Sports)

Table 3.3 provides a breakdown of the results of the traits for male entrepreneurs and male athletes pursuing individual sports. Two out of five Big Five traits show significant differences between the groups, which are Extraversion ($p < 0.05$) and Openness ($p < 0.01$). While Extraversion is higher in athletes pursuing individual sports, entrepreneurs score higher in Openness.

Coming to the sub-traits, for Extraversion, excitement seeking is higher in male athletes pursuing individual sports with 99% confidence. For Openness, there are no sub-traits that significantly differ. For Conscientiousness sub-traits, achievement strive and self-efficacy are lower in male entrepreneurs with 99% significance. For Neuroticism sub-traits, immoderation ($p < 0.01$) and prone to worry ($p < 0.05$) are both significantly lower and melancholy ($p < 0.1$) significantly higher in male entrepreneurs. Lastly for Agreeableness sub-traits, cooperative ($p < 0.1$) and uncompromising ($p < 0.05$) are higher in male entrepreneurs, while trusting ($p < 0.1$) and modesty ($p < 0.1$) are higher in male athletes pursuing individual sports.

3.2.2 Female Groups

Traits	(0) Female Entrepreneur (N = 24)		(1) Female Athlete (TS) (N = 24)		(2) Female Athlete (IS) (N = 24)		p: (1)-(0)	p: (2)-(0)
	Mean	SD	Mean	SD	Mean	SD		
Extraversion	0.554	0.018	0.547	0.02	0.55	0.026	0.234	0.513
Active	0.561	0.015	0.552	0.018	0.559	0.023	0.056*	0.785
Assertive	0.575	0.031	0.54	0.021	0.548	0.018	0.0***	0.0***
Cheerful	0.56	0.02	0.556	0.02	0.569	0.027	0.555	0.187
Outgoing	0.56	0.012	0.554	0.02	0.558	0.018	0.229	0.578
Gregariousness	0.573	0.022	0.577	0.021	0.571	0.017	0.521	0.672
Excitement seeking	0.544	0.019	0.546	0.022	0.56	0.029	0.738	0.03**
Openness	0.552	0.014	0.526	0.016	0.534	0.011	0.0***	0.0***
Adventurous	0.561	0.021	0.548	0.015	0.557	0.021	0.018**	0.496
Artistic	0.563	0.033	0.539	0.014	0.552	0.029	0.002***	0.232
Imaginative	0.557	0.02	0.543	0.009	0.556	0.019	0.003***	0.871
Intellectual	0.549	0.012	0.543	0.009	0.546	0.007	0.082*	0.306
Challenge authority	0.552	0.017	0.537	0.017	0.533	0.016	0.004***	0.0***
Emotionally aware	0.548	0.014	0.55	0.01	0.545	0.012	0.59	0.434
Conscientiousness	0.556	0.012	0.55	0.016	0.553	0.011	0.161	0.38
Cautious	0.547	0.015	0.552	0.016	0.549	0.012	0.281	0.63
Disciplined	0.548	0.01	0.533	0.016	0.541	0.018	0.0***	0.089*
Dutiful	0.55	0.017	0.551	0.017	0.548	0.015	0.884	0.657
Achievement strive	0.584	0.036	0.585	0.028	0.591	0.049	0.863	0.571
Self efficacy	0.574	0.024	0.567	0.019	0.57	0.018	0.249	0.533
Orderliness	0.542	0.013	0.538	0.011	0.548	0.013	0.164	0.169
Neuroticism	0.398	0.018	0.4	0.018	0.397	0.013	0.586	0.833
Melancholy	0.388	0.025	0.395	0.023	0.379	0.023	0.328	0.203
Self conscious	0.393	0.022	0.4	0.027	0.398	0.016	0.329	0.328
Stress prone	0.402	0.016	0.411	0.023	0.407	0.014	0.138	0.239
Prone to worry	0.403	0.019	0.425	0.027	0.418	0.025	0.002***	0.026**
Fiercy	0.405	0.013	0.408	0.015	0.402	0.016	0.375	0.494
Immoderation	0.39	0.015	0.398	0.015	0.398	0.011	0.088*	0.057*
Agreeableness	0.538	0.014	0.535	0.022	0.534	0.026	0.556	0.6
Cooperative	0.557	0.018	0.551	0.027	0.55	0.021	0.339	0.229
Trusting	0.557	0.022	0.555	0.027	0.553	0.02	0.724	0.529
Altruism	0.569	0.02	0.562	0.028	0.563	0.028	0.339	0.4
Modesty	0.542	0.019	0.536	0.011	0.542	0.013	0.257	0.951
Sympathy	0.541	0.023	0.552	0.02	0.55	0.033	0.094*	0.293
Uncompromising	0.557	0.024	0.543	0.021	0.542	0.021	0.038**	0.029**

