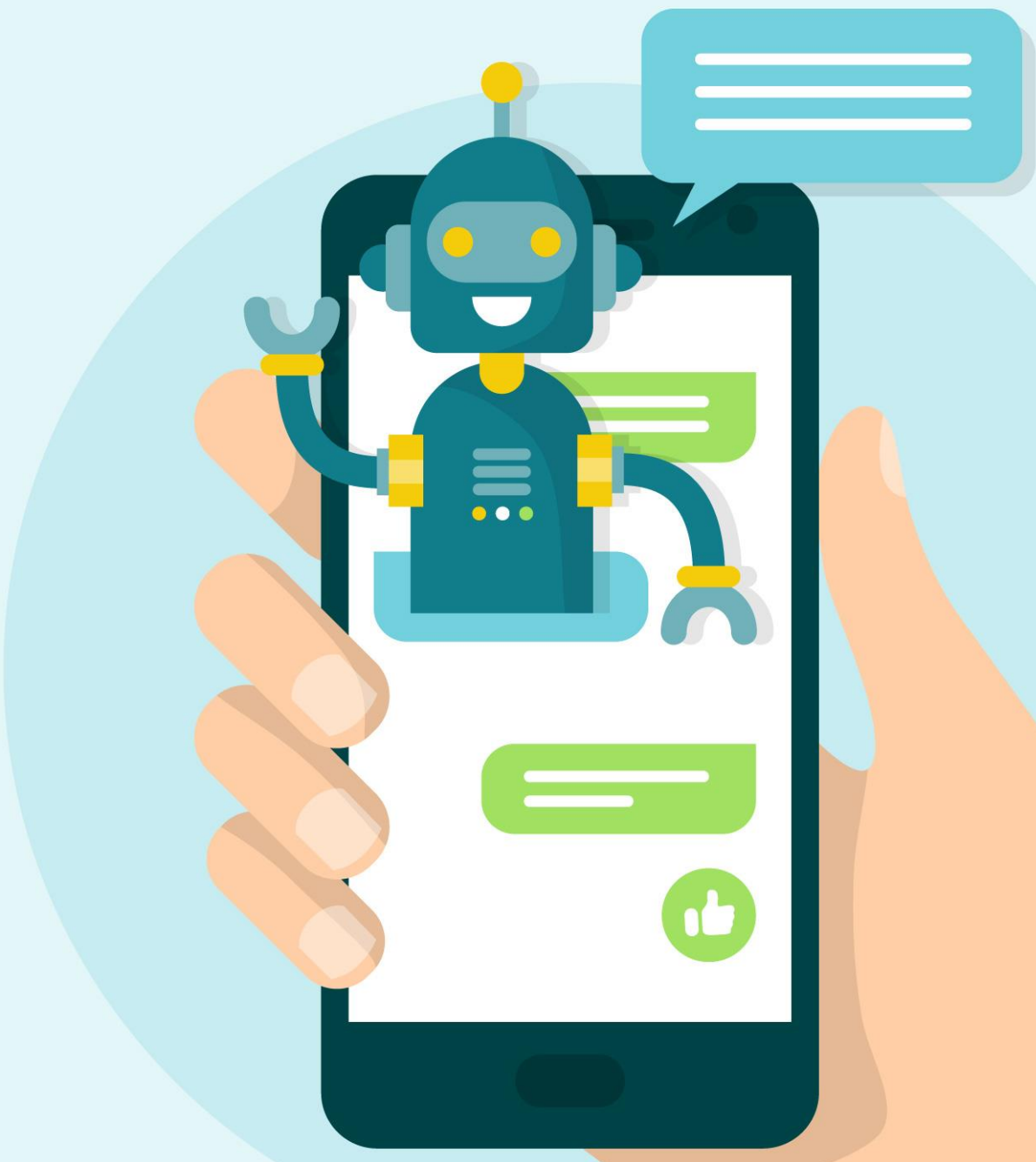
Language Inquiry for Personalized Mental Health Chatbots



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Language Inquiry for Personalized Mental Health Chatbots

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Abstract

Anxiety is one of the most widespread and dangerous mental health disorders in developed and underdeveoped countries, affecting a wide number of college students all over the world. If not correctly treated in time, it might procure irreparable damages in people's life, leading to drastic consequenses such as depression and suicidal intentions. However, although some students seek for medical consultation, only one quarter of them is able to have access to clinical treatments.

At the same time, chatting apps gradually became a new communication trend during the last few years, resulting in the development of a new cutting-edge technology named conversational agents. After several studies, this technology has been found to be a possible solution for the healthcare imparity between demand and supply. With this invention, students might have the possibility to chat with a sort of "online therapist" anywhere and anytime they feel the need, without stigma or judgement barriers. In order to successfully implement these conversational agents, the therapeutic alliance between the doctor and the patient should be recreated as accurately as possible. Personality seems to be an important factor for the success and eventual satisfaction in the whole treatment. The present research – through LIWC software – explores the extent to which students use different linguistic patterns in an expressive writing task depending on their personality and mental health status.

This study hypothesized that students sufffering from Generalized Anxiety Disorder (GAD) use different words than mentally stable students, and that their linguistic patterns are further influenced by their behavioral activation or inhibition systems. The main findings were in line with these two hypotheses. Based on the results, both students affected and not by GAD use different words specifically depending on their BAS levels. In conclusion, as predicted by previous researchers, personality is well-reflected through language styles: each student with a specific behavior, mental health characteristic, and even nationality expresses him/her self with different linguistic patterns.

Preface

Almost two years ago, I was struggling to find the best university, which could give me an excellent academic preparation in an international environment, and, at the same time, could reflect my personal interests, ambitions and preferences. While scrolling through the browser, I noticed TUDelft and, impressed by the positive recommendations of former students, I finally decided to send the application.

Honestly, it has not been easy leaving for the unknown, in a country whose culture, traditions and people are definitely different from the ones of my home place. Now, while making the final adjustments of my master thesis on an unexpected sunny and warm day, I can say it was 100% worth it. With hard work, commitment and sacrifices, I could reach so many goals that I did not even expect to aim for at the beginning of the master. Two years ago, I was preparing for the last bachelor exams, and only one year later I was working on a project hosted at CERN and discussing my team's business plan with managers in Dubai offices. All of these challenging projects and extracurricular activities permitted me to get in touch with smart and inspiring peers full of energy, who now I can call friends. Sharing ideas with them, being inspired by their constant ambition and their dreams completely opened my mind, helping me to think out of the box, to push myself over any barrier and to have a different vision of life. Finally, now, I am reaching one of the most important achievements for me: my master thesis, based on a theme which represents a difficult reality for many students.

All of this would have never been possible without the support of my family, both economically and psychologically speaking. It is thanks to my beloved parents and brother if I could fiercely surpass all the obstacles and breakdowns I encountered during my journey, particularly during the last five months entirely dedicated to my thesis.

For the latter, I need to sincerely thank my first supervisor, Professor Laurens Rook, who supported me through the overall process, being always available for all my inquiries, and, of course, Professor Frances Brazier, not only for agreeing to be my second supervisor, but also for all of her precious insights and knowledge.

Last but not least, a huge thanks goes to Andrea, who supported me for the whole two years of master, surrounding me with love, hope and valuable advice, and giving me the strength to go over my fears and insecurities.

For all people reading this, do not let what you cannot do interfere with what you can do. Always believe in the beauty of your dreams.

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1 Introduction

Nowadays, the mobile internet industry occupies a prominent place in people's lives, not only in personal and private contexts, but also in professional and working environments (De Reuver, Bowman, Heerschap, & Verkasalo, 2012). The introduction of smartphones has led to an exponential growth of app downloads, whose principal aim is to give major accessibility to email, entertainment and social applications (West & Mace, 2010). According to researchers, mobile phones are now principally used as small and portable laptops which, thanks to their built-in sensors (such as GPS, high-quality cameras, gyroscope, ambient light sensors and many more), allow users to be connected anywhere and anytime (Do, Blom, & Gatica-Perez, 2011). Particularly, messaging apps, both with text and voice interface, has become one of the most popular means of communication throughout the past years (Greenberg, 2019). In fact, by the end of the last decade, around 40% of the entire population started to communicate with online SMS applications such as WhatsApp™ or Messenger™ instead of via traditional calls, meaning that the majority of people seem to find short-text and quick responses a convenient communication option (Dale, 2016). Humanity has witnessed a continuous and restless evolution of the so called "mobile Internet" industry, one of the fastest growing sectors in the communication field (Sanz-Velasco, 2007). Since the early 90s, the European Union itself has spent billions for the adoption of mobile data services, for the creation of new network delivery terminals and for the development of user-friendly smartphones, leading to a 3rd generation of telephone standards (Web 3.0) (Kidd & Chen, 2009; West & Mace, 2010). All of these drastic technological changes have gradually affected people's thinking and culture, letting them unconsciously alter their living and communication habits, accelerating rhythms of both companies and individuals' lives (Hansen, Postmes, Van Der Vinne, & Van Thiel, 2012). People's culture is in a continuous and whirling dynamic adaptation with the surrounding environment, particularly as a result of modernization, globalization and industrialization (Inglehart & Welzel, 2005).

These numbers and discoveries have represented a profitable background for the development of the so-called conversational agents, software agents that simulate real conversations with humans, representing a clone of the common interaction that people are used to have with other human beings (Mislevics, Grundspenkis, & Rollande, 2019). Although it seems to be a new and cutting-edge concept, the first attempts in creating a conversational agent date back to the 50s, when the British computer scientist Alan Turing introduced the concept of "imitation gaming", speculating that computer machines could have the capabilities to interact and consequently imitate humans (Peitzker, 2019). This theory has been lately re-considered and elaborated upon by other academics and psychologists, who tried to put into practice what Turing assumed to be

possible with further technological advancements. Between 1964 and 1966, the scientist Joseph Weizenbaum was the first to program a fully functioning conversational agent, called ELIZA (Zhang, & Busch, 2017). This conversational agent was intended to imitate a psychotherapist during treatment to influence patients' behaviours and attitudes (Rogers, 1995). After its success, other conversational agents like ALICE have been released, with the intent of improving their human-like conversational patterns and user experience (Shawar & Atwell, 2015). Presently, conversational agents are used by millions of people all over the world in many different situations, and, by the end of 2020, it is estimated that 80% of the industries will deploy conversational agents (Greenberg, 2019).

Although conversational agents are implemented in countless contexts, from e-commerce to finance, healthcare is one of the most investigated sectors for the introduction of new advanced technologies (Laumer, Maier, & Gubler, 2019). As shown in Figure 1[1], 27% of the healthcare industry is adopting conversational agents, with the common aim of providing a better experience to its customers and improving time efficiency inside hospitals, clinics and other medical centres, allowing doctors to be more human (Academy of Medical Royal Colleges, 2019).

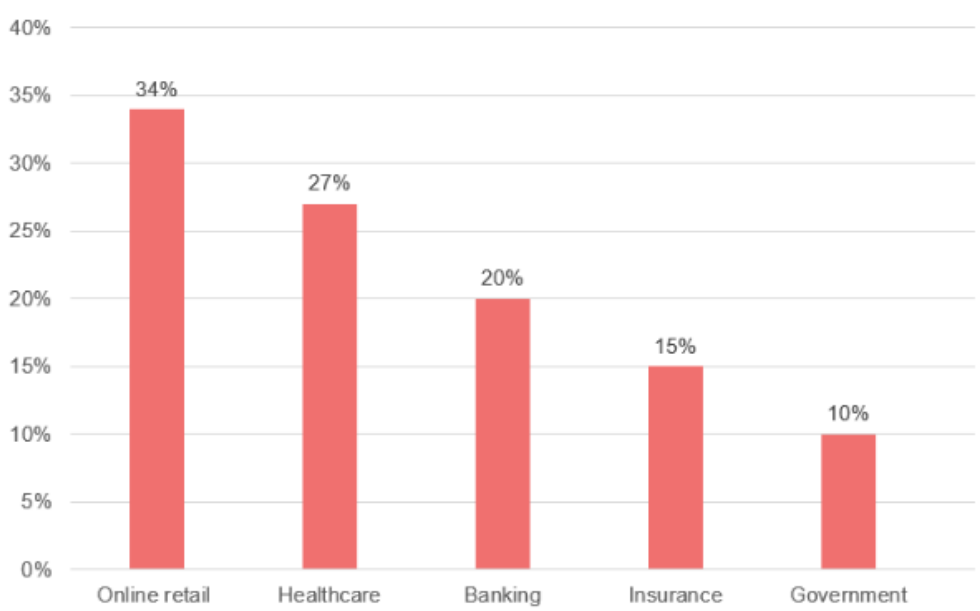

Figure 1: Chatbot adoption among different industries

Many people seek for better medical services, facilities the governments have still some difficulties to procure (Brandeau, 2005). Different researchers have hypothesized that

[1] The App solutions (2020). Best chatbots development trends in 2020. url https://theappsolutions.com/blog/development/chatbot-development-trends/

conversational agents might work in a better way if personalized to users' characteristics both regarding their behaviour and their way of writing or speaking (cf., Kocaballi, Berkovsky, Quiroz, & Laranjo, 2019). This is the main reason why several studies have focused their attention on the detection of linguistic patterns and differences among groups of people with diverse features, such as ethnicity, culture, personality and health status (Holtgraves, 2011).

These themes have attracted the attention of other scientists whom began to investigate personality and medical variables in linguistic patterns in addition to cultural aspects (Mehl, Gosling, & Pennebaker, 2006). Several studies have analysed the impact of different kinds of personalities on self-narrative texts. Five types of personality (the so-called Big Five Dimensions) have been associated with specific patterns of narrative styles: conscientiousness has shown to be positively correlated to words related to work and to achievement, extraversion with words linked to humans, family and society, agreeableness and openness to experience with empathic idioms, and finally neuroticism with negative terms, particularly in students' essays (Hirsh & Peterson, 2009). These recent experimental discoveries have revealed that linguistic differences may reflect individual psychological and behavioural patterns, specifically in self-narratives (Mehl & Pennebaker, 2003).

In the meanwhile, medical doctors and (health) psychologists have explored linguistic patterns of groups of people differentiating for mental status (Xu & Zhang, 2016). An example can be found in Molendijk's work, in which people classified with major depressive disorders expressed themselves with more self-referential and negative or pessimistic words compared to a non-clinical sample (Molendijk et al., 2010).

The next subsections will introduce the research problem, the research objective and the research questions that will be answered at the end of the thesis, followed by a summary of the overall structure of the project with the relative sections.

1.1 Problem Definition

Many students all over the world suffer from mental health disorders, with anxiety and depression ranked at the top (Hunt & Eisenberg, 2010). These disorders are usually overlooked, and not considered important enough to treat, while they can be extremely dangerous if continuously neglected (Mann, Carrington, O'Donnell, Miller, & Goedert, 1992). People affected by mental disorders are often misunderstood not only by friends and families, but also by General Practitioners and other medical experts, whom might consider them to be "low risk patients" (Chadda, 2000). Specifically, people affected by unstable familiar or social situations might

develop stressful and anxious mental disorders, which may put them at higher risk for negative life outcomes (Moses, 2010).

However, although students suffering from mental health disorders, such as generalized anxiety or bipolar disorders, usually look for some external advice, the waiting lists are long, preventing students from accessing psychological clinics, for whom 75% of them is not able to arrange a clinical consultation in a short period of time (Hunt & Eisenberg, 2010). This situation leads to even greater disorders that can be reflected into physical illnesses, social dysfunctions, lowers grades and suicidal intentions (Dwight, Evans, & Edna, 2005). Nevertheless, timing and geographical distance are not the only factors that create a barrier between professionals and students in need, but, on the contrary, the concept of stigma is another important aspect that should not be under-evaluated (Wahl, 2011). People are often afraid to externalize their problems and behaviours in front of others, with the fear of being judged and labelled as something they are not, particularly if they are still immature and with little experience (Chandra & Minkovitz, 2007). The relationship between a patient and a doctor is fundamental for obtaining the desired outcome from the psychological treatment, and the way through which the patient feels the connection with his therapist might determine the final result (Fjermestad, 2012).

In general, the healthcare environment has witnessed an increase of people seeking for medical support and, on the other hand, a huge decline from the supply edge, creating a sort of disequilibrium between the demand and supply (Laumer et al., 2019). Researchers have indicated that hospitals, governments or other national institutions cannot guarantee a smooth and correct functioning of medical processes in both developed and underdeveloped countries (Zurn, Dal Poz, Stilwell, & Adams, 2004).

1.2 Research Objective

Conversational agents are a promising solution to help people understand and overcome their mental disorders in a short amount of time and with low expenses (Kretzschmar, Tyroll, & Pavarini, 2019). However, to correctly develop a useful conversational agent, some research on natural language needs to be done. As student's personality is a key factor that should be taken into account during treatment, it is essential for a conversational agent to be able to comprehend the keywords they use and to understand how they differ depending on their personality, behaviour and anxiety level (Coleman, 2006). The main objective of this thesis is to analyse the overlap generated by the intersection of three different disciplines concerning personality, natural language and mental health (Figure 2),

with the principal aim to explore if and how conversational agents can recognize a student's personality and generalized anxiety disorder and, to find out if they can adapt their use of language appropriately.

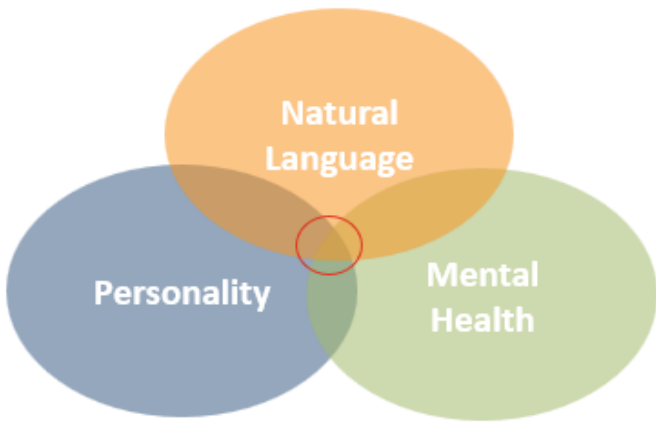

Figure 2: Research Overlap

As described above, the connection is essential and, to develop a conversational agent as an engaging tool for students suffering from anxiety disorders, careful attention to their characteristics is fundamental to the creation of an emotional connection.

1.3 Research Question

Given the problem definition and the objective of this study, the main research question for the thesis is:

RQ: *Do students use different linguistic patterns depending on their personality and generalized anxiety disorders?*

The main research question includes the key variables: anxiety, personality and natural languages (collected through self-narrative). Understanding the principal linguistic patterns depending on patient's personality is important for the creation and development of personalized conversational agents that can potentially substitute and complement a psychologist. This relationship between words and expressions used by patients and their personality is fundamental to this thesis, and is not only important for the academic environment, but also for practitioners.

To answer the main research question, the following sub-research questions are defined.

Sub RQ1: *Do the linguistic patterns used by students depend on their generalized anxiety disorders?*

This question is necessary to comprehend if there are differences between the two main groups of students: students suffering from anxiety and students without anxious behaviours.

Sub RQ2: *Does personality influence the linguistic patterns used by students not suffering from generalized anxiety disorders?*

This sub-research question is strictly related to the first sub-research question.

Sub RQ3: *Does personality influence the linguistic patterns used by students suffering from generalized anxiety disorders?*

This research question has the same aim as sub RQ2, with the only difference that it concerns the sub-group of anxious students.

1.4 Research Approach

In order to address the main research question and to collect data on anxiety, personality and linguistic patterns, a sort of interactive method is used. As better explained in the following chapters, students have been requested to firstly answer some multiple-choice questions and then to reply to an open question in the form of expressive writing, a method already validated and highly recommended by other researchers (Travagin, Margola, & Revenson, 2015). However, before conducting the experiment, part of its design is studied through the literature and interviews with expert psychologists.

Table 1 summarizes the methodology used to address the three research questions.

Research Questions	Methodology
RQ: Do students use different linguistic patterns depending on their personality and generalized anxiety disorders?	Online Survey and LIWC software
Sub RQ1: Do the linguistic patterns used by students depend on their generalized anxiety disorders?	
Sub RQ2: Does personality influence the linguistic patterns used by students not suffering from generalized anxiety disorders?	
Sub RQ3: Does personality influence the linguistic patterns used by students suffering from generalized anxiety disorders?	

Table 1: Methodology for Research Questions

Thus, the research approach is divided into three phases: (1) instrument design, (2) survey, and finally (3) data analysis. The first phase relates to the design of an appropriate survey. The second phase is entirely dedicated to the survey and collection of the data, which will be later analysed firstly through LIWC and secondly through SPSS. All the details regarding the research methodology are explained in greater detail in the 4th and 5th chapter, including the sample, the procedures, the material and measures used.

1.5 Research Relevance

As described in the previous paragraphs, the state-of-the-art in mental healthcare provisioning, particularly for students, is problematic and personalized conversational agents are considered to be a potential solution to this problem (Callahan, Hilty, & Nesbitt, 1998). Their deployment, including linguistic patterns, however, mandates a better understanding of the influence of personality differences and mental disorders. There are few studies that have carefully examined the effects of personality differences, specifically among students suffering from anxiety.

This knowledge gap represents a crucial domain for further research, not just from a scientific perspective, but also from a practical point of view. In fact, as far as the latter is concerned, this study might procure enormous advantages for the development of safe, reliable and effective

personalized conversational agents aimed for students suffering anxiety. Students will not need to be on a pending list for more than 12 weeks, waiting for a single clinical consultation (The Guardian, 2019). On the contrary, they will have the opportunity to express their emotions and fears to a conversational agent capable of recognizing and incorporating their personalities to guarantee the best outcomes from the treatment. Students will be able to liberally talk about their problems without the fear of being judged. This would mean creating a solid background for future academic research for deeply understanding the interaction between artificial intelligence and people in the medical environment.

1.6 Report Structure

This section describes the report structure. **Chapter 1** introduces the research context, showing why this study is important both in the academic and professional environment, giving a brief description of the main problem and how it can be solved. Next, **Chapter 2** is dedicated to the literature review. The key variables are described, showing the points of view of different schools of thought and how they can be combined to grasp different perspectives. **Chapter 3** presents the conceptual model and the development of the hypotheses, to be verified during the experiment, stressing the knowledge gap identified. This chapter is followed by **Chapter 4**, that is dedicated to the requirements for the design of the text instrument used in the survey. **Chapter 5** describes the methodology used for answering the main and sub research questions, underlying the experimental design, participants' characteristics, the procedures, and finally the validated scales used for the survey. **Chapter 6** analyses the data collected during the experiment and presents the results. The section is followed by **Chapter 7,** which concerns the main discussion about the results and how they can be applied to the main objective of the research. Finally, **Chapter 8** sums up the main conclusions with recommendations for further research.

2 Literature Review

The aim of this chapter is to review the existing literature concerning conversational agent technology, mental healthcare, personality and language inquiry relevant to the present research. This needs to be done for developing a correct structure of the study and for finding a potential knowledge gap in the literature.

2.1 Mental Health Situation

According to the World Health Organization (WHO), approximately 1 person out of 4 will be affected by mental health or neurological disorders at one point in their life, meaning that around 450 millions of people are presently experiencing such sicknesses, with anxiety and depression listed as top ones (WHO, 2019). This number is expected to considerably increase in the upcoming years, reaching epidemic proportions all over the world (Dogra & Cooper, 2017). Different studies have demonstrated that people with emotional disorders may be at higher risks for chronic physical conditions, social problems, peers alienation, and, last but not least, low productivity (Kessler, 1995). Particularly students, due to their rapid physiological and psychological change, their new concerns and creation of future beliefs, seem to be the most affected part of the whole population (Grant, 2014). 74% of mental health disorders have been firstly registered before the age of 24, out of this number, students have been identified and half of them complained about concentration malfunctioning caused by depression and anxiety symptoms (Fitzpatrick, Darcy, Vierhile, & Darcy, 2017). Mentally disturbed students might experience significant consequences not only on their short-term academic achievements, but also on their long-term well-being, becoming potential subjects of dramatic events like suicide (Andrews & Wilding, 2004). In a national survey of undergraduate students, 10% of the respondents admitted their attempts of suicide after some mental breakdowns (Fricker & Schonlau, 2002). Another example can be found in American colleges, where suicide has been estimated to be the second cause of death around the campuses (American Foundation for Suicide Prevention, 2018).

Many scientists tried to comprehend the main factors beyond mental disorders among students, attributing alcoholism, traumatic life events or feelings of pressure as potential key drivers of bad psychological conditions (cf., Rector, Bourdeau, Kitchen, & Massiah, 2011). *Technology dependency* appears to be one of the most prominent reasons for mental health diseases (Hoge, Bickham, & Cantor, 2017). Longnecker demonstrated the existence of a positive correlation between smartphone usage and anxiety, leading to a drastic decrease of academic performance and, therefore, major depressive disorders, creating in this way a never-ending loop

(Longnecker, 2017). This is mainly due to the multitasking capabilities mobile devices have nowadays. They drive users to spend much more time on their devices than they would do with a traditional telephone (Soukup, 2015). Although there is no comprehensive explanation why smartphones' dependency is associated with stress and anxiety, the relationship between these two variables has been found correct by some authors, stating that having a continuous access to social media might be felt as a stressful and apprehensive duty of being available at any moment (Thomee, Dellve, Härenstam, & Hagberg, 2010).

In spite of the increasing prevalence and severity of the above-mentioned psychological problems, almost third quarters of college students have no access to face-to-face psychological consultations when they have a need to (Hunt & Eisenberg, 2010). This percentage captured the curiosity of countless academics who tried to figure out the principal barriers preventing the correct accessibility of clinical centres for students (Salaheddin, 2016). The first studies suggested economic shortage and geographical distance as the main obstacles for the presence of psychological treatments, particularly for students who do not have huge monetary dispositions (Butryn, 2017). Other authors instead demonstrated that difficulties in reaching psychologists were not only present in low income countries but also in developed nations, where anxiety rates are even higher (WHO, 2017). Fitzpatrick identified *stigma* as the main reason why students avoid going to the psychotherapist, so not because of monetary matters but, on the contrary, because of their fear and distress of being judged by someone else (Fitzpatrick et al., 2017).

2.1.1 Generalized Anxiety Disorder

As mentioned before, this research is dedicated to students suffering from mental health disorders, specifically generalized anxiety. Anxiety is defined as the overall response of humans to dangerous situations, being a process of psychological alarm activation (Moss, 2002). In students, it is considered as a sort of significant stress caused by societal and performance pressures (Kirmani, 2015). There are different kinds of anxiety disorders and, in order to have a better overview on students' mental problems, the present research focalizes on a specific kind of anxiety which underlies many psychological distresses, named Generalized Anxiety Disorder (GAD) (Nolen-Hoeksema, 2013). GAD anxiety is defined as a paradigm of uncontrollable, extreme and constant worry, which does not target a particular situation but concerns different and generalized areas such as finances, social relationships, achievements, health, and so on, thus resulting in a basic form of anxiety (Zincir, 2016). Zincir argues that many researchers consider GAD as the most common form of anxiety among adolescents (2016).

2.2 Healthcare Conversational Agents

In today's society people keep in touch with friends through tools like Messenger™, WhatsApp™, Telegram™ and many others, where the conversation on such social media platforms is largely driven by text (Thurlow, 2003). Approximately, 42 millions of mobile messages are sent per minute around the globe, and there are around 1.5 billion of active users per month just on WhatsApp™, one of the most famous messaging apps (Statista, 2019).

These numbers caught the attention of scientists who started developing conversational agents in order to keep the pace with people's needs (Vaidyam, Wisniewski, Halamka, Kashavan, & Torous, 2019). As the name states, virtual agents are considered as "chat – robots", in which the first part refers to their chatting capabilities in one-to-one interaction with the user, and the second word alludes to their technological features, being a software which simulates natural language, boosting text-based conversations as human beings (Zumstein & Hundertmark, 2018). Satya Nadella, CEO of Google, defined conversational agents as the new *conversational apps*: the principal aim of the virtual agent is to answer both basic and more complex questions depending on what the robot has been programmed for, in order to satisfy user's inquiries (Della Cava, 2016).

The conversational agent in recent years had great success in the academic and professional world. Advanced virtual agents have been implemented with the aim of improving the human-likeness of natural language interfaces, leading to an exponential diffusion of platforms, such as Pandorabots, facilitating the interaction of countless computer scientists for the creation of different conversational agents (Brandtzaeg, 2017). Conversational agents have raised attention also outside the pure academic environment, catching the interest of multinational companies like Google or Facebook™ which, impressed by the increasingly amount of people using chatting apps all over the world (Figure 3)[2], started developing their own conversational agents (Dale, 2016). After the introduction of conversational agents on the market, people have gradually adopted and accepted them, not only because of the possibility to get a quick answer in a little amount of time, but also because of the opportunity to have complaints resolved with detailed answers (Greenberg, 2019).

[2] Daniel Sevitt. The Most Popular Messaging Apps by Country. Feb. 27, 2017. url: https://www.similarweb.com/blog/popular-messaging- apps- by- country

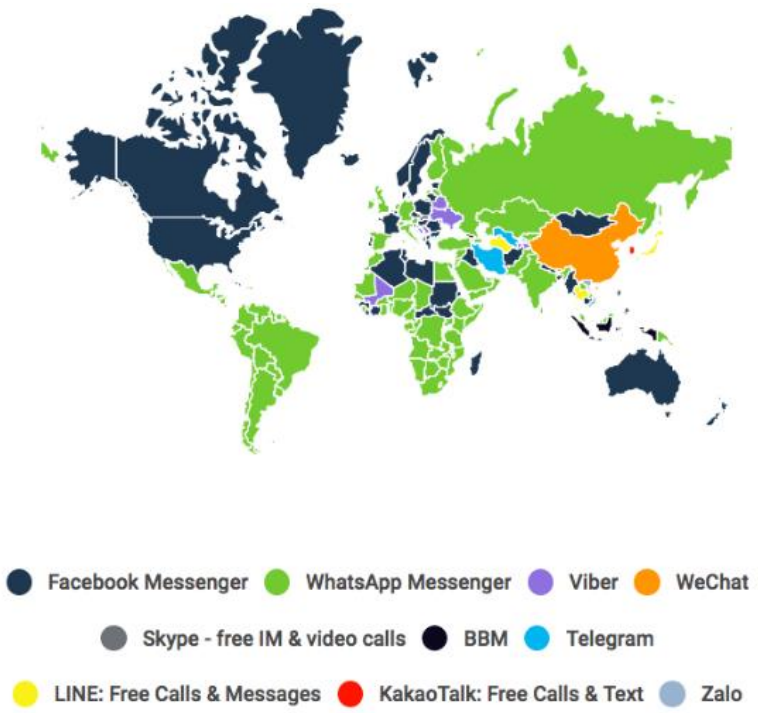

Figure 3: Most Popular Messaging App per Country

Particularly, conversational agents represent a prominent technology which might positively change the future of medicine and healthcare, both from a doctor and patient perspective (Palanica, Flaschner, Thommandram, Li, & Fossat, 2019). Hospitals are often overcrowded by people seeking for help (Jeanmonod & Jeanmonod, 2018). Most of the time there is not enough space or workforce to guarantee the correct cares (Harris, 1986). Several disparities exist between medical demand and supply, both in developed and underdeveloped countries, meaning that something in the system is not working in the right way (Brandeau, 2005). Patients with low activation scores, meaning that they are not actively involved in their healthcare experience, have higher chances in incurring into additional costs, up to 21% more compared to the standards (James, 2013). In order to solve (some of) these problems and maintain an elevated patient engagement with their own clinical path, various eHealth tools – aimed at overcoming geographical, monetary and temporal barriers – have been introduced into the market (Laumer et al., 2019). However, such Mobile Health software can only provide an oversimplified and incomplete solution for patients, since they provide basic features such as counting the calories or the heart beats only (Silva, Rodrigues, & Della Torre Diez, 2015). With the fast advancement of technology, conversational agents are gradually replacing old supporting devices with the intent of offering more complex diagnostic suggestions through interactive methods, such as

intelligent chats (Amato et al., 2017). Although some people may get an immediate medical consultation for their problems, the treatment will not last for more than 8/10 minutes on average, which, for the majority of patients, is not enough (Fadhil, 2018). Thanks to their mirror-human features, conversational agents may overcome this obstacle proposing a viable alternative for a more satisfactory relationship needed by the patient (Fadhil, 2018).