* p < 0.10

** p < 0.05

*** p < 0.01

TS = Team Sport

IS = Individual Sport

TABLE 3.4: Big Five Personality group differences between Female Entrepreneurs, Female Athletes Pursuing Team Sports and Female Athletes Pursuing Individual Sports (Symanto)

Female Entrepreneurs vs Female Athletes (Team Sports)

Table 3.4 demonstrates the Big Five traits and sub-traits for Female Entrepreneurs and Athletes pursuing team sports. One of the five Big Five traits differs significantly between the groups, Openness ($p < 0.01$). It is significantly higher in female entrepreneurs.

However, there are more differences regarding the sub-traits. For Extraversion sub-traits, assertive ($p < 0.01$) and active ($p < 0.1$) significantly differ. For Openness sub-traits, five out of six significant differences between the groups. These are imaginative, artistic, and challenge authority with more than 99% significance and adventurous with 95% significance. All of these are higher in female entrepreneurs. For Conscientiousness sub-traits, discipline is significantly higher in female entrepreneurs ($p < 0.01$). For Neuroticism sub-traits, prone to worry ($p < 0.01$) and immoderation ($p < 0.1$) is significantly higher in female athletes. Regarding Agreeableness sub-traits, uncompromising significantly is higher in entrepreneurs with 95% confidence, and sympathy is significantly higher in female athletes pursuing individual sports with 90% confidence.

Female Entrepreneurs vs Female Athletes (Individual Sports)

Looking at Table 3.4, one can see that one out of five Big Five traits, Openness, demonstrates a significant difference between female entrepreneurs and female athletes pursuing individual sports with more than 99% confidence. Other Big Five traits are not close to a significant difference.

Considering the sub-traits, for Extraversion, assertiveness is significantly higher in female entrepreneurs with more than 99% confidence, and excitement seeking is significantly lower for the same group with 95% confidence. For Openness sub-traits, only challenge authority is significantly higher in female entrepreneurs ($p < 0.01$). Considering Conscientiousness sub-traits, disciplined is higher in entrepreneur ($p < 0.1$). Regarding Neuroticism sub-traits, female athletes pursuing individual sports have a higher prone to worry with 95% confidence and higher immoderation with 90% confidence. Lastly, for Agreeableness sub-traits, female entrepreneurs show significantly higher scores for uncompromising with 95% confidence.

Chapter 4

Discussion & Conclusion

4.1 Discussion of the findings

4.1.1 LIWC Categories ¹

Summary Variables

The summary variables that we discuss are the most extensive ones covering all 114 variables for an LIWC analysis. Starting with the Analytic variable, the results show that female entrepreneurs display expressions of analytical thinking significantly more than female athletes. There is, however, no significant difference in the male groups. A study by Lewis, 2006 found that female entrepreneurs seek to hide their gender differences and try to avoid being identified differently from their male counterparts. It would make women give more analytic-sounding footprints as being analytical is often identified with masculinity (Leikas et al., 2007). Also, the nature of being an entrepreneur requires more analytic thinking than being an athlete.

The most significant discussion point for the Clout variable is that athletes pursuing team sports show higher Clout scores than those pursuing individual sports. There is a simple explanation for this difference. Clout's score is lower in LIWC if the usage of "I" is higher than the usage of "we" and "you" (Fox and Royne Stafford, 2021). Thus, it is evident that athletes pursuing team sports use more group-related tweets because of the nature of the sport. Additionally, Clout scores for female entrepreneurs are also high, in fact, higher than their male counterparts which means they are less likely to use first-person singular on Twitter.

Regarding the Authentic variable, entrepreneurs show significantly lower scores than athletes regardless of sport type. Entrepreneurs use social media in accordance with their business endeavours that follow a pre-constructed lingo. Additionally, their accounts are more likely to be run by other professional people (Obschonka, Fisch, and Boyd, 2017), resulting in more calculated expressions and less authenticity. In contrast, athletes react simultaneously to current events in sports (Hambrick et al., 2010). The results support the argument that athletes are generally more in charge of their social media accounts, indicating that they write out their thoughts in their own words, showing genuineness, compared to entrepreneurs. It could explain the more frequent displays of authenticity for athletes.