The application domains in healthcare are numerous, varying from self-diagnosis to maternity (Bhirud, Tataale, Randive, & Nahar, 2019). Particularly, the latter is one of the medical fields which needs a lot of attention from a human and emotional perspective, particularly for to-be-mothers, for whom the correct information at the right moment is essential for their child health practice (Mugoye, Okoyo, & Mcoyowo, 2019). Although personal education and inherent knowledge play a prominent part in the process, there might be some alarming symptoms, such as strong nausea or swollen breast, which should need immediate medical consideration (Parvanta & Nelson, 2011). For these reasons, healthcare conversational agents, representing virtual experts, may procure a positive impact in mothers' lives, letting them save money and making them feel safer (Fadhil, 2018). A smart companion for pregnant women could represent an important innovation for minimizing maternal mortality, especially for women who do not have the possibility, both economically and geographically, to consult a doctor in time (Fadhil, 2018). Even national institutions could benefit from the implementation of a health digital ecosystem (Parker, 2009).

Another medical field touched by possible benefits of virtual agents is oncology, a branch of medicine studied by different scientists in order to explore the potential effects the introduction of conversational agents could bring to the patients (Bibault, Chaix, Nectoux, Pienkowski, & Guillemasé, 2019). iDecide is one example of a conversational agent that helps patients to acquire relevant information about prostate, engaging them into a decision-making process (Bibault, Chaix, & Nectoux, 2019). In order to assess its self-efficacy, a peer-reviewed study has been assessed giving a completely positive outcome, showing that the greatest majority of the participants experienced an increase in their knowledge of cancer (Howgego, Yellowlees, Owen, & Meldrum, 2003). Due to conversational agents' success, several ongoing experiments have been launched in the field of radiation oncology, from cancer screening, diagnosis and treatment with the principal aim to safety finalize conversational agents' implementation in the hospital processes (Howgego et al., 2003).

2.2.1 Conversational agents for Mental Disorders

Conversational agents seem to be one of the most cutting-edge inventions of the last decade, and, according to some theorists, might be the right answer for different medical problems (Gratzer & Goldbloom, 2019; Li, 2011). Due to the continuous technological advancement in the healthcare sector, internet-based cognitive behavioural therapists (iCBT) became the new means of providing mental sympathy and support, filling the created gap between the psychotherapist and the patient (Suganuma, Sakamoto, & Shimoyama, 2018). These conversational agents, via their easy accessibility with social apps like Facebook™, have recently proven to resolve various problems including bipolar disorders, depression and anxiety (Coyle, McGlade, Doherty, & O'Reilly, 2011). The interaction of a broad range of disciplines, from clinical and social work to computer science, has made the creation of artificial intelligent agents for therapeutic treatment viable and feasible for everyone as supportive communication tools (Hudlicka et al., 2008). For instance, the conversational agent *WoeBot* demonstrates how the usage of such an automated bot might decrease psychological symptoms and at the same time facilitate a beneficial interaction and engagement with the user (Fitzpatrick et al., 2017). Nevertheless, some researchers are sceptical about the introduction of conversational agents in the healthcare environment, claiming that the devices are not ready to safely enter the market yet (Ask, Facemire, & Hogan, 2016). These objections are based on the fact that conversational agents cannot guarantee the same amount of enjoyment and smoothness that a human therapist can give – potentially slowing down the whole process (Bell, Sarkar, & Wood, 2019).

Conversational agents seem to be a double-edge weapon, that, if not used in the correct way, might become extremely dangerous, procuring irreversible damages. In order to solve the above-mentioned paradox, it is fundamental to look into the role that variables like trust play in this respect. According to Fadhil, perceived trust, together with people's mood detection, is one of the most important mediators for the achievement of final users' satisfaction (Fadhil & Schiavo, 2017). Moreover, the positive correlation among therapeutic alliance, customization and trust has been discovered to be the right trigger for the correct functioning of conversational agents during a psychological process, meaning that if the conversational agent recognizes and aligns with users' behaviour, the adoption rate of the technology, and consequently the trust shared by the patient, will increase (Kim, 2019).

2.2.2 Personalized conversational agents

Nowadays, there is a growing interest for the improvement of virtual intelligent agents which can better respond to client's inquiries and requests (Eisman, López, & Castro, 2009). Human beings' behaviour needs to be studied carefully in order to be able to create conversational agents with high levels of realism since they must be able to consistently react accordingly to people's emotions and traits (Liu, 2008).

Personalization plays a prominent and key role in this form of human-computer interaction (Smestad & Volden, 2018). Scientists are constantly looking for precise methods to set up correct relations among motivation and personality traits between the person and the conversational agent, coming up with different models (Gadiyar, 2017). For instance, Ortony and his colleagues developed the so-called OCC model (representing the initial letters of the creators Ortony, Clore and Collins), in which 22 diverse feeling types are generated after particular events or actions (Ortony, 1988). This model has later been re-used by the researcher Picard for her models of affective human-computer interaction (Picard, 1997). Another example can be found in AiA (Adaptive InfoBahn Access), a project based on the implementation of personalized information assistants, through which it is possible to acquire web contents depending on your interests and personality (André & Rist, 2002). These are just a few examples of research concerning conversational agent personalization. Matching people's and conversational agent's personalities is an important and noteworthy step for the advancement of both economics and computer science (Smestad & Volden, 2018). As explained in the next paragraph, the personalization of conversational agents has also caught the attention of psychotherapists.

2.3 Personality traits during psychological treatments

Personality is considered an important variable which should be taken into account during the therapeutic treatment (Corr, 2009). This feature is such noteworthy that a whole psychological branch, called Personality Psychology, focuses on the study of personality differences among individuals with the aim of having major insights on patients' behaviour and thoughts (Friedman, 2011). Personality represents people's feelings and way of thinking which might influence their needs, values and perceptions in a long-term perspective (Winne, 1973). Personality seems to be an outstanding factor which can boost the relationship between a psychologist and a patient (Dennhag & Ybrandt, 2017). Specifically, this dynamic relationship, called therapeutic alliance, is considered a key component for the overall therapy (Ross, Polaschek, & Ward, 2008). Still, this concept has no unitary definition, considered as an umbrella that includes many features of the

rapport between a doctor and a patient (Green, 2006). For instance, the majority of academics defined therapeutic alliance as a combination of three different aspects: emotional bond, agreement on the tasks, and agreement on the final goal of the treatment (Bordin, 1979). Other researchers, on the other hand, focus more on the emotional connection and the actual behaviour of the patient (Karver, 2005). As shown in Figure 4[3], the constant and mutual cooperation between the therapist and the patient positively influences responsiveness, patient's satisfaction and the final outcome of a treatment (Re, 2012).

Figure 4: Conceptual Relationship

Consequently, according to previous studies, to guarantee higher patient's satisfaction and a better outcome of the whole psychological treatment, personality should be taken into account (Wales, 2016). Wales underlined how understanding people's personality can create a more harmonious environment and consequently a better care for the patient (2016).

Due to the possibility to recognize people's personality during treatment, a robot might have higher chances of being successful during a dialogue, guaranteeing at the same time positive outcomes out of the process (Coleman, 2006).

Although there are countless different types of personalities, the following sub-section describes the definition of personality used for this research.

2.3.1 BIS/BAS personality

As described in the previous paragraphs, personality plays an important role in the creation of the therapeutic alliance between the patient and the doctor. It thus also impacts the final client's satisfaction of the treatment.

The BIS/BAS scales have been designed after the well-known *Biopsychological Theory of Personality* model developed by Gray, who wanted to find a new psychological conception of personality parameters underlying the extraversion and neuroticism a person could have (Gray, 1970). Personality could be divided into two principal neurobiological systems: behavioural inhibition system (BIS), strictly related to neuroticism, and behavioural activation system (BAS),

[3] Re, A. C. Del. (2012). Therapist effects in the therapeutic alliance-outcome relationship: A restricted-maximum likelihood meta-analysis. 1–34. url https://www-ncbi-nlm-nih-gov.tudelft.idm.oclc.org/pubmed/22922705

linked to extraversion (Gray, 1981). Figure 5[4] better represents the relationship among all of these variables, showing how high levels of neuroticism – and consequently of sensitivity to punishment – constitutes the behavioural inhibition system, and how high extraversion – with reward sensitivity – represents the behavioural activation system (P. J. Corr, 2004).

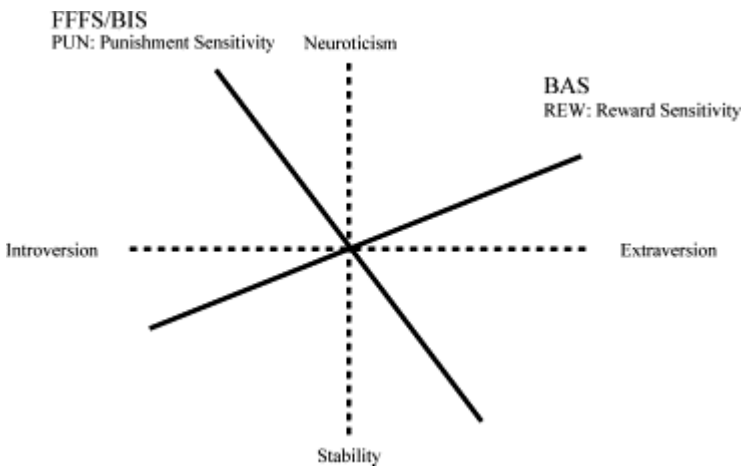

Figure 5: BIS/BAS relationship

Motivation plays a prominent role in this theory, as shown in the validated BIS/BAS scales developed by Carver and White (Balconi, Angioletti, De Filippis, & Bossola, 2019; Carver & White, 1994). People avoiding motivational goals (primarily moving away from something which is unpleasant and sad) are considered BIS, while people primarily seeking for reward (motivated by obtaining their desires) are categorized as BAS (Leentje Vervoort et al., 2010).

The BIS/BAS Scales have been adopted to assess potential personality differences depending on people's behaviours within medical and psychological contexts (cf., Aubi, Yousefi, & Alimoradi, 2011), and is used for this reason in this thesis.

2.4 Importance of Natural Language

Humans differ depending on an infinite number of ways, ranging from cultural patterns, traditions, music, art, to, last but not least, language (Trehub, 2015; Winegard, Winegard, & Boutwell, 2017). Particularly, language raised the attention of researchers of countless fields who wished to understand how specific forms language could adopt depending on each person's behaviour (Holtgraves, Ireland, & Mehl, 2014). People's way of speaking, writing and their usage

[4] Corr, P. J. (2004). Reinforcement sensitivity theory and personality. *Neuroscience and Biobehavioral Reviews*, 28(3), 317–332. https://doi.org/10.1016/j.neubiorev.2004.01.005

of words can be a reflection of their lifestyle, of the situations they are in, and of their social status, gender or other demographic or personality variables (Pennebaker, Mehl, & Niederhoffer, 2003). The first theories date back to 1901, when the Austrian neurologist Sigmund Freud developed the first conjecture that the common mistakes people make in their speeches represent people's fears, doubts and deeper motives (Freud, 1914). This hypothesis has been lately extended by other psychologists whom have showed how the recognition of linguistic patterns could help keeping grasp of the psychological reality (Robinson & Giles, 2001). In fact, the ways through which people describe events can implicitly signal how people think, how they behave and consequently their individual differences (McFadden & Ricoeur, 1978). Pennebaker states that in order to recognize individual differences in personality, it is fundamental looking at the styling of the sentence rather than its meaning (Pennebaker & Graybeal, 2001).

The first methods used to study language differences were done purely manually, and were extremely time consuming (Tausczik & Pennebaker, 2010). However, the advent of internet and computer science has permitted the development of more advanced and reliable scientific methods in order to detect the categories and the number of words used by different people, leading to the creation of the analytical LIWC (Linguistic Inquiry and Word Count) package (Pennebaker & Francis, 1993).

In the following subsections an overview of some studies done with LIWC software in the personality and mental health field are provided.

2.4.1 LIWC and Personality

Only a few papers have explored and tested the different kinds of words used by people depending on their personality, and the majority use the Big Five personality framework (Lee, Kim, Young, & Chung, 2007). For instance, Hirsh and Peterson have explored the relationship between the Big Five personalities (also known as OCEAN) and the type of sentences used during their daily social interactions, finding that people with high levels of extraversion tend to use words more related to humans and family (Hirsh & Peterson, 2009). Another study has identified correlations between LIWC categories (e.g., proper noun, exclamations, swear words, emotional word, expectation, personal pronoun) and each of the Five Personalities expressed by OCEAN, namely openness, consciousness, extraversion, agreeableness and neuroticism (Lee et al., 2007). Yarkoni found robust evidence of the relationship between some LIWC categories and personality behaviours (Yarkoni, 2010). For instance, neuroticism is strongly correlated to words of negative feelings such as anger, anxiety and sadness. Extraversion is positively associated to categories representing high interpersonal interaction and peaceful emotions (social processes, friends and

2nd person references). From the same research, unexpected findings were also detected. It is usually thought that open-minded people have higher levels of intellect, emotions, and sensory experience compared to narrow-minded and conservative people. Yarkoni found that the behaviour of openness to experience is negatively correlated to almost half of LIWC categories and a positive correlation was only found in the usage of prepositions and articles (Yarkoni, 2010).

Although the majority of the work done is based on the Big Five Personality traits, a few studies have deployed personality scales such as the BIS/BAS metrics (Roffo, Giorgetta, Ferrario, Riviera, & Cristani, 2014). Cohen, Minor, Baillie, & Dahir (2008) have shown that people with behavioural activation systems (BAS) tend to use positive emotion words, while people with behavioural inhibition system (BIS) prevalently use negative emotion words in their speeches (Cohen, Minor, Baillie, & Dahir, 2008). At the same time, other researchers tried to discover how personality could be found in chats and written texts. Wong incorporated the concept of language inquiry together with the BIS/BAS scale: participants were asked to write a 3 minute speech about their most stressful aspect during the recovery from their disease and through these texts the scientist could detect some relational patterns, such as higher correlation between BAS Drive and Fun Seeking with people suffering from traumatic brain injury (TBI) (Wong, 2013).

Most literature, however, focuses primarily on the Big Five Personality traits and not on other kind of scales such as the BIS/BAS scale.

2.4.2 LIWC and Mental Health

Scholars in the medical domain have also explored the relationship between language and mental health disorders (Xu & Zhang, 2016). Many scientists were curious to understand if particular physical or mental diseases could influence people's way of writing or speaking. As far as the mental health sector is concerned, Ruder examined the relationship between language and depression in college students (Rude, Gortner, & Pennebaker, 2004). Al-Mosaiwi and colleagues studied a group of English language internet forums with the common theme of depression and suicidal intentions, and analysed the words (min 100) from posts composed by authored members of the community (Al-Mosaiwi & Johnstone, 2019). Each post specifically described thoughts or moments in which the writer felt depressed and was looking for external help. The authors discovered that people suffering from depression used more absolutist words, meaning that more a person has a suicidal intention, more phrases showing magnitude or probability are used (Al-Mosaiwi & Johnstone, 2019).

Although depression seems to be the most common theme on which academics have focused to detect of language differences, some scientists have expanded their vision to other disorders. For

instance, Hofmann have investigated language differences in one of the most common anxiety types: social anxiety disorder (Clark, Pilling, & Mayo-Wilson, 2013). He divided students into two groups, respectively students suffering from social anxiety and students not affected by it and let them give a general speech in front of an audience. He found that people with social anxiety tend to use more negations compared to the control group (Hofmann, Moore, Gutner, & Weeks, 2012).

Math anxiety, another common problem affecting several students in both high school and university, has been carefully studied (Ashcraft, 1994). In one experiment, students were asked to write a paragraph regarding their thoughts and fears before an important and difficult mathematical test. Students suffering from math anxiety improved their exam results when they wrote a self-narrative text about their fears before partaking in the exam (Park, Ramirez, & Beilock, 2014).

Finally, people with personality-disorders have the tendency to write in a self-referential way, overusing first person pronounces and negative emotional words (Tackman et al., 2019).

2.5 Summary Literature Review

As indicated above, only one third of students with a mental disorder is able to access therapeutic treatment when needed, and conversational agents may be a promising solution for this problem. The literature review indicates (1) the importance of personality during psychological treatment as it influences the alliance created during treatment and patient satisfaction, and (2) the importance of alignment of language and health disorders.

3 Conceptual Model and Knowledge Gap

Although some research has been conducted in the field of natural language and its psychological meaning, almost no studies analyse the effects of anxiety (Generalized Anxiety Disorder (GAD)) on the use of language in relation to BIS/BAS-derived personality characteristics.

As shown in Figure 6, this thesis focuses on understanding if and how students affected by anxiety disorders use different expressions compared to people with stable mental health and explores the potential differences between BIS/BAS personality traits.

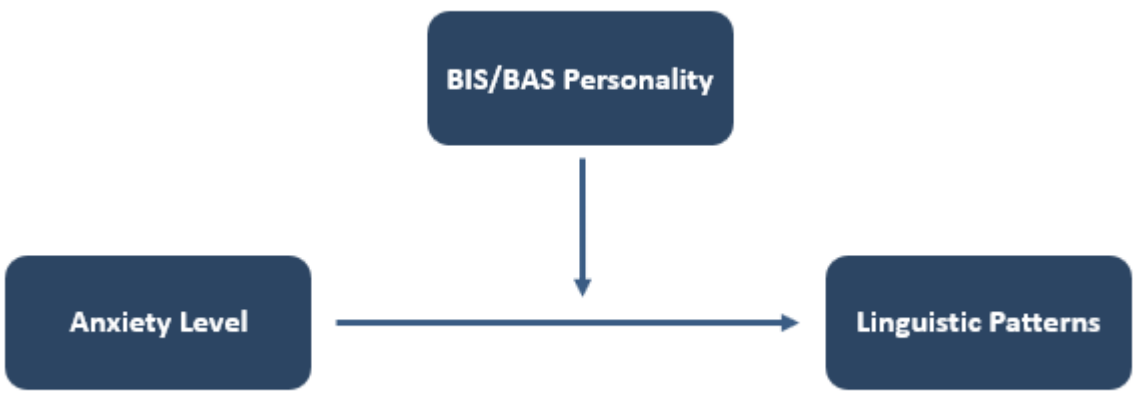

Figure 6: Conceptual Framework

The conceptual framework visualizes the relationships and correlations among the three principal variables of this research: anxiety, natural language and personality. The first two represent the independent and the dependent variable, respectively. This means that the language and expressions used by people might vary depending on their mental health status. This relation might be altered by the so-called moderating variable, in this case personality traits, that can give major insights in the research study. Little research exists carefully analysing text or language expressions of people suffering from anxiety with a focus on these specific personalities.

The conceptual framework better represents the model used to structure the thesis. It is a sort of pivot around which different research questions and consequently several hypotheses are narrowed down to form a coherent and worthwhile scientific study. As mentioned in the first chapter of the research, the main research question concerns the influence that anxiety disorders

among students together with their kind of personality can actually have on their natural language. These results might possibly lead to the creation of linguistic patterns associated to particular categories of students. For instance, students suffering from anxiety and with high or low BIS personality will have a specific linguistic style, and so on.

Three different hypotheses are derived from the conceptual framework. First of all, the anxiety variable has been considered, specifically the generalized anxiety disorder (or GAD). The first Hypothesis states that the anxiety level of each student in some ways affects the language and phraseology used. Specifically:

H1: Students suffering from anxiety use different linguistic patterns compared to mentally stable students

The second variable that plays a prominent role in the overall framework is personality. Thus, the second Hypothesis that will be tested during the experiment concerns the fact that BIS/BAS variable may also change the way students express themselves. Specifically:

H2a: The kinds of linguistic patterns used by students with low levels of anxiety disorders are different depending on students' personality

H2b: The kinds of linguistic patterns used by students with high levels of anxiety disorders are different depending on students' personality

With the help of the conceptual model, it is possible to better understand the present knowledge gap in the current state of the literature, and easier to identify what has not been discovered yet, and all the elements and their relationships that are still missing. The novelty of the research is in the creation of relationships among three different variables that thus far had not been investigated jointly: BIS/BAS personality traits, anxiety, and finally, linguistic patterns in the natural language.

4 Instrument Design

Before structuring the methodology, it is essential to understand how the key instruments of the experiment should be correctly developed. To ask the right questions to the future respondents of the survey, a detailed literature review and targeted interviews with expert psychologists were needed. In this way, it was possible to comprehend what kinds of text (blogs, self-narratives, songs, diaries, exam papers, and many others) would have been the most tailored to the overall research with regard to language inquiry. This chapter is dedicated to the description of the instrument design, based on the literature review and on the results from the conducted interviews, with the aim to provide insights into the development of the methodology.

The literature review led to a possible understanding of how other scientists approached the problem, and what kind of questions could be asked to the participants of the test. Studies by Mcadams revealed that self-narratives are the best way to predict personality differences among people, specifying that "self" description better expresses cultural behaviours (Mcadams, 2001). This approach has been adopted by other researchers while conducting language analysis with the help of LIWC software. Tang used autobiographical texts to catch personality differences among people (Tang & Schmeichel, 2014), whereas Molendijk asked participants to write an essay about their experience of going to college (Molendijk et al., 2010). Therefore, self-narrative is important to grasp people's personality, and this key insight can be applied to this research. Specifically, as explained in the last sub-chapter, the concept of *expressive writing* is used.

4.1 Exploratory expert interviews

The second part of this chapter is fully dedicated to the interviews conducted before the final drafting of the research methodology. In order to grasp essential elements concerning psychology and therapeutic treatment, five expert psychologists (both freelancers and employees within a clinical centre at Delft University of Technology) have been interviewed. To avoid any kind of bias, the therapists were shortly introduced to the topic of the research, without going into detail. In this way, it was possible for the experts to form a general overview of the research's topic so that they could provide the most tailored advice. After this brief introduction, the experts were queried with five different questions (see below). The questions were structured as follows in Table 2:

	Questions
1	What are the most common mental health illnesses students have?
2	How do you usually start an approach with the patient?
3	Through which kind of questions/answers can you understand if the patient is mentally distressed?
4	What are your techniques to keep him/her engaged during the treatment? (particularly during the first meeting).
5	Are there differences of the procedure/treatment depending on the mental illness?

Table 2: Interview's Questions

The majority of these questions had the common aim of discovering the essential techniques used by psychologists in order to understand the key words, sentences or answers through which the patient (in this specific case: the student) could be diagnosed with mental health disorders[5]. From the interviews, it was possible to get more involved in the real world, environment and problems that a student often faces, and to understand a bit better how the relationship between a doctor and a student can be installed. All the interviews' details, with the relative questions and answers from each psychologist, can be found in the Appendix. However, the key outcomes are summarized in the sub-chapter below.

4.2 Results from the expert interviews

One of the main take-aways is related to so-called "*cognitive behavioural therapy*". This refers to a specific kind of psychological treatment used by the majority of the experts in order to approach the problems affecting students' wellbeing. Through this technique, the therapist directly looks inside the mind of the student, searching for his/her deepest thoughts. It is commonly believed that what people actually think is much more valuable than the mere description of some actions. For instance, understanding *how students feel about a particular kind of situation* may give more knowledge to the psychologist than just looking at what actually happened. To spur the students to talk about their emotions can give them the chance of being

[5] Lately, the findings have been merged with the conducted literature review in order to formulate the correct questions in the text exercise of the online survey.

more open and self-confident, boosting at the same time the relationship with the therapist. This theory has been also discussed in academic world, where Cognitive Behavioural Therapy is considered as one of the most active ingredients for GAD (Generalized Anxiety Disorder) treatment (Borkovec, 1993).

In most of the interviews, the concept of unleashing the potential of students' thoughts and behaviours instead of their actions emerged. For this reason, the majority of the questions proposed during the first part of the treatment are general, and not specific to a single event, in order to let students free to express their deepest thoughts. Some of these questions might be: *"How are you feeling this week?"* or "*What do you think about your university experience?*" From the answers, psychologists are able to understand students' mind, and their fears. The expressions and the specific words used by students apparently reveal part of themselves. In conclusion, with these techniques, therapists not only create some sort of a lasting connection with the patient, but also understand the real problems and mental distress the students might have. This phase, characterized by general questions, is usually called *intake,* and it is one of the most interesting sources of knowledge for this research. Subsequently, the questions following the introduction part are more specific and more tailored to the situation of the student.

Another important factor which evolved during the interviews is related to the creation and maintenance of the alliance between the psychologist and the student. Due to the extremely delicate situation, the psychologists need to show empathy and full understanding to the student, both with facial or physical expressions (for instance nodding) and with the typology of language used. They need to show their concerns, and this is usually done with a careful reflection of students' personality and behaviours. Note that this confirms the literature as reviewed in chapter 2. Thus, recognizing patient's personality is important for the creation of a lasting alliance. All of these procedures seem to apply to any kind of potential mental health issue affecting students (varying from anxiety to depression).

In conclusion, the key insight (for the development of the instrument in the survey) is that general questions should be asked during the first session of the therapy, and that these questions need to explore students' thoughts, giving them free space to express their personal emotions and fears.

4.3 Development of the questions

In order to design the correct instruments for the experiment, both literature review and the insights from the interviews have been taken into account, and this translated into the following two questions to be asked in the intended research: "*What do you think about your university*

experience? Moreover, can you describe an anxious moment during your university life and how you felt during it?" Following these questions, some examples of potential sub-questions were developed in order to better direct the participant during the response. For example, students were asked to underline if they liked university and if they thought it was the right choice for them; if they thought their university gave them a positive or negative experience, and so on. These questions were developed following the main results of the interviews, together with some theories from the literature review. Pennebaker firstly introduced the concept of *writing therapy* in the 80s, claiming that writing about feelings and emotions can actually release from emotional trauma (Pennebaker & Chung, 2007). This *expressive writing paradigm* is apparently adopted by the psychologists interviewed and thus, reflected also in the questions asked for this research.

The question asked is general, but it directly grasps the main thoughts, emotions and fears of students, without looking at any particular action or situation. Thus, it reflects the main characteristics described by the psychologists and in the literature (cf., Mcadams, 2001). Finally, the length of the texts to be written by the students is important for the research. Researchers in psycholinguistics like Al-Mosaiwi reviewed texts with minimum of 100 words. To guarantee text validity while using the software LIWC, the same parameter has been used with this research.

5 Methodological Approach

This chapter discusses the methodology used for the experimental design, underlying the main procedures, participants' characteristics and – of course – the scales used.

5.1 Ethics Approval

This research obtained the ethical approval by the Human Research and Ethics Committee (HREC) of the Technical University Delft.

5.2 Participants

A total of 144 responses was collected, but the data of 2 participants (1% of the full sample) had to be removed, because they had not completed the writing task in the correct way: one participant copy-pasted the description of the assignment in the section dedicated to his/her writing, and the other candidate did not reach the minimum amount of words required for the experiment. Moreover, both participants completed the survey in less than 1 minute, when the estimated average time was around 10 minutes. Thus, the final sample is composed of 142 participants, with 86 females and 56 males (M_{AGE} = 23.33; SD = 1.96), collected over a period of one month. Participants voluntary took part in the experiment and were informed about the principal goal of the research, about the importance of their contribution, and about how their data would be finally used (in an anonymous way). The following tables provide the descriptives of the sample.

Nationality	***N***
Italian	58
Dutch	28
Belgian	5
German	3
Others	48

Table 3: Nationality of the sample

Education	*N*
Natural Sciences	68
Social Sciences	24
Humanities	19
Others	31

Table 4: Education of the sample

Social Media	*N*	Time	*N*
Instagram™	83	< 1 hour	27
Facebook™	31	Between 1 and 3 hours	82
LinkedIn™	8	> 3 hours	33
Snapchat™	5		
Others	15		

Table 5: Social Media usage of the sample

5.3 Procedure

Participants were provided with an URL link powered by Qualtrics™. As soon as they opened the link, an introductory page was shown, which provided the main instructions and rights each participant had during the completion of the survey, together with a brief introduction into the experiment. Also, the confidentiality agreement was provided. When a student decided to take part into the experiment, first a survey was presented with a personality and generalized anxiety disorders questionnaire, followed by a writing exercise, and a post-questionnaire on demographics.

5.4 Materials

The writing task for this experiment reflects a self-narrative style, through which students are able to express themselves and their deepest thoughts – to give importance to people's beliefs and ideas, instead of their actions. The writing assignment involved different components, which were supposed to identify the main thoughts that students have about their university career and life. Participants were asked to reconstruct their past experiences and their feelings during anxious moments at university.

5.5 Measures

5.5.1 Anxiety Scale

For this study the 7-item GAD-7 scale is used to assess the severity through which anxiety affects students (Spitzer, Kroenke, Williams, & Löwe, 2006). This measurement instrument is an efficient tool for recognizing people suffering from generalized anxiety disorders (Spitzer et al., 2006). Participants are supposed to select one out of four options for each item of the scale (from 1, not sure at all, till 4, nearly every day). This will result in an overall anxiety sum score: higher the sum, more likely the participant suffers from GAD. The internal reliability for this scale in the present study was good (Cronbach alpha = .903).

5.5.2 Personality Scale

The BIS/BAS Scales consist of 24 items, and have been designed to distinguish people's behavioural inhibition and activation tendencies (Carver & White, 1994). In total, there are 7 BIS related questions (two of them are reversed score) and 13 BAS related questions, the remaining 4 items are fillers. The scales have been developed to be uncorrelated, meaning that BIS and BAS are two independent behavioural systems (Vandeweghe et al., 2016). The scales are measured on a 4-point scale ranging from 1 (very true for me) to 4 (very false for me). Table 6 illustrates a factor analysis of the scale, which, as stated by Carver and White, reveals the presence of four factors.

Rotated Component Matrix[a]

	Component			
	BIS	BAS Drive	BAS Fun Seeking	BAS Reward
BIS 2	.502			
BIS 8	.718			
BIS 13	.798			
BIS 16	.606			
BIS 19	.730			
BIS 21	.898			
BIS 24	.829			
BAS 3		.554		
BAS 9		.756		
BAS 12		.825		
BAS 21		.513		
BAS 5			.482	
BAS 10			.687	
BAS 15			.688	
BAS 20			.523	
BAS 4				.712
BAS 7				.689
BAS 14		.523		.302
BAS 18				.710
BAS 23		.565		.237

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Table 6: Personality Factor Analysis

The BAS scale is usually subdivided into three components: drive, fun seeking and reward responsiveness. As shown in the table, the results of the principal component analysis confirm this subdivision. In the present study, the Cronbach Alpha values for the behavioural inhibition and activation scales were reliable: BIS (.870), BAS (.818), BAS Drive (.761), BAS Fun (.544) and BAS Reward (.719).

5.5.3 Categories of LIWC

The LIWC software package can be customized to research. The main categories used in this research were chosen as follows: Mairesse and colleagues analysed the total number of pronouns (with a specific focus on personal pronouns), the number of words per sentence and the

positive/negative emotions found in the texts of participants who took part in his experiment (Mairesse, Walker, Mehl, & Moore, 2007). Some of these variables were also adopted by Hirsh, who tried to understand which kind of personality features emerge from self-narrative scripts (Hirsh & Peterson, 2009). Also general adverbs, swear words and word length have been considered in the identification of personality patterns (Lee et al., 2007; Mehl et al., 2006). This led to a selection of main LIWC categories to be used in the present study.

6 Results

This chapter describes the main findings from the experiment, in which correlations between GAD, personality and linguistic patterns of student writings were explored. In the first part, the descriptives and correlations are provided. Second, the results of the hypothesis testing are presented. Third, supplementary analyses are offered.

6.1 Data Cleaning

All the data were collected with the software Qualtrics, and received as a .cvs format. The textual part of the dataset was uploaded on LIWC 2015 software package and, in a second stage, on the statistical software SPSS (v 25), through which it was possible removing the outliers and transforming the raw data into a cleaned dataset ready for the analysis.

6.2 Pre-Analysis and Descriptive Statistics

As suggested by the creators of GAD scale, 10 is the optimal cutpoint to distinguish people suffering from GAD from those who are not (Spitzer et al., 2006). Based on these instructions, a total of 55 students (39% of the participants) suffer from GAD in the present study (Figure 7). Considering the entire sample without any distinctions within the two sub-groups, students have a GAD mean score of 8.95 with SD=5.79.

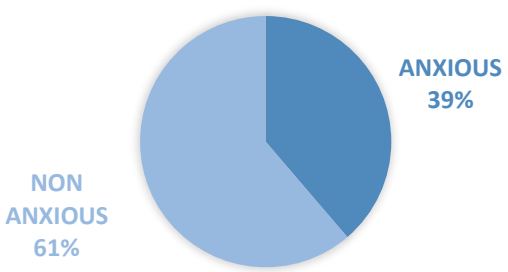

Figure 7: Anxious and Non-Anxious students

6.2.1 Self-reported Measures of Personality

The second important aspect of this research concerns students' personality in terms of BIS and BAS sensitivity. The following table summarizes the descriptives for overall BIS/BAS personality as well as for the BAS sub-dimensions, together with skewness and kurtosis values.