Psychological Processes

The results for psychological processes indicate that for both gender groups, athletes show more emotions in their digital footprints compared to entrepreneurs. The study of Obschonka, Fisch, and Boyd, 2017 also revealed that entrepreneurs are "more emotionally unresponsive"

¹See the list of summary variables and psychological processes in Table 2.1

compared to mean data and managers. Entrepreneurs' lack of emotional expression might also be interpreted as an internalized emotional suppression not to be perceived as unprofessional in the business world; an effort to refrain from expressions that may be deemed unprofessional for entrepreneurs as expressions of emotion are often wrongly stereotyped as unfit for professional business roles. Regarding these emotions, male athletes pursuing team sports show more positive and anger-related emotions than male entrepreneurs. It is also the same for female athletes in both groups compared to female entrepreneurs. However, the anger or sadness emotions are still low compared to reference groups which suggest entrepreneurs are very neutral in their tweets. This finding also relates to the study of De Cock, Denoo, and Clarysse, 2020, which suggested leader entrepreneurs are more "neutral and stable" regarding their emotions.

Swear word usage is also higher in male athletes compared to entrepreneurs. It can be explained by athletes showing more authenticity and Twitter accounts of entrepreneurs are being more professionally managed.

The last discussion point for the psychological processes is that there is a considerable gap between the female entrepreneurs and female athletes, even more significant than male groups. It suggests that woman entrepreneurs tend to hide their emotions on Twitter which again may relate to the findings of Lewis, 2006, suggesting that female entrepreneurs avoid highlighting their femininity by avoiding emotional text on social media. Additionally, a study done by Coche, 2017 highlights that female athletes emphasize their femininity according to an analysis of Twitter profiles. Thus, both can have an effect on the emotional differences between female entrepreneurs and athletes.

4.1.2 Big Five Traits ²

It is important to mention that no reference table is provided for Symanto Big Five analysis, so the results and discussion only give insights into the comparison between groups.

Extraversion

The results show that male entrepreneurs have higher Extraversion than male athletes (both individual and team sports), while females have no significant differences. The main point that explains these results is the lower scores in male entrepreneurs compared to female counterparts. The studies that compare athletes and entrepreneurs (Steinbrink, Berger, and Kuckertz, 2020 & Khan, Ahmed, and Abid, 2016) both find out Extraversion is higher in both athletes and entrepreneurs. While this study does not add anything to this result, it adds that male entrepreneurs are less extraverted than athletes and their female counterparts. The study by Murgesan and Jayavelu, 2017 did also find out that female entrepreneurs are more extraverted than male entrepreneurs, which is parallel with our findings. One major thing to discuss in the sub-traits is that female entrepreneurs are significantly more assertive than all other groups. However, there is no indication in the scientific literature to support or contradict this finding.

Openness

The results for both male and female groups clearly show that entrepreneurs show much higher Openness than athletes, both pursuing team sports or individual sports and regardless of gender. Regarding this trait, a study by Khan, Ahmed, and Abid, 2016 found out that Openness is positively related to sports performance. Conversely, another study by Quast,

²All traits and sub-traits including their descriptions can be found in Table 2.2

2016 did not find Openness to be related to athletic performance but found an essential trait for entrepreneurship success. Our results do not necessarily determine which study is more accurate but support the latter study as even top athletes do not come close to the Openness levels of entrepreneurs.

One explanation for such results could be that entrepreneurs need to be open to trying and embracing new ideas or concepts regarding their profession, mainly based on innovation and creativity (Hsieh and Wu, 2019), which makes it more likely to express them on the social media platforms than athletes.

Another possible observation is that female team sport athletes, and individual athletes differ significantly from female entrepreneurs when looking at the trait of challenging authority. It could further support the above-stated argument that entrepreneurs need to be more innovative and creative than their athlete counterparts since their profession requires them to drift around many challenges, regulations and possibly many others to improve their company or products. In contrast, rules and authorities mainly bind athletes throughout their competitions with other athletes or teams. Then again, this difference is not significant for male entrepreneurs and athletes even though male entrepreneurs show higher scores, so the argument does not entirely explain this phenomenon.