Descriptive Statistics

	N	Skewness		Kurtosis	
	Statistic	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
GAD	142	.513	.203	-.862	.404
BIS	142	-.408	.203	-.393	.404
BAS	142	-.463	.203	-.310	.404
BAS Drive	142	-.111	.203	-.715	.404
BAS Fun	142	-.375	.203	.157	.404
BAS Reward	142	-1.036	.203	1.070	.404

Table 7: Kurtosis and Skewness

The table below provides the correlations between the 4 different behavioural activation and inhibition systems – personality – and Generalized Anxiety Disorder, together with the respective means and standard deviations. A strong positive correlation was observed between BIS and GAD ($r = .439$, $p < .01$) as was also found in the literature (Vervoort, 2010).

	Variable	m	sd	1	2	3	4	5	6
1	GAD	8.95	5.79	-					
2	BIS	3.04	.617	.439**	-				
3	BAS	3.15	.401	-.118	.007	-			
4	BAS Drive	3.07	.540	-.103	-.139	.832**	-		
5	BAS Fun	2.85	.535	-.205*	-.114	.784**	.474	-	
6	BAS Reward	3.45	.427	.022	.272**	.813**	.545**	.431**	-

Note: ** p < .01; * p < .05; two-tailed;

Table 8: Personality and GAD correlations

6.2.2 LIWC categories

This sub-chapter is dedicated to the descriptive analysis of LIWC categories used in the experiment. The table below summarizes the linguistic patterns (together with examples of words which fit each category), their abbreviations and the word density both of the sample and of the software norms. Some values, if compared between the last two columns, slightly vary, since LIWC is not contextualized (Holtgraves, 2011).

Categories	Abbrev	Examples	Words density of the sample	Word density of LIWC2015 norms
Words/sentence	WPS	-	22.22 (not %)	17.40 (not %)
Words > 6 letters	SIX	-	19.85	15.60
Linguistic Dimensions				
Personal Pronoun	PPron	I, them, her	12.03	9.95
1sr Singolar	I	I, me, mine	10.74	4.92
1st Plural	We	We, us, our	0.34	0.72
Adverbs	adverb	Very, really	6.08	5.27
Negations	Negate	No, not, never	1.95	1.66
Psychological Processes				
Affective processes	Affect	Happy, cried	7.49	5.57
Positive Emotions	Posemo	Love, nice	3.95	3.67
Negative Emotions	Negemo	Hurt, ugly	3.44	1.84
Anxiety	Anx	Worried, fear	1.90	0.31
Anger	Anger	Hate, kill	0.21	0.54
Sadness	Sad	Crying, grief	0.63	0.41
Social Processes	Social	Mate, talk	4.08	9.74
Family	Family	Dad, aunt	0.15	0.44
Friends	Friends	Buddy, neighbour	0.24	0.36
Certainty	Certain	Always, never	2.19	1.35
Past Focus	Focuspast	Ago, did, talked	5.72	4.64
Present Focus	Focuspres	Today, is, now	9.52	9.96
Future Focus	Focusfut	May, will, soon	0.94	1.42
Time	Time	End, until, season	6.37	5.46
Work	Work	Jobs, majors	7.01	2.56
Leisure	Leisure	Cook, chat, movie	0.30	1.35
Home	Home	Kitchen, landlord	0.19	0.55
Money	Money	Audit, cash, owe	0.33	0.68
Religion	Relig	Altar, church	0.05	0.28
Death	Death	Bury, coffin, kill	0.02	0.16
Swear words	Swear	Fuck, damn	0.04	0.21

Table 9: LIWC categories

6.3 Hypothesis testing

The following section will present the statistical analysis needed for the correct answering of the research questions.

6.3.1 Anxiety and LIWC categories

Hypothesis 1 predicted an association between the anxiety levels of students and the linguistic patterns used by them. To put this to the test, correlations were computed between overall anxiety and each of the following LIWC cateories: WPS (word per sentence), words with more than six letters, personal pronouns, I, we, adverbs, negations, affect words, positive emotions, negative emotions, anxious, anger, sad, social, family, friend, certainty, focus present verbs, focus past verbs, focus future verbs, time, work, leisure, home, religion, death and swear. For simplicity, only significant correlations between GAD and the LIWC categories are displayed. In the Appendix, the full table with all the correlations is presented.

	Variable	1	2	3	4	5	6	7	8	9	10	11
1	GAD	-										
2	SIX	- .18*	-									
3	Pronoun	.186*	-.293**	-								
4	Negate	.300**	-.296**	.291**	-							
5	Posemo	-.196*	.159	.095	-.083	-						
6	Negemo	.182*	.047	.153	.204*	.232**	-					
7	Anger	.257**	-.074	.128	.195*	-.106	.155	-				
8	Sad	.304**	-.002	.178*	.317**	-.043	.434**	.114	-			
9	Social	.226**	-.089	.015	.074	.151	-.133	.150	-.040	-		
10	Family	.250**	-.133	.092	.240**	-.021	.013	.127	.297**	.080	-	
11	Focus Pres	.175*	-.302**	.203*	261**	-.007	-.011	.107	-.172*	.103	.021	-
12	Focus Fut	- .17*	.090	.025	.083	.041	-.093	.047	.045	-.17*	.116	.08

Note: ** p < .01; * p < .05; two-tailed;

Table 10: LIWC categories and GAD correlations

Table 10 shows that negations (r = .300, p < .01) and sad words (r = .304, p <.01) are the linguistic categories with the highest correlation coefficients with overall anxiety. The more a student suffers from generalized anxiety disorder, the more sad words are used in a text. In other words, there is a positive correlation between GAD and the inclusion of sad words while speaking or writing. On the contrary, words with more than six letters (r = -.184, p < .05), positive emotions (r = -.196, p < .05) and verbs in future tense (r = -.178, p < .05) are negatively correlated to GAD. Figure 8 visualizes this relationship between GAD and sad words.

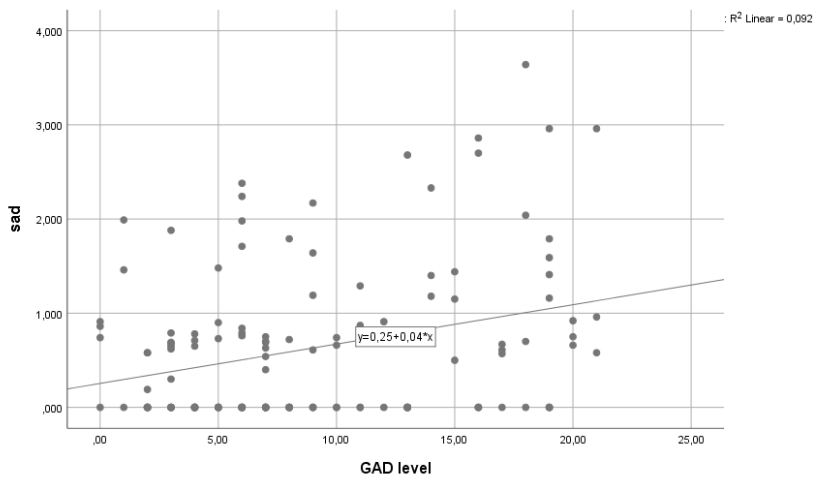

Figure 8: Correlation between sad words and GAD

6.3.2 Personality and LIWC categories

Hypothesis 2a and 2b predicted that the relationship between GAD and linguistic categories differs depending on BIS/BAS personality differences. The following table represents the correlation coefficients between BIS/BAS and LIWC categories. Table 11 illustrates the sub-sample of non-anxious and anxious students with the significant correlations between their BAS and BIS levels and the linguistic patterns.

These correlation coefficients show that students high on BAS, but low on GAD, tend to use more family expressions ($r = .217, p < .05$), fewer affect words ($r = -.293, p < .01$), negative emotions (r = -.264, p < .05) and religion words ($r = -.318, p < .01$). Students high on BAS and GAD use more anxious words ($r = .275, p < .05$). These results confirm what was previously hypothesized by this research: personality – specifically BAS – affects the relationship between GAD and linguistic patterns. No significant correlations were found between BIS personality and linguistic patterns, as shown in the corresponding correlation matrix.

		BIS		BAS	
		Non Anxious	**Anxious**	**Non Anxious**	**Anxious**
1	WPS	-.050	.043	.139	-.042
2	Six	-.031	-.087	.139	.040
3	Pronouns	.109	.180	-.144	.265
4	I	.084	.167	-.083	.185
5	We	.048	-.030	-.090	.122
6	Adverb	-.012	-.011	.085	-.132
7	Negate	.179	.019	.028	-.074
8	Affect	.016	.121	-.293**	.156
9	Posemo	.051	-.023	-.127	.096
10	Negemo	-.056	.173	-.264*	.122
11	Anx	-.087	.123	-.190	.275*
12	Anger	.011	.048	-.083	.010
13	Sad	.004	.079	-.134	-.159
14	Social	.185	.114	.006	.081
15	Family	.076	.089	.217*	-.084
16	Friend	.170	-.069	-.022	.002
17	Certain	-.138	.051	.012	.218
18	Focus past	.099	-.158	.057	.067
19	Focus pres	.008	.207	-.133	.067
20	Focus fut	-.041	-.073	-.174	-.062
21	Time	-.109	-.190	.058	.006
22	Work	.110	-.143	.094	.085
23	Leisure	.026	.133	.163	-.229
24	Home	-0.68	.127	-.117	-.229
25	Money	-.175	-.012	-.050	-.007
26	Religion	-.102	.127	-.318**	-.060
27	Death	-.076	-.057	.206	-.099
28	Swear	.007	.056	.055	.123

Note: ** $p < .01$; * $p < .05$; two-tailed;

Table 11: LIWC and BIS and BAS correlations (anxious and non-anxious sample)

6.4 Supplementary Analysis

The work of Carver and White (1994) and the factor analysis provided in the previous chapter indicated that the BAS should be subdivided into three sub-categories. The table below provides the significant correlations between each sub-category and LIWC categories for people low and high on GAD.

		BAS Drive		BAS Fun		BAS Reward	
		Non Anxious	**Anxious**	**Non Anxious**	**Anxious**	**Non Anxious**	**Anxious**
1	Six	.216*	.110	.031	.131	.082	-.166
2	Pronoun	-113	.206	-.268*	.037	.009	.427**
3	I	-.083	.117	-.182	-.055	.047	.421**
4	Affect	-.182	.127	-.278**	.101	-.263*	.145
5	Negemo	-.143	.022	-.200	.138	-.303**	.124
6	Anx	-.040	.182	-.129	.286*	-.294**	.181
7	Family	.134	-.151	.220*	-.067	.181	.018
8	Certain	.115	.183	-.029	.285*	-.062	.044
9	Leisure	.067	-.265	.219*	-.132	.124	-.160
10	Home	-.123	-.273*	.028	-.133	-.178	-.154
11	Money	.074	.053	.029	.073	-.217*	-.153
12	Religion	-.199	-.102	-.220*	.043	-357**	-.099

Note: ** $p < .01$; * $p < .05$; two-tailed;

Table 12: Correlation with Sub-categories of BAS

Several studies examined how people's personality and way of speaking is reflected by their cultural origins (cf., Kaml, 2019). The sample in the present study was mainly composed of Italian and Dutch students – nationalities considered to be quite different from each other in many aspects (Hofstede & Bond, 1984). The following table summarizes the significant correlations between GAD and word usage for Dutch and Italian students. Tha exhibit shows that depending on the nationality, students affected by GAD tend to use different linguistic patterns.

	Variable	GAD level	
		Dutch	**Italians**
1	Negate	.114	.426**
2	Affect	.017	-.260*
3	Posemo	-.184	-.397**
4	Anger	.159	.279*
5	Sad	.104	.335*
6	Social	.423*	.053
7	Focus Fut	-.322	-.263*
8	Death	.501**	c

Note: ** p < .01; * p < .05; two-tailed; c= cannot be computed because one of the variable is constant.

Table 13: LIWC categories and GAD correlations (Dutch and Italian sample)

The complete table can be found in the Appendix.

Finally, previous research reported an association between time spent on social media and anxious or depressive levels in students (Calancie, Ewing, Narducci, Horgan, & Khalid-Khan, 2017). This study additionally examined this relationship by means of a one-way Analysis of Variance (ANOVA). The ANOVA almost reached statistical significance, with $F(2, 139) = 2.950$, $p < .056$. Therefore, contrast analysis was run to understand if the comparison between specific means (for the time spent by students on social media) was significant or not. Figure 3 clearly shows that the anxiety levels among students using social media for more than 3 hours are higher if compared to the other groups of students spending less than 3 hours on social media. Planned contrasts revealed that there is a significant difference between the means of the first two groups and the last one, respectively with $t(139) = 2.157$, $p < .033$ and $t(139) = 2.142$, $p < .034$. When considering students using social media for less than 1 hour and between 1 and 3 hours as a unique sub-group and comparing it to students spending more than 3 hours on social media, the mean difference results significant with $t(139) = -2.423$, $p < .017$. No statistical significance was found in the comparison between only the first two groups.

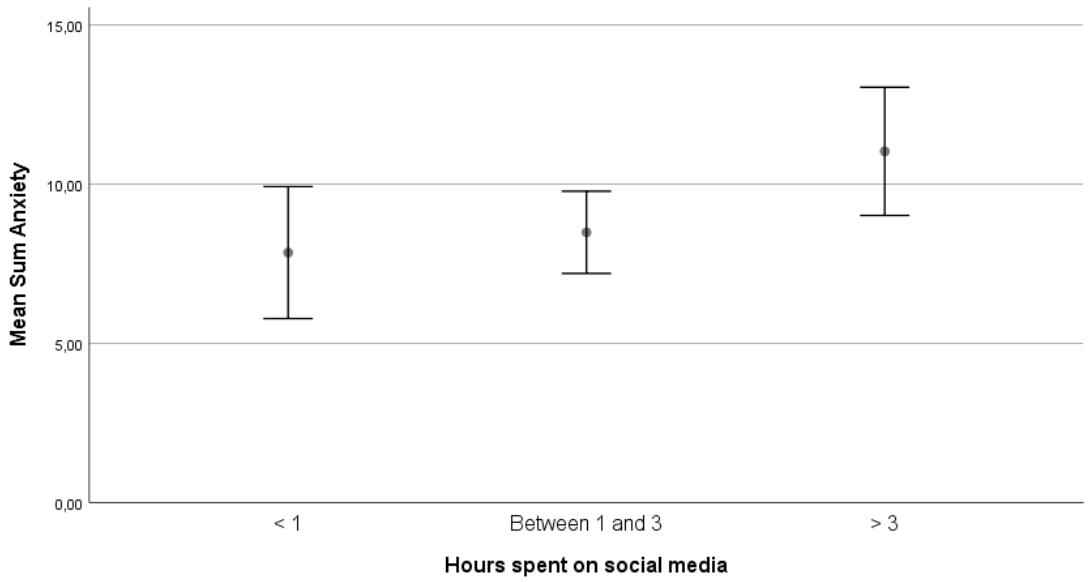

Figure 9: Anxiety and time spent on social media

7 Discussions

This section will discuss the main findings, their scientific and practical relevance, the limitations and the potential of this study for future research.

7.1 Scientific Relevance

The present study showed that students suffering from GAD tend to use more personal pronouns, negations, negative emotions, focus present verbs, sad, social and anger emotions than mentally stable students. Moreover, students high on GAD employ fewer positive emotions, focus future verbs and words with more than six letters – so they tend to use shorter words. These results are in harmony with previous research, which investigated the impact on word usage of diverse mental disorders such as depression, traumatic brain injury and Social Anxiety Disorders (SAD) (Hofmann, Moore, Gutner, & Weeks, 2012; Wong, 2013; Tackman et al., 2019). Importantly, this study also brought to light new correlations in specific affective emotions (such as anger and sadness), time orientation (future and present tense verbs), social words, and in word length. Contrarily to previous papers that reported higher presence of only first singular pronouns in depressed people (Ramirez-Esparza, Chung, Kacewicz, & Pennebaker, 2008), this study revealed significant correlations between GAD levels and overall personal pronouns, without any significant distinctions between singular and plural pronouns separately. Still, general pronouns usage is considered a better predictor of anxiety disorders than the use of negative emotion words (Simpson, 2002).