Conscientiousness

For Conscientiousness, the results do not show any difference between any groups there, for the finding suggests that top athletes and entrepreneurs possess a similar level of Conscientiousness. It can be argued that it is essential for top people as it "helps in developing impulse control, and focus on specific goals; it makes a person persistent, responsible, dependable and to work in an organized manner" (Khan, Ahmed, and Abid, 2016). It is found to be highly important in various studies of athletes (Aidman and Schofield, 2004 & Allen, Greenlees, and Jones, 2013) and also entrepreneurship (Leonelli, Ceci, and Masciarelli, 2016 & Postigo, Cuesta, and García-Cueto, 2021). However, regarding the sub-traits of Conscientiousness, there are some discussion points. The most significant finding is top male athletes (both pursuing team or individual sports) are more achievement striving and have higher self-efficacy than male entrepreneurs. A paper by Singh, Bhardwaj, and Bhardwaj, 2009 shows that top athletes show high levels of self-efficacy. Also, studies show that successful sportsmen competing in the top competitions have the highest self-efficacy, which contributes to feeling less emotional and more concentrated (Feltz, Short, and Sullivan, 2008). Another study on young baseball players supports this result (Watkins, Garcia, and Turek, 1994). Moreover, most top athletes undergo self-efficacy training (Feltz, Short, and Sullivan, 2008). Thus, this can be interpreted as male athletes having a significantly higher level of self-efficacy, not because entrepreneurs lack this trait but because athletes in top competition highly require and use it. Hence, they possess a great amount of self-efficacy.

Regarding a study by Nia and Besharat, 2010, it was found that individual sports athletes are more achievement-striving than team sport athletes. However, our results do not support this for both male and female groups; the achievement strive trait does not hold any significant differences between team vs individual sports.

Neuroticism

Regarding Neuroticism, the results show that the only significant difference occurs in male entrepreneurs vs male athletes pursuing team sports. The difference exists because the latter group showed the least Neuroticism score out of all groups. It can be argued that the most

popular (watched) sports are the male-performed team sports (Das, 2022), and so these sports have the most media and social media attention. Thus, these sports require lower levels of Neuroticism to handle the attention and even use it in their favour. Various studies show that both top athletes and entrepreneurs have low levels of Neuroticism (Steinbrink, Berger, and Kuckertz, 2020). It is also discussed in the paper of Khan, Ahmed, and Abid, 2016 that all champion athletes that studied in that research had low levels of Neuroticism. Then again, top male athletes showing significantly lower Neuroticism than entrepreneurs is a crucial result for the scientific literature. An interesting finding in our results regarding the sub-traits of Neuroticism is significantly lower prone to worrying levels in both male and female entrepreneurs compared to all athlete groups. This finding was not mentioned before in scientific literature, and the reason for it should also be looked at in future studies. Since both professions benefit from low prone the worry levels, maybe the explanation for this difference could be related to the Twitter usage of the athletes and entrepreneurs. As found in the LIWC analysis of this study, athletes are significantly more authentic on Twitter compared to entrepreneurs, who might suggest entrepreneur accounts are more led by social media professionals. It might eventually lead entrepreneurs to hide their prone the worrying on their social media.

Agreeableness

The only significant difference in the Agreeableness trait is between male entrepreneurs and male athletes pursuing team sports. The study by Khan, Ahmed, and Abid, 2016 found that lower Agreeableness predicts better performance in athletes. Additionally, the study of Steinbrink, Berger, and Kuckertz, 2020 mentioned that individual athletes might be thought to have lower agreeableness scores because of the nature of the sport they do. However, this might not be the case as they also have a team of coaches, managers or any training squad, which also requires Agreeableness trait as other team athletes do. This study also backs this up as in both genders, individual or team athletes did not show any significant difference between them in Agreeableness. Equally important, the sub-traits of Agreeableness make room for some discussions. In male groups, cooperative sub-trait is significantly higher in entrepreneurs compared to both team and individual sport pursuing athletes. Additionally, the trusting sub-trait is significantly lower in entrepreneurs compared to both athletes. It can be explained by the argument in the study of Bloom et al., 1998, as it mentions the importance of trusting relationships in high-level athletes. Considering uncompromising sub-trait, both in male and female gender groups, entrepreneurs score significantly higher than athletes. This could be explained by the nature of entrepreneurship, as many successful entrepreneurs show unyielding characters to become successful in their early careers (Nurjaya Nurjaya et al., 2022). While this may also be true for the athletes, the more guided nature of their profession may make them more compromising, especially in injury-related problems (Waldron and Krane, 2005).