Second, the experiment showed that students with high behaviour activation system (BAS) use different linguistic patterns depending on their GAD levels: students high on BAS and high on GAD tend to use more anxious words, while students high on BAS but low on GAD use more family words and fewer negative emotions, affect and religion words. Studies that investigated the correlation between BIS/BAS personality and LIWC categories reported a correlation between BAS, positive words and positive affect (Cohen et al., 2008). These findings are similar to this research for students high on BAS, but without GAD. A linguistic finding in the present study, which never emerged from previous studies, is the strong correlation between BAS and religious words for students with stable mental health. Students with high BAS use fewer religious words, while students with low BAS use more religious words. Previous studies stated that a lack of spirituality in people might lead to negative psychological consequences like depression or high anxiety (Safara & Bhatia, 2008). The results of this research expand this position and show that behavioural activation systems might influence the relationship mentioned above. Moreover, the

supplementary analysis for the sub-scales of BAS show that especially students high on GAD and with high BAS Reward Responsiveness use many singular personal pronouns ($r = .421$, $p < .01$). This confirms previous findings stating that anxious people use more self-referent words because they failed to integrate with society (Brockmeyer, 2015), and offer a further theoretical refinement.

No significant correlations have been found between BIS and LIWC categories. Instead, the statistical analysis revealed that students suffering from GAD in general have high behavioural inhibition systems. This result is in harmony with previous findings suggesting that people affected by depression, anxiety or other mental health disorders also have high sensitivity to punishment, and thus BIS personality (L Vervoort, 2010). Furthermore, although BIS is associated with both high attention deficits and anxiety, this effect might be diminished with a correct balance between BIS and BAS (Oguchi & Takahashi, 2019). This interaction between BIS and BAS might be a possible explanation for the above-mentioned results in the present study.

The distribution of the sample has permitted the analysis of two main sub-groups (Dutch and Italians) depending on a nationality variable. As Hofstede observed in his study of cultural dimensions, Italian and Dutch people differ from each other on masculinity, uncertainty avoidance and indulgence (Hofstede, 1983). This also applied to the specific linguistic patterns and generalized anxiety disorders in the present case. As the result section illustrates, Dutch and Italians use different linguistic patterns depending on their anxiety disorders. While the first sub-sample – Dutch – use more social and death related words when they are more anxious, the second group – Italian – when anxious communicate with more negations, anger and sad words and with fewer affective, positive emotions and future verbs. Since no other research had ever considered both nationality and GAD, this is an interesting first observation how linguistic patterns differ in students depending on cultural and psychological aspects.

Finally, the last supplementary analysis shows that GAD means between students using social media for less and more than 3 hours are statistically significant. This confirms an idea in the literature from Samaha and other researchers (Samaha & Hawi, 2016), that time spent on social media like Facebook™, Instagram™ or Snapchat™ during a day matters for mental health: the more students use social media, the more anxious they tend to be.

7.2 Practical Relevance

The present research showed that students suffering from anxiety tend to use different kinds of linguistic patterns depending on their personality – and their cultural background. These are useful insights for the development of e-health applications – especially personalized chatbots –

which can better recognize people's personality features, anxiety levels and cultural background from simple messages. For instance, *Babylon Health* or *Tess* – mental health conversational agent created with the help of psychologists – might start incorporating personality aspects during the dialogue with the patient, in order to increase the satisfaction for the overall treatment. Current psychological studies demonstrate that, during a therapeutic treatment, psychologists should understand a patient's personality in order to provide a more efficient service and, consequently, a positive outcome (Corr, 2009). At the same time, nowadays, there is a growing interest in the usage of conversational agents in countless fields, and particularly in the healthcare sector, becoming a sort of business's life blood which, at the same time, can boost customers' engagement (Greenberg, 2019). According to Business Insider, almost half of the worldwide population communicates via online messaging apps instead of via traditional phone calls (Business Insider Intelligence, 2016). For these reasons, chatbots are gradually introduced as potential aids and supporting tools for people suffering from mental health diseases, when psychologists or other experts are too expensive or busy. By doing so, they will be able to reply in a way to boost the final outcome of the treatment or consultancy service.

7.3 Limitations

The results presented above should be taken into consideration together with some limitations, mainly due to the methodology of the experiment. First of all, the experiment was conducted within an uncontrolled environment. The survey was distributed through online means, as a result of which it was not possible to observe the space and circumstances, in which the participants undertook the experiment. Second, the writing task of the survey was assessed in English, while the majority of the participants did not have English as their mother tongue. This might have created some biases in the interpretation and expression of participants' emotions and feelings. They might have used words that did not really represent their mental status at test. For instance, some students might have adopted English linguistic expressions whose meaning is different from the one of their mother-language. Finally, the minimum amount of words participants were supposed to write in this study was set at 100. Although many researchers use this specific boundary condition in their text-based studies (Al-Mosaiwi & Johnstone, 2019), bigger texts might increase the validity of the results coming from LIWC analysis.

7.4 Suggestions for future research

Language inquiry research within GAD and personality parameters is in its infancy. Thus, this sub-chapter is entirely dedicated to recommendations for future research regarding the neuroscience and psychological fields. First of all, future researchers should use participants that speak the same mother language, in order to avoid possible misinterpretations during language inquiry. At the same time, they can both improve the sample size and focalize on students with a specific academic background to get more statistically significant results.

Moreover, future researchers could try to use a different kind of method to extrapolate the linguistic patterns from the participants of the experiment. For instance, the EAR (Electronically Activated Recorder) might be used instead of the expressive writing task. In this way, thanks to the portable audio recorder, researchers will be able to get many more words to be lately analyzed through the software, increasing the overall reliability (M. Mehl, 2017).

Finally, researchers might try to adopt different computerized text analysis software which – contrarily to LIWC – incorporate the context of the study, recognizing if it is a medical, political or scholastic background. For instance, *Google Cloud Natural Language* is a different kind of software which allows content classification together with emotional analysis of the text (Google, 2020).

8 Conclusions

Nowadays, there is a growing interest in the usage of conversational agents in countless fields to boost users' engagement (Greenberg, 2019). Specifically, conversational agents are a worthwhile tool for overcoming potential geographical, psychological and economical barriers in the mental health sector (cf., Suganuma et al., 2018). Despite the increase in the usage of these agents, few studies examined the correct recognition and incorporation of patient's personality – considered as an important factor for the final outcome of the therapeutic treatment – within conversational agents (P. Corr, 2009). Thus, this research explored how linguistic patterns of students are affected by their behavioral systems within GAD (Generalized Anxiety Disorder) context. Through an experiment, based on an expressive writing task, the following hypotheses have all been accepted:

N	Hypothesis	Final Results
H1	*Students suffering from anxiety use different linguistic patterns compared to mentally stable students*	Accepted
H2a	*The kinds of linguistic patterns used by students with low levels of anxiety disorders are different depending on students' personality*	Accepted
H2b	*The kinds of linguistic patterns used by students with high levels of anxiety disorders are different depending on students' personality*	Accepted

Table 14: Hypothesis Results

Particularly, behavioral activation systems, together with cultural background, have significant correlations with specific linguistic patterns, depending on GAD's presence or not. This study therefore shows how personality traits can affect word usage in self-narratives of students suffering from generalized anxiety disorders and those with mental stable conditions.

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Appendix

Appendix A: Interviews with Psychologists

QUESTIONS:

1. What are the most common mental health illnesses in students?
2. How do you start an approach with the patient?
3. Through which kind of questions/answers can you understand if the patient is mentally distressed?
4. What are your techniques to keep him/her engaged during the treatment? (particularly during the first meeting).
5. Are there differences of the procedure/treatment depending on the mental illness?

PSYCHOLOGIST 1

1. There are different kinds of mental illnesses depending on the context, the person, his familiar situation and of course also his age. Regarding students, we are usually overcrowded by students who suffer from fear of failure, generalized anxiety, social anxiety and fear of exams. For students, depression is a little bit more difficult to catch.
2. In order to start an approach with the patient there are some techniques. The one which is more utilized is the so called "cognitive behavioural therapy". First of all, my colleagues and I, start with the intake, a dedicated session through which we gather all the information we need from the patient. It is a sort of first meeting where the patient has the chance to know the therapist and the procedure better. At the end of the meeting, the outcomes are two: the first one is the recognition of the problem of the patient and the second one is the decision to take the patient or refer him to an external specialist (eg: GP). The cognitive behaviour therapy is a therapy that looks inside the thoughts of people and their respective behaviour. We ask the patients to tell us about their fears, so that they can express their feelings and deepest thought about particular situations. We need the help the students to face their fears and not avoid them, looking both at the positive and negative sides of it.
3. You need to look at their thoughts and some concrete examples related to them. Sometimes you directly ask the students: What do you fear? What is your problem? However, some students are quite shy and thus you cannot take this approach. So, we just go deeper in their thoughts and see how they articulate them.

4. Just try to compliment a lot and stay positive, following his feelings, letting him/her understand his/her sentiments.
5. No, usually we all start with this approach and then there will be more branches.

PSYCHOLOGIST 2

1. I have seen a lot of students coming here asking for some counselling. The majority of them were affected by anxiety disorders regarding taking exams, failing exams and speaking in English (if this was not their first mother language). If not treated correctly, there are a lot of cases that can transform their anxiety into high level of depression and in some rare cases even suicide.
2. There are different methods in starting the approach with our patients, particularly if they are students. You need to deeply understand them, they are usually shy and feel a little bit embarrassed while talking about their thoughts. This is why we usually start with general questions so that he can be more comfortable. Such questions are usually: what do you think about life? How are you feeling? What do you think about your university experience? In this way we can start understanding the thoughts and how students articulate them. This concept is called cognitive behavioral therapy and it stands for the deep study of behaviors and thoughts of the patients.
3. As mentioned before, we can understand if someone is depressed or anxious through both more general questions and also asking them specifically about a situation in which they felt mentally disturbed. In some cases, you need to go deeper in the research, however in other cases it is really easy to see what the patient is thinking and expressing.
4. You need to nod a lot while he/she speaks, look interested in what he/she is saying and let him talk as more as you can. Understanding their personality is essential.
5. It depends, but usually if we do not know the mental disease we always start with the same method.

PSYCHOLOGIST 3

1. There are different mental disorders in students. What I found more prevalent was the fact that students are anxious for tests, particularly if they are mathematical tests. This is called math's anxiety. It blocks you and in this way you under perform. However, another prominent disorder is social anxiety and stress of failure. A lot of students want

to reach high scores, they are extremely ambitious and consequently, if they cannot reach a goal, they feel fools, stupid and they start under evaluating themselves. This leads to other kinds of anxiety.

2. Usually I start asking him/her general questions, such as: how are you feeling today? How was your week? Then I start to go deeper and deeper in his/her thoughts, to better understand what is wrong, what he thinks, and how he behaves. This technique is called cognitive behavioral technique. It is widely used by different psychologists and it helps you to better understand what people think instead of what they do.
3. You need to look at their thoughts. Usually they already come at the session pretending to know what they have and what is their problem. However, asking them both general and detail questions permit us to better understand the situation.
4. Just try to be his/her friend, if they see that you are interested in their thoughts and problems, without showing too much empathy, they will be more open with the whole treatment.
5. The methods are all the same. Obviously, it varies from psychologist to psychologist.

PSYCHOLOGIST 4

1. I have seen a lot of cases of anxiety or depression by different people, particularly students during their final year of studies. They feel in a phase of transition and they start getting a lot of different emotions all together, losing the main focus that they should have. This can be referred to generalized anxiety. However, there are a lot of other cases, mainly related to stress and fear of not passing the exams.
2. There is an intake that the patient needs to take before starting the sessions. Here the case is summarized and identified. In this way the patient starts being in contact with the psychological center and feeling more familiar. After this a particular treatment is formulated.
3. We ask specific questions about his experience, for instance we directly ask him why he decided to come at our center and why he just recently thought of coming at our center if the problem persisted for much more time. However, a lot of patients are shy, they do not really know what they have. In these cases, you need to be more general and try to get his deepest thoughts with general questions. Such as what do you think of this event? How are you feeling when with someone else? What do you think about your life?
4. Our main job is to give trust to our patient, in this way the whole treatment will be much easier, and the thoughts of the patient are easier to catch. Smile a lot, try to reflect the

personality that he needs and that he can trust more. Try to be his best friend. Trust is really important.

5. Usually we start with the same procedure. In case of possibilities of suicides we redirect him to a doctor and a general practitioner.

PSYCHOLOGIST 5

1. Usually students come here because they feel stressed about their university they are attending. The fact that teachers are too strict, pretending too much from them, putting a sort of pressure. Some students can't even sleep because of this. Moreover, they feel so anxious and depressed that they cannot do anything, they stop studying because they fear of not being enough. However, there are a lot of cases, all different from each other. In this studio, I usually have adults, not students because they cannot really afford to pay for the treatment.
2. It depends. Usually I use the so called cognitive behavioral therapy, in which I try to grasp the essence of the human being, their thoughts, and not their actions. You know, people usually describe their actions thinking that through this they can have a good overview of what is happening, however, what is extremely important is the thought. From this you can understand what is going on in their mind.
3. The questions are specific for each participant and from the level of their therapy. If they are beginner and they never had therapeutic treatment before I start asking them general questions about their life. If they are students, I usually ask them to tell me something about their university.
4. With adults is different than students. However, I always try to prepare a comfortable environment for them. I prepare coffee, tea, I start smiling and so on.
5. Not really, the first phase is more or less equal for everyone.

Appendix B: LIWC Categories used

Scientific Papers	LIWC Categories
Mairesse, F., Walker, M. A., Mehl, M. R., & Moore, R. K. (2007). Using linguistic cues for the automatic recognition of personality in conversation and text. *Journal of Artificial Intelligence Research*, *30*(Xxxx), 457–500. https://doi.org/10.1613/jair.2349 Hirsh, J. B., & Peterson, J. B. (2009). Personality and language use in self-narratives. *Journal of Research in Personality*, *43*(3), 524–527. https://doi.org/10.1016/j.jrp.2009.01.006	Total Pronouns Time Orientations 1st person of personal pronouns WPS (words per sentence) Affective process Negative emotions Positive emotions Optimism Anxiety Sadness Anger Personal Concerns
Lee, C. H., Kim, K., Young, S. S., & Chung, C. K. (2007). The relations between personality and language use. *Journal of General Psychology*, *134*(4), 405–413. https://doi.org/10.3200/GENP.134.4.405-414	Common Adverbs Swear Words
Mehl, M. R., Gosling, S. D., & Pennebaker, J. W. (2006). *Personality in Its Natural Habitat : Manifestations and Implicit Folk Theories of Personality in Daily Life*. *90*(5), 862–877. https://doi.org/10.1037/0022-3514.90.5.862	Words of more than six letters
Hirsh, J. B., & Peterson, J. B. (2009). Personality and language use in self-narratives. *Journal of Research in Personality*, *43*(3), 524–527. https://doi.org/10.1016/j.jrp.2009.01.006	Social Processes Certainty

Appendix C: GAD scale Questionnaire

The questions below represent statements for which you might identify yourself or not. For each of the 7 items, please indicate how many times (from "not sure at all" to "nearly every day") you feel like what the item states. Please be as accurate and honest as you can be without missing any statement. Choose from the following four response options:

0 Not sure at all

1 Several days

2 Over half the days

3 Nearly every day

Over the last 2 weeks, how often have you been bothered by the following problems?

1. Feeling nervous, anxious or on edge.
2. Not being able to stop or control worrying.
3. Worrying too much on different things.
4. Trouble relaxing.
5. Being so restless that it is hard to sit still.
6. Becoming easily annoyed or irritable.
7. Feeling afraid as if something awful might happen.

Appendix D: BIS/BAS scale Questionnaire

Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank. Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options:

1 = very true for me

2 = somewhat true for me

3 = somewhat false for me

4 = very false for me

1. A person's family is the most important thing in life.
2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.
3. I go out of my way to get things I want.
4. When I'm doing well at something I love to keep at it.
5. I'm always willing to try something new if I think it will be fun.
6. How I dress is important to me.
7. When I get something I want, I feel excited and energized.
8. Criticism or scolding hurts me quite a bit.
9. When I want something I usually go all-out to get it.
10. I will often do things for no other reason than that they might be fun.
11. It's hard for me to find the time to do things such as get a haircut.
12. If I see a chance to get something I want I move on it right away.
13. I feel pretty worried or upset when I think or know somebody is angry at me.
14. When I see an opportunity for something I like I get excited right away.
15. I often act on the spur of the moment.
16. If I think something unpleasant is going to happen I usually get pretty "worked up."
17. I often wonder why people act the way they do.
18. When good things happen to me, it affects me strongly.
19. I feel worried when I think I have done poorly at something important.
20. I crave excitement and new sensations.

21. When I go after something I use a "no holds barred" approach.
22. I have very few fears compared to my friends.
23. It would excite me to win a contest.
24. I worry about making mistakes.

Appendix E: GAD correlations with LIWC categories

Correlations

Variables		SUM_ANX	Word per sentence	SIX	PPRON	i	we	adverb	negate	affect	posemo	negemo	anx	anger	sad	social	family	friend	certain	focuspast	focuspres	focusfut	time	work	leisure	home	money	relig	death	swear
SUM_ANX	Pearson Correlation	1	-,027	-,164*	,186*	,095	,076	-,061	,300**	-,040	-,196*	,182*	-,119	,257**	,304**	,226**	,250**	-,011	-,084	-,066	,175*	-,178*	-,139	-,144	,042	,093	,050	,102	,092	,091
	Sig. (2-tailed)		,751	,029	,027	,261	,366	,469	,000	,635	,019	,030	,159	,002	,000	,007	,003	,897	,321	,310	,037	,034	,098	,087	,616	,269	,551	,227	,275	,281
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
Word per sentence	Pearson Correlation	-,027	1	,135	-,085	-,038	,012	,100	-,132	,076	,054	,010	,086	-,176*	,067	,037	,081	,003	,125	,013	,876**	,031	,869**	,014	,121	-,139	-,035	-,081	-,009	-,062	-,061	-,049
	Sig. (2-tailed)	,751		,109	,315	,654	,887	,237	,117	,367	,522	,906	,309	,036	,425	,660	,338	,970	,137	,876**	,031	,869**	,151	,100	,676**	,336	,914	,465	,473	,564
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
SIX	Pearson Correlation	-,184*	,135	1	-,293**	-,276**	,054	-,164	-,296**	,178*	,159	,047	,207*	-,074	-,021	-,089	-,133	-,065	,182*	,031	-,302**	-,090	-,173*	,464**	-,138	-,085	,237**	,001	-,162	,005
	Sig. (2-tailed)	,029	,109		,000	,001	,520	,052	,000	,034	,058	,576	,013	,380	,808	,294	,115	,440	,030	,714	,000	,288	,040	,000	,101	,314	,004	,991	,055	,956
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
PPRON	Pearson Correlation	,186*	-,085	-,293**	1	,906**	-,082	,066	,291**	,180*	,095	,153	-,071	,128	,178*	,015	,092	-,015	-,060	,126	,203*	,025	-,087	-,186*	-,084	-,069	-,209*	-,018	,167*	,010
	Sig. (2-tailed)	,027	,315	,000		,000	,335	,434	,000	,032	,261	,069	,402	,129	,034	,860	,276	,866	,479	,136	,015	,771	,303	,026	,322	,413	,012	,835	,048	,909
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
i	Pearson Correlation	,095	-,038	-,276**	,906**	1	-,311**	,063	,260**	,175*	,048	,192*	,000	,097	,196*	-,277**	,133	,005	-,115	,219**	,088	,038	-,016	-,188*	-,022	-,020	-,237**	-,051	,147	-,009
	Sig. (2-tailed)	,261	,654	,001	,000		,000	,457	,002	,037	,571	,022	,997	,250	,020	,001	,115	,949	,172	,009	,297	,652	,850	,025	,798	,816	,005	,549	,081	,917
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
we	Pearson Correlation	,076	,012	,054	-,062	-,311**	1	-,001	-,081	,001	,104	-,101	-,099	-,092	-,090	,449**	-,092	,140	,133	-,060	,083	,050	-,063	,017	,039	,007	,064	,059	-,066	-,013
	Sig. (2-tailed)	,366	,887	,520	,335	,000		,989	,337	,987	,218	,231	,242	,277	,285	,000	,278	,096	,115	,557	,324	,558	,466	,839	,649	,938	,451	,487	,432	,877
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
adverb	Pearson Correlation	-,061	,100	-,164	,066	,063	-,001	1	,226**	,183*	,006	,139	,139	,077	,171*	,084	,052	-,001	,110	,038	,091	,059	,058	,494	,020	,938	,573	,134	,809	,086	,072
	Sig. (2-tailed)	,469	,237	,052	,434	,457	,989		,007	,029	,941	,002	,098	,364	,042	,320	,537	,987	,194	,657	,282	,489	,494	,020	,938	,573	,134	,809	,086	,072
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
negate	Pearson Correlation	,300**	-,132	-,296**	,291**	,260**	-,081	,226**	1	,073	-,083	,204*	-,145	,195*	,317**	,074	,240**	-,089	,091	,039	,261**	-,083	-,159	-,325**	,037	,081	-,082	,100	,117	,097
	Sig. (2-tailed)	,000	,117	,000	,000	,002	,337	,007		,390	,328	,015	,085	,020	,000	,378	,004	,294	,281	,642	,002	,323	,059	,000	,661	,341	,332	,237	,165	,251
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
affect	Pearson Correlation	-,040	,076	,178*	,180*	,175*	,001	,183*	,073	1	,694**	,528**	,321**	,006	,290**	,020	-,010	,021	,145*	,060	,477**	,934**	,711**	,010	,194*	,396**	,943**	,206*	,240**	,190*	,713**
	Sig. (2-tailed)	,635	,367	,034	,032	,037	,987	,029	,390		,000	,000	,000	,945	,000	,813	,907	,805	,086	,477	,934	,711	,010	,194	,396	,943	,206	,240	,190	,713
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
posemo	Pearson Correlation	-,196*	,054	,159	,095	,048	,104	-,006	-,063	,694**	1	-,232**	-,174*	-,106	-,043	,151	-,021	,025	,169*	-,029	-,007	,041	-,230**	,042	-,028	-,035	-,023	,057	,160	,027
	Sig. (2-tailed)	,019	,522	,058	,261	,571	,218	,941	,338	,000		,005	,039	,208	,608	,074	,802	,767	,044	,734	,935	,630	,006	,617	,743	,679	,788	,500	,057	,753
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
negemo	Pearson Correlation	,182*	,010	,047	,153	,192*	-,101	,256**	,204*	,528**	-,232**	1	,646**	,155	,434**	-,133	,013	,021	,021	,128	-,011	-,093	-,040	-,196*	-,069	,029	-,113	,040	-,047	-,081
	Sig. (2-tailed)	,030	,906	,576	,069	,022	,231	,002	,015	,000	,005		,000	,065	,000	,114	,882	,801	,807	,130	,900	,270	,634	,020	,736	,181	,638	,576	,340
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
anx	Pearson Correlation	-,119	,086	,207*	,071	,000	,099	,139	-,145	,321**	-,174*	,646**	1	-,144	-,094	,217**	,179*	,026	,189*	-,003	,079	,039	,024	,003	,119	,103	,160	,015	,124	,142
	Sig. (2-tailed)	,159	,309	,013	,402	,997	,242	,098	,085	,000	,039	,000		,088	,264	,010	,033	,756	,024	,973	,353	,646	,775	,973	,157	,223	,058	,859	,141	,091
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
anger	Pearson Correlation	,257**	-,176*	-,074	,128	,097	-,092	-,077	,195*	,006	-,106	,155	,144	1	,114	,150	,127	-,017	,034	,063	,107	-,047	-,075	,070	,037	,039	,160	-,005	,088	,338**
	Sig. (2-tailed)	,002	,036	,380	,129	,250	,277	,364	,020	,945	,208	,065	,088		,176	,076	,131	,837	,688	,454	,204	,578	,377	,407	,659	,648	,057	,958	,296	,000
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
sad	Pearson Correlation	,304**	,067	-,021	,178*	,196*	-,090	,171*	,317**	,290**	-,043	,434**	-,094	,114	1	-,040	,297**	-,002	-,060	,293**	-,172*	-,045	-,078	-,146	,122	,267**	,024	,090	-,044	-,058
	Sig. (2-tailed)	,000	,425	,806	,034	,020	,285	,042	,000	,000	,608	,000	,264	,176		,635	,000	,977	,476	,000	,041	,592	,358	,083	,149	,001	,774	,287	,605	,495
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142

social	Pearson Correlation	,226**	-,037	-,089	,015	-,277**	,449**	-,084	,074	,020	,151	-,133	-,217**	,150	-,040	1	,080	,265**	,128	-,127	,103	-,173*	-,161	,002	,076	,069	-,019	,040	,098	,151
	Sig. (2-tailed)	,007	,660	,294	,860	,001	,000	,320	,378	,813	,074	,114	,010	,076	,635		,346	,001	,129	,133	,224	,039	,055	,981	,368	,415	,818	,637	,244	,072
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
family	Pearson Correlation	,250**	-,081	-,133	,092	,133	-,092	,052	,240**	-,010	-,021	,013	-,179*	,127	,297**	,080	1	,097	-,101	,093	,021	-,116	,006	,011	,403**	,549**	,161	-,066	,138	-,076
	Sig. (2-tailed)	,003	,338	,115	,276	,115	,278	,537	,004	,907	,802	,882	,033	,131	,000	,346		,251	,230	,273	,805	,168	,948	,894	,000	,000	,056	,435	,102	,366
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
friend	Pearson Correlation	-,011	,003	-,065	-,015	,005	,140	-,001	-,089	,021	,025	,021	-,026	-,017	-,002	,265**	,097	1	-,103	,014	-,017	-,263**	,011	,112	,194*	,117	-,078	-,112	-,052	-,044
	Sig. (2-tailed)	,897	,970	,440	,856	,949	,096	,987	,294	,805	,767	,801	,756	,837	,977	,001	,251		,223	,873	,845	,002	,894	,185	,021	,167	,354	,184	,535	,602
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
certain	Pearson Correlation	-,084	,125	,182*	-,060	-,115	,133	,110	,091	,145	,169*	,021	,189*	,034	-,060	,128	-,101	-,103	1	-,114	,092	-,045	-,030	-,065	-,157	-,134	-,077	,053	-,016	,062
	Sig. (2-tailed)	,321	,137	,030	,479	,172	,115	,194	,281	,086	,044	,807	,024	,688	,476	,129	,230	,223		,176	,276	,591	,727	,444	,063	,112	,363	,535	,850	,462
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
focuspast	Pearson Correlation	-,086	,013	,031	,126	,219**	-,050	,038	,039	,060	-,029	,128	-,003	,063	,293**	-,127	,093	,014	-,114	1	-,695**	-,138	,108	-,080	,081	,118	,047	-,113	-,054	-,232**
	Sig. (2-tailed)	,310	,876	,714	,136	,009	,557	,657	,642	,477	,734	,130	,973	,454	,000	,133	,273	,873	,176		,000	,102	,202	,344	,335	,164	,581	,180	,523	,005
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
focuspres	Pearson Correlation	,175*	-,181*	-,302**	,203*	,088	,083	,091	,261**	-,007	-,007	-,011	-,079	,107	-,172*	,103	,021	-,017	,092	-,695**	1	,087	-,090	-,145	-,049	-,091	-,073	,072	,136	,205*
	Sig. (2-tailed)	,037	,031	,000	,015	,297	,324	,282	,002	,934	,935	,900	,353	,204	,041	,224	,805	,845	,276	,000		,305	,286	,084	,565	,282	,386	,393	,106	,014
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
focusfut	Pearson Correlation	-,178*	-,014	-,090	,025	,038	,050	,059	-,083	-,031	,041	-,093	-,039	-,047	-,045	-,173*	-,116	-,263**	-,045	-,138	,087	1	,288**	-,082	-,074	-,134	-,035	,003	-,043	-,042
	Sig. (2-tailed)	,034	,869	,288	,771	,652	,558	,489	,323	,711	,630	,270	,646	,578	,592	,039	,168	,002	,591	,102	,305		,001	,333	,381	,112	,677	,967	,612	,618
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
time	Pearson Correlation	-,139	,121	-,173*	-,087	-,016	-,063	,058	-,159	-,214*	-,230**	-,040	,024	-,075	-,078	-,161	,006	,011	-,030	,108	-,090	,288**	1	-,138	,170*	,028	-,259**	-,117	-,074	-,006
	Sig. (2-tailed)	,098	,151	,040	,303	,850	,456	,494	,059	,010	,006	,634	,775	,377	,358	,055	,948	,894	,727	,202	,286	,001		,101	,043	,738	,002	,167	,384	,939
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
work	Pearson Correlation	-,144	-,139	,464**	-,186*	-,188*	,017	-,196*	-,325**	-,110	,042	-,196*	-,003	,070	-,146	,002	,011	,112	-,065	-,080	-,145	-,082	-,138	1	,049	-,086	,164	-,102	-,084	,160
	Sig. (2-tailed)	,087	,100	,000	,026	,025	,839	,020	,000	,194	,617	,020	,973	,407	,083	,981	,894	,185	,444	,344	,084	,333	,101		,560	,310	,051	,226	,323	,057
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
leisure	Pearson Correlation	,042	-,035	-,138	-,084	-,022	,039	-,007	,037	-,072	-,028	-,089	-,119	,037	,122	,076	,403**	,194*	-,157	,081	-,049	-,074	,170*	,049	1	,465**	-,030	-,056	,088	,113
	Sig. (2-tailed)	,616	,676	,101	,322	,798	,649	,938	,661	,396	,743	,294	,157	,659	,149	,368	,000	,021	,063	,335	,565	,381	,043	,560		,000	,723	,507	,299	,182
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
home	Pearson Correlation	,093	-,081	-,085	-,069	-,020	,007	-,048	,081	,006	-,035	,029	-,103	,039	,287**	,069	,549**	,117	-,134	,118	-,091	-,134	,028	-,086	,465**	1	,079	,070	,095	-,010
	Sig. (2-tailed)	,269	,336	,314	,413	,816	,938	,573	,341	,943	,679	,735	,223	,648	,001	,415	,000	,167	,112	,164	,282	,112	,738	,310	,000		,351	,410	,262	,909
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
money	Pearson Correlation	,050	-,009	,237**	-,209*	-,237**	,064	-,126	-,082	-,107	-,023	-,113	-,160	,160	,024	-,019	,161	-,078	-,077	,047	-,073	-,035	-,259**	,164	-,030	,079	1	-,001	-,043	-,033
	Sig. (2-tailed)	,551	,914	,004	,012	,005	,451	,134	,332	,206	,788	,181	,058	,057	,774	,818	,056	,354	,363	,581	,386	,677	,002	,051	,723	,351		,992	,607	,697
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
relig	Pearson Correlation	,102	-,062	,001	-,018	-,051	,059	,020	,100	,099	,057	,040	,015	-,005	,090	,040	-,066	-,112	,053	-,113	,072	,003	-,117	-,102	-,056	,070	-,001	1	,158	-,055
	Sig. (2-tailed)	,227	,465	,991	,835	,549	,487	,809	,237	,240	,500	,638	,859	,958	,287	,637	,435	,184	,535	,180	,393	,967	,167	,226	,507	,410	,992		,060	,517
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
death	Pearson Correlation	,092	-,061	-,162	,167*	,147	-,066	,145	,117	,111	,160	-,047	-,124	,088	-,044	,098	,138	-,052	-,016	-,054	,136	-,043	-,074	-,084	,088	,095	-,043	,158	1	-,033
	Sig. (2-tailed)	,275	,473	,055	,048	,081	,432	,086	,165	,190	,057	,576	,141	,296	,605	,244	,102	,535	,850	,523	,106	,612	,384	,323	,299	,262	,607	,060		,698
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
swear	Pearson Correlation	,091	-,049	,005	,010	-,009	-,013	-,152	,097	-,031	,027	-,081	-,142	,338**	-,058	,151	-,076	-,044	,062	-,232**	,205*	-,042	-,006	,160	,113	-,010	-,033	-,055	-,033	1
	Sig. (2-tailed)	,281	,564	,956	,909	,917	,877	,072	,251	,713	,753	,340	,091	,000	,495	,072	,366	,602	,462	,005	,014	,618	,939	,057	,182	,909	,697	,517	,698	
	N	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix F: BIS correlations with LIWC (non-anxious and anxious)