4.2 Limitations and recommendation for future research

Like many credible studies, this study also has some considerable limitations. Since the target of this study is to maximize the societal and scientific relevance of this study, we will go into detail about the limitations that came across while conducting the research.

A critical limitation of this study is the credibility of the Big Five personality analysis using an external tool. While Symanto is a breakthrough tool to analyze text for the Big Five in the most accurate way possible, it is still not widely used, and there aren't any studies that measure the accuracy of this tool. In other words, this study is one of the few that analyzed personal text to

extract Big Five personalities. While our research shows that it is a reliable method, it is yet to be externally assessed. The tool does not have a reference table to evaluate the results without depending on other studies or comparisons. In the future, there may be other tools or updates to conduct this study in a completely reliable way.

In this study, we managed the separate professional athletes into various categories to conduct the analysis in a more meaningful and reliable way that has never been done before. However, we could not categorize entrepreneurs based on type for this study. In the research literature on the entrepreneurs, there are still some findings that may indicate that there exist different personalities for different types of entrepreneurs (Leutner et al., 2014). However, it still needs to be studied in separate and broader research for the scientific literature to have a clear scope of which types differ. The problem is there are too many types of entrepreneurs, and often the difference between the types is not significant to define. Therefore, this complicates the connection of personality differences between various types of entrepreneurs. We believe that it requires actual intensive research because of the many types of entrepreneurs to categorize entrepreneurs correctly. Because of the sample sizing difficulties, we couldn't conduct this analysis in this paper. It is also an important limitation for this paper and a topic to look into for future research. Specifically, since there are apparent differences between team and individual sports athletes, a comparison between solo founders and founding teams in terms of personality would be an excellent subject to study in future research.

Improved sample sizing is also an important factor to always look into in future research. In our study, we used a significant amount of text and successfully conducted the analysis. Nevertheless, it is always better to use a larger and more diverse sample for a personality analysis that holds significant relevance. Also, with our categorization in this research, it would be wiser to include more people for a more reliable result. Because of financial reasons, we could not have more people in this study. Then again, this does not mean the analysis is unreliable, but improving the sample size could increase confidence in the results and potentially open the ground to add more categories in this type of analysis.

4.3 Conclusion

This study aimed to provide empirical results and discussion points for differences between top athletes and entrepreneurs, as the research question suggests. It is safe to say that this goal is accomplished using data science techniques to measure 144,000 tweets on a total of 51 different traits and variables for six defined sub-groups of athletes and entrepreneurs. Based on the quantitative results, various emotional and summary values using LIWC22 and Big Five traits using Symanto according to the two groups' Twitter footprints are documented and discussed. To shortly summarize the findings, out of 51 variables, top male athletes pursuing team sports differed in 23 variables, and top male athletes pursuing individual sports differed in 17 variables compared to top male entrepreneurs (with at least 90% significance) and most of their variable differences being in Big Five personalities. Also, for female groups, athletes pursuing team sports differed in 20 variables, while athletes pursuing individual sports showed a difference in 18 variables compared to female entrepreneurs (with at least 90% significance), and most of their differences were in emotional variables. Thus, the analysis provides new insights into the relationship between top entrepreneurs and top professional athletes. With these insights, the educational options could become more suited for athletes who want to pursue an entrepreneurial career as a second job which is quite common. In short, this paper

generates previously discovered and undiscovered insights and discusses both to contribute to the topic scientifically and societally.

Appendix A

Technical Appendix

A.1 LIWC Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Analytic	1.0													
(2) Clout	0.246	1.0												
(3) Authentic	-0.236	-0.515	1.0											
(4) Tone	0.304	0.441	0.054	1.0										
(5) Affect	0.048	0.351	-0.037	0.549	1.0									
(6) Pos. Tone	0.191	0.435	-0.049	0.707	0.949	1.0								
(7) Neg. Tone	-0.376	-0.274	-0.022	-0.501	0.149	-0.158	1.0							
(8) Emotion	-0.047	0.272	-0.046	0.506	0.863	0.819	0.11	1.0						
(9) Pos. Emotion	0.063	0.324	-0.048	0.596	0.855	0.872	-0.079	0.972	1.0					
(10) Neg. Emotion	-0.37	-0.182	-0.045	-0.252	0.258	0.002	0.856	0.306	0.09	1.0				
(11) Anxiety	-0.201	0.056	-0.14	0.017	0.341	0.176	0.594	0.369	0.217	0.778	1.0			
(12) Anger	-0.482	-0.319	0.087	-0.497	-0.181	-0.368	0.539	-0.083	-0.227	0.515	0.116	1.0		
(13) Sadness	0.007	-0.003	-0.159	0.036	0.489	0.314	0.64	0.449	0.308	0.77	0.658	0.0	1.0	
(14) Swear	-0.445	-0.215	0.192	-0.378	-0.014	-0.217	0.447	0.004	-0.081	0.248	0.023	0.492	-0.02	1.0

Green/lime: $p < 0.10$

Yellow: $p < 0.05$

Orange: $p < 0.01$

TABLE A.1: Correlation matrix of LIWC variables used in this study and their significance levels

A.2 Symanto Big Five Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)			
(1) Extraversion	1.0																																					
(2) Active	0.793	1.0																																				
(3) Assertive	0.566	0.65	1.0																																			
(4) Cheerful	0.377	0.335	0.038	1.0																																		
(5) Outgoing	0.317	0.341	0.155	0.555	1.0																																	
(6) Gregariousness	0.498	0.413	0.157	0.648	0.678	1.0																																
(7) Excitement seeking	0.694	0.57	0.195	0.51	0.168	0.37	1.0																															
(8) Openness	0.274	0.452	0.628	0.201	0.15	0.053	0.113	1.0																														
(9) Adventurous	0.539	0.535	0.424	0.655	0.383	0.678	0.524	0.5	1.0																													
(10) Artistic	0.404	0.455	0.474	0.329	0.448	0.358	0.303	0.532	0.616	1.0																												
(11) Imaginative	0.394	0.465	0.357	0.476	0.537	0.481	0.455	0.38	0.639	0.811	1.0																											
(12) Intellectual	0.21	0.332	0.298	0.096	0.346	0.315	0.123	0.326	0.3	0.527	0.539	1.0																										
(13) Challenge authority	0.376	0.426	0.592	-0.152	-0.209	-0.023	0.108	0.456	0.06	0.105	0.006	0.082	1.0																									
(14) Emotionally aware	-0.033	-0.142	-0.069	0.085	0.129	0.131	-0.186	-0.024	0.119	0.116	0.022	0.102	-0.185	1.0																								
(15) Conscientiousness	0.159	0.301	0.391	-0.234	0.262	0.025	-0.094	0.104	0.085	0.372	0.29	0.576	0.16	0.066	1.0																							
(16) Cautious	-0.475	-0.276	-0.138	-0.52	-0.045	-0.307	-0.69	-0.249	-0.493	-0.213	-0.312	0.124	-0.079	0.078	0.505	1.0																						
(17) Disciplined	0.3	0.467	0.579	-0.117	0.278	-0.042	-0.05	0.381	0.191	0.39	0.259	0.302	0.175	0.108	0.645	0.188	1.0																					
(18) Dutiful	-0.009	0.106	0.2	0.013	0.397	0.172	-0.25	0.054	0.218	0.152	0.078	0.245	-0.076	0.277	0.578	0.413	0.426	1.0																				
(19) Achievement motive	0.621	0.659	0.513	0.107	0.173	0.19	0.446	0.039	0.266	0.259	0.225	0.189	0.373	0.009	0.467	-0.023	0.463	0.311	1.0																			
(20) Self efficacy	0.386	0.478	0.545	0.019	0.416	0.334	0.179	0.065	0.325	0.47	0.43	0.525	0.218	-0.039	0.792	0.22	0.552	0.501	0.658	1.0																		
(21) Orderliness	-0.16	0.004	-0.028	-0.034	0.382	-0.02	-0.212	-0.012	-0.028	0.073	0.103	0.302	-0.132	-0.277	0.302	0.485	0.271	0.457	0.054	0.397	1.0																	
(22) Neuroticism	-0.282	-0.396	-0.292	-0.078	-0.264	-0.107	-0.267	-0.106	-0.218	-0.119	-0.087	-0.248	-0.132	0.476	-0.311	-0.03	-0.226	-0.192	-0.398	-0.437	-0.504	1.0																
(23) Self-conscious	-0.245	-0.422	-0.177	-0.495	-0.519	-0.391	-0.283	-0.213	-0.387	-0.178	-0.312	-0.287	0.035	0.438	-0.137	0.053	-0.128	-0.124	-0.127	-0.285	-0.531	0.657	1.0															
(24) Stress-prone	-0.291	-0.505	-0.464	-0.1	-0.304	-0.157	-0.187	-0.232	-0.253	-0.11	-0.123	-0.317	-0.272	0.273	-0.369	-0.034	-0.392	-0.316	-0.447	-0.481	-0.394	0.821	0.574	1.0														
(25) Stress-prone	-0.06	-0.167	-0.176	-0.006	-0.144	0.037	-0.019	-0.175	-0.145	-0.081	-0.016	-0.12	-0.04	0.372	-0.138	-0.074	-0.189	-0.086	-0.134	-0.166	-0.405	0.804	0.495	0.675	1.0													
(26) Prone to worry	-0.158	-0.343	-0.442	-0.017	-0.022	0.102	-0.1	-0.544	-0.305	-0.197	-0.078	-0.043	-0.241	0.426	-0.122	0.119	-0.319	-0.104	-0.158	-0.127	-0.25	0.606	0.391	0.516	0.684	1.0												
(27) Fiery	0.278	0.216	0.28	-0.047	-0.228	0.209	0.239	-0.052	0.058	0.105	0.084	0.056	0.294	0.068	-0.02	-0.226	-0.024	-0.278	0.219	0.146	-0.571	0.235	0.207	0.081	0.313	0.263	1.0											
(28) Immotivation	0.28	0.044	-0.084	0.178	-0.142	0.109	0.532	-0.243	0.145	0.054	0.057	-0.223	-0.081	0.079	-0.339	-0.558	-0.218	-0.329	0.246	-0.062	-0.489	0.137	0.206	0.251	0.24	0.225	0.423	1.0										
(29) Agreeableness	-0.069	-0.064	-0.089	0.505	0.632	0.467	-0.19	0.177	0.482	0.222	0.234	0.056	-0.38	0.258	-0.029	-0.01	0.021	0.434	-0.265	-0.026	0.256	0.05	-0.264	0.038	-0.057	-0.478	-0.339	1.0										
(30) Cooperative	0.023	0.18	0.192	0.288	0.308	0.349	-0.281	0.242	0.332	0.176	0.192	0.16	-0.049	0.171	0.325	0.269	0.284	0.658	0.083	0.252	0.358	0.011	-0.248	-0.145	0.037	-0.113	-0.384	-0.494	0.739	1.0								
(31) Trusting	0.451	0.495	0.416	0.485	0.651	0.558	0.251	0.136	0.572	0.314	0.328	0.245	0.074	0.059	0.331	-0.033	0.328	0.531	0.557	0.6	0.258	-0.52	-0.499	-0.596	-0.31	-0.202	-0.114	-0.022	0.413	0.521	1.0							
(32) Altruism	0.367	0.413	0.338	0.483	0.644	0.611	0.139	0.341	0.672	0.473	0.416	0.298	0.076	0.321	0.144	-0.029	0.332	0.615	0.337	0.443	0.163	-0.095	-0.205	-0.214	0.046	-0.1	-0.082	-0.175	0.634	0.698	0.635	1.0						
(33) Modesty	0.262	0.162	0.306	0.211	0.53	0.342	0.091	0.036	0.464	0.452	0.382	0.264	-0.191	0.14	0.516	0.065	0.449	0.538	0.347	0.599	0.327	-0.191	-0.163	-0.115	-0.096	-0.099	-0.072	-0.068	0.453	0.389	0.486	0.591	1.0					
(34) Sympathy	-0.147	-0.158	-0.342	0.57	0.537	0.44	-0.029	0.027	0.389	0.256	0.322	0.166	-0.477	0.41	-0.088	-0.05	-0.203	0.293	-0.23	-0.09	0.186	0.174	-0.141	0.222	0.121	0.144	-0.435	-0.111	0.782	0.494	0.247	0.513	0.281	1.0				
(35) Uncompromising	-0.158	-0.116	0.097	0.113	0.139	0.029	-0.374	0.282	0.151	0.007	-0.097	-0.185	0.096	0.334	-0.073	0.153	0.011	0.205	-0.157	-0.132	0.054	0.226	0.09	0.148	0.049	-0.029	-0.267	-0.39	0.491	0.507	0.086	0.344	0.112	0.279	1.0			

Green/line: P < 0.10 Yellow: P < 0.05 Orange: P < 0.01

TABLE A.2: Correlation matrix of Big Five personality traits used in this study and their significance levels

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