Correlations

		N_MEAN_BIS
N_MEAN_BIS	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87
Word per sentence	Pearson Correlation	-,050
	Sig. (2-tailed)	,647
	N	87
SIX	Pearson Correlation	-,031
	Sig. (2-tailed)	,773
	N	87
PPRON	Pearson Correlation	,109
	Sig. (2-tailed)	,315
	N	87
i	Pearson Correlation	,084
	Sig. (2-tailed)	,438
	N	87
we	Pearson Correlation	,048
	Sig. (2-tailed)	,662
	N	87
adverb	Pearson Correlation	-,012
	Sig. (2-tailed)	,911
	N	87
negate	Pearson Correlation	,179
	Sig. (2-tailed)	,097
	N	87
affect	Pearson Correlation	,016
	Sig. (2-tailed)	,886
	N	87
posemo	Pearson Correlation	,051
	Sig. (2-tailed)	,642
	N	87
negemo	Pearson Correlation	-,056
	Sig. (2-tailed)	,608
	N	87
anx	Pearson Correlation	-,087
	Sig. (2-tailed)	,423
	N	87
anger	Pearson Correlation	,011
	Sig. (2-tailed)	,920
	N	87
sad	Pearson Correlation	,004
	Sig. (2-tailed)	,974
	N	87
social	Pearson Correlation	,185
	Sig. (2-tailed)	,086
	N	87
family	Pearson Correlation	,076
	Sig. (2-tailed)	,485
	N	87
friend	Pearson Correlation	,170
	Sig. (2-tailed)	,116
	N	87
certain	Pearson Correlation	-,138
	Sig. (2-tailed)	,202
	N	87
focuspast	Pearson Correlation	,099
	Sig. (2-tailed)	,360
	N	87
focuspres	Pearson Correlation	,008
	Sig. (2-tailed)	,944
	N	87
focusfut	Pearson Correlation	-,041
	Sig. (2-tailed)	,709
	N	87
time	Pearson Correlation	-,109
	Sig. (2-tailed)	,313
	N	87
work	Pearson Correlation	,110
	Sig. (2-tailed)	,312
	N	87
leisure	Pearson Correlation	,026
	Sig. (2-tailed)	,813
	N	87
home	Pearson Correlation	-,068
	Sig. (2-tailed)	,531
	N	87
money	Pearson Correlation	-,175
	Sig. (2-tailed)	,105
	N	87
relig	Pearson Correlation	-,102
	Sig. (2-tailed)	,346
	N	87
death	Pearson Correlation	-,076
	Sig. (2-tailed)	,485
	N	87
swear	Pearson Correlation	,007
	Sig. (2-tailed)	,949
	N	87

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		N_MEAN_BIS
N_MEAN_BIS	Pearson Correlation	1
	Sig. (2-tailed)	
	N	55
Word per sentence	Pearson Correlation	,043
	Sig. (2-tailed)	,755
	N	55
SIX	Pearson Correlation	-,087
	Sig. (2-tailed)	,528
	N	55
PPRON	Pearson Correlation	,180
	Sig. (2-tailed)	,189
	N	55
i	Pearson Correlation	,167
	Sig. (2-tailed)	,224
	N	55
we	Pearson Correlation	-,030
	Sig. (2-tailed)	,828
	N	55
adverb	Pearson Correlation	-,011
	Sig. (2-tailed)	,934
	N	55
negate	Pearson Correlation	,019
	Sig. (2-tailed)	,890
	N	55
affect	Pearson Correlation	,121
	Sig. (2-tailed)	,377
	N	55
posemo	Pearson Correlation	-,023
	Sig. (2-tailed)	,868
	N	55
negemo	Pearson Correlation	,173
	Sig. (2-tailed)	,206
	N	55
anx	Pearson Correlation	,123
	Sig. (2-tailed)	,369
	N	55
anger	Pearson Correlation	,048
	Sig. (2-tailed)	,729
	N	55
sad	Pearson Correlation	,079
	Sig. (2-tailed)	,565
	N	55
social	Pearson Correlation	,114
	Sig. (2-tailed)	,405
	N	55
family	Pearson Correlation	,089
	Sig. (2-tailed)	,519
	N	55
friend	Pearson Correlation	-,069
	Sig. (2-tailed)	,618
	N	55
certain	Pearson Correlation	,051
	Sig. (2-tailed)	,710
	N	55
focuspast	Pearson Correlation	-,158
	Sig. (2-tailed)	,249
	N	55
focuspres	Pearson Correlation	,207
	Sig. (2-tailed)	,130
	N	55
focusfut	Pearson Correlation	-,073
	Sig. (2-tailed)	,598
	N	55
time	Pearson Correlation	-,190
	Sig. (2-tailed)	,164
	N	55
work	Pearson Correlation	-,143
	Sig. (2-tailed)	,298
	N	55
leisure	Pearson Correlation	,133
	Sig. (2-tailed)	,335
	N	55
home	Pearson Correlation	,127
	Sig. (2-tailed)	,356
	N	55
money	Pearson Correlation	-,012
	Sig. (2-tailed)	,929
	N	55
relig	Pearson Correlation	,127
	Sig. (2-tailed)	,355
	N	55
death	Pearson Correlation	-,057
	Sig. (2-tailed)	,679
	N	55
swear	Pearson Correlation	,056
	Sig. (2-tailed)	,685
	N	55

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix G: BAS correlations with LIWC (non-anxious and anxious)

Correlations

		N_MEAN_BAS
N_MEAN_BAS	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87
Word per sentence	Pearson Correlation	,139
	Sig. (2-tailed)	,199
	N	87
SIX	Pearson Correlation	,139
	Sig. (2-tailed)	,201
	N	87
PPRON	Pearson Correlation	-,144
	Sig. (2-tailed)	,183
	N	87
i	Pearson Correlation	-,083
	Sig. (2-tailed)	,444
	N	87
we	Pearson Correlation	-,090
	Sig. (2-tailed)	,407
	N	87
adverb	Pearson Correlation	,085
	Sig. (2-tailed)	,433
	N	87
negate	Pearson Correlation	,028
	Sig. (2-tailed)	,798
	N	87
affect	Pearson Correlation	-,293**
	Sig. (2-tailed)	,006
	N	87
posemo	Pearson Correlation	-,127
	Sig. (2-tailed)	,241
	N	87
negemo	Pearson Correlation	-,264*
	Sig. (2-tailed)	,013
	N	87
anx	Pearson Correlation	-,190
	Sig. (2-tailed)	,078
	N	87
anger	Pearson Correlation	-,083
	Sig. (2-tailed)	,445
	N	87
sad	Pearson Correlation	-,134
	Sig. (2-tailed)	,218
	N	87
social	Pearson Correlation	,006
	Sig. (2-tailed)	,958
	N	87
family	Pearson Correlation	,217*
	Sig. (2-tailed)	,043
	N	87
friend	Pearson Correlation	-,022
	Sig. (2-tailed)	,837
	N	87
certain	Pearson Correlation	,012
	Sig. (2-tailed)	,914
	N	87
focuspast	Pearson Correlation	,057
	Sig. (2-tailed)	,599
	N	87
focuspres	Pearson Correlation	-,133
	Sig. (2-tailed)	,219
	N	87
focusfut	Pearson Correlation	-,174
	Sig. (2-tailed)	,106
	N	87
time	Pearson Correlation	,058
	Sig. (2-tailed)	,593
	N	87
work	Pearson Correlation	,094
	Sig. (2-tailed)	,386
	N	87
leisure	Pearson Correlation	,163
	Sig. (2-tailed)	,132
	N	87
home	Pearson Correlation	-,117
	Sig. (2-tailed)	,279
	N	87
money	Pearson Correlation	-,050
	Sig. (2-tailed)	,645
	N	87
relig	Pearson Correlation	-,318**
	Sig. (2-tailed)	,003
	N	87
death	Pearson Correlation	,206
	Sig. (2-tailed)	,055
	N	87
swear	Pearson Correlation	,055
	Sig. (2-tailed)	,612
	N	87

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		N_MEAN_BAS
N_MEAN_BAS	Pearson Correlation	1
	Sig. (2-tailed)	
	N	55
Word per sentence	Pearson Correlation	-,042
	Sig. (2-tailed)	,760
	N	55
SIX	Pearson Correlation	,040
	Sig. (2-tailed)	,774
	N	55
PPRON	Pearson Correlation	,265
	Sig. (2-tailed)	,050
	N	55
i	Pearson Correlation	,185
	Sig. (2-tailed)	,177
	N	55
we	Pearson Correlation	,122
	Sig. (2-tailed)	,376
	N	55
adverb	Pearson Correlation	-,132
	Sig. (2-tailed)	,337
	N	55
negate	Pearson Correlation	-,074
	Sig. (2-tailed)	,591
	N	55
affect	Pearson Correlation	,156
	Sig. (2-tailed)	,256
	N	55
posemo	Pearson Correlation	,096
	Sig. (2-tailed)	,487
	N	55
negemo	Pearson Correlation	,122
	Sig. (2-tailed)	,374
	N	55
anx	Pearson Correlation	,275*
	Sig. (2-tailed)	,042
	N	55
anger	Pearson Correlation	,010
	Sig. (2-tailed)	,944
	N	55
sad	Pearson Correlation	-,159
	Sig. (2-tailed)	,245
	N	55
social	Pearson Correlation	,081
	Sig. (2-tailed)	,556
	N	55
family	Pearson Correlation	-,084
	Sig. (2-tailed)	,543
	N	55
friend	Pearson Correlation	,002
	Sig. (2-tailed)	,991
	N	55
certain	Pearson Correlation	,218
	Sig. (2-tailed)	,110
	N	55
focuspast	Pearson Correlation	,067
	Sig. (2-tailed)	,629
	N	55
focuspres	Pearson Correlation	,067
	Sig. (2-tailed)	,626
	N	55
focusfut	Pearson Correlation	-,062
	Sig. (2-tailed)	,652
	N	55
time	Pearson Correlation	,006
	Sig. (2-tailed)	,963
	N	55
work	Pearson Correlation	,085
	Sig. (2-tailed)	,535
	N	55
leisure	Pearson Correlation	-,229
	Sig. (2-tailed)	,093
	N	55
home	Pearson Correlation	-,229
	Sig. (2-tailed)	,092
	N	55
money	Pearson Correlation	-,007
	Sig. (2-tailed)	,960
	N	55
relig	Pearson Correlation	-,060
	Sig. (2-tailed)	,661
	N	55
death	Pearson Correlation	-,099
	Sig. (2-tailed)	,470
	N	55
swear	Pearson Correlation	,123
	Sig. (2-tailed)	,373
	N	55

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix H: sub-BAS correlations with LIWC (non-anxious and anxious)

Correlations

		MEAN_BASDrive
MEAN_BASDrive	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87
Word per sentence	Pearson Correlation	,189
	Sig. (2-tailed)	,080
	N	87
SIX	Pearson Correlation	,216*
	Sig. (2-tailed)	,044
	N	87
PPRON	Pearson Correlation	-,113
	Sig. (2-tailed)	,297
	N	87
i	Pearson Correlation	-,083
	Sig. (2-tailed)	,444
	N	87
we	Pearson Correlation	-,125
	Sig. (2-tailed)	,249
	N	87
adverb	Pearson Correlation	,035
	Sig. (2-tailed)	,745
	N	87
negate	Pearson Correlation	-,097
	Sig. (2-tailed)	,369
	N	87
affect	Pearson Correlation	-,182
	Sig. (2-tailed)	,091
	N	87
posemo	Pearson Correlation	-,107
	Sig. (2-tailed)	,323
	N	87
negemo	Pearson Correlation	-,143
	Sig. (2-tailed)	,186
	N	87
anx	Pearson Correlation	-,040
	Sig. (2-tailed)	,716
	N	87
anger	Pearson Correlation	-,063
	Sig. (2-tailed)	,561
	N	87
sad	Pearson Correlation	-,117
	Sig. (2-tailed)	,282
	N	87
social	Pearson Correlation	-,010
	Sig. (2-tailed)	,930
	N	87
family	Pearson Correlation	,137
	Sig. (2-tailed)	,204
	N	87
friend	Pearson Correlation	-,012
	Sig. (2-tailed)	,916
	N	87
certain	Pearson Correlation	,115
	Sig. (2-tailed)	,289
	N	87
focuspast	Pearson Correlation	-,015
	Sig. (2-tailed)	,889
	N	87
focuspres	Pearson Correlation	-,109
	Sig. (2-tailed)	,314
	N	87
focusfut	Pearson Correlation	-,053
	Sig. (2-tailed)	,625
	N	87
time	Pearson Correlation	,072
	Sig. (2-tailed)	,510
	N	87
work	Pearson Correlation	,054
	Sig. (2-tailed)	,620
	N	87
leisure	Pearson Correlation	,067
	Sig. (2-tailed)	,541
	N	87
home	Pearson Correlation	-,123
	Sig. (2-tailed)	,258
	N	87
money	Pearson Correlation	,074
	Sig. (2-tailed)	,496
	N	87
relig	Pearson Correlation	-,199
	Sig. (2-tailed)	,064
	N	87
death	Pearson Correlation	,176
	Sig. (2-tailed)	,102
	N	87
swear	Pearson Correlation	-,010
	Sig. (2-tailed)	,926
	N	87

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		MEAN_BASDrive
MEAN_BASDrive	Pearson Correlation	1
	Sig. (2-tailed)	
	N	55
Word per sentence	Pearson Correlation	-,098
	Sig. (2-tailed)	,474
	N	55
SIX	Pearson Correlation	,110
	Sig. (2-tailed)	,422
	N	55
PPRON	Pearson Correlation	,206
	Sig. (2-tailed)	,132
	N	55
i	Pearson Correlation	,117
	Sig. (2-tailed)	,396
	N	55
we	Pearson Correlation	,074
	Sig. (2-tailed)	,589
	N	55
adverb	Pearson Correlation	-,154
	Sig. (2-tailed)	,262
	N	55
negate	Pearson Correlation	-,022
	Sig. (2-tailed)	,872
	N	55
affect	Pearson Correlation	,127
	Sig. (2-tailed)	,356
	N	55
posemo	Pearson Correlation	,142
	Sig. (2-tailed)	,301
	N	55
negemo	Pearson Correlation	,022
	Sig. (2-tailed)	,876
	N	55
anx	Pearson Correlation	,182
	Sig. (2-tailed)	,183
	N	55
anger	Pearson Correlation	-,046
	Sig. (2-tailed)	,739
	N	55
sad	Pearson Correlation	-,125
	Sig. (2-tailed)	,364
	N	55
social	Pearson Correlation	,066
	Sig. (2-tailed)	,632
	N	55
family	Pearson Correlation	-,151
	Sig. (2-tailed)	,270
	N	55
friend	Pearson Correlation	-,048
	Sig. (2-tailed)	,727
	N	55
certain	Pearson Correlation	,183
	Sig. (2-tailed)	,181
	N	55
focuspast	Pearson Correlation	,064
	Sig. (2-tailed)	,643
	N	55
focuspres	Pearson Correlation	,104
	Sig. (2-tailed)	,450
	N	55
focusfut	Pearson Correlation	-,029
	Sig. (2-tailed)	,836
	N	55
time	Pearson Correlation	-,088
	Sig. (2-tailed)	,521
	N	55
work	Pearson Correlation	,021
	Sig. (2-tailed)	,877
	N	55
leisure	Pearson Correlation	-,265
	Sig. (2-tailed)	,050
	N	55
home	Pearson Correlation	-,273*
	Sig. (2-tailed)	,044
	N	55
money	Pearson Correlation	,053
	Sig. (2-tailed)	,698
	N	55
relig	Pearson Correlation	-,102
	Sig. (2-tailed)	,457
	N	55
death	Pearson Correlation	-,135
	Sig. (2-tailed)	,327
	N	55
swear	Pearson Correlation	,153
	Sig. (2-tailed)	,264
	N	55

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		MEAN_BASFun
MEAN_BASFun	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87
Word per sentence	Pearson Correlation	,006
	Sig. (2-tailed)	,953
	N	87
SIX	Pearson Correlation	,031
	Sig. (2-tailed)	,776
	N	87
PPRON	Pearson Correlation	-,268*
	Sig. (2-tailed)	,012
	N	87
i	Pearson Correlation	-,182
	Sig. (2-tailed)	,092
	N	87
we	Pearson Correlation	-,035
	Sig. (2-tailed)	,745
	N	87
adverb	Pearson Correlation	,052
	Sig. (2-tailed)	,632
	N	87
negate	Pearson Correlation	,098
	Sig. (2-tailed)	,367
	N	87
affect	Pearson Correlation	-,278**
	Sig. (2-tailed)	,009
	N	87
posemo	Pearson Correlation	-,158
	Sig. (2-tailed)	,145
	N	87
negemo	Pearson Correlation	-,200
	Sig. (2-tailed)	,064
	N	87
anx	Pearson Correlation	-,129
	Sig. (2-tailed)	,235
	N	87
anger	Pearson Correlation	-,066
	Sig. (2-tailed)	,541
	N	87
sad	Pearson Correlation	-,091
	Sig. (2-tailed)	,403
	N	87
social	Pearson Correlation	-,034
	Sig. (2-tailed)	,753
	N	87
family	Pearson Correlation	,220*
	Sig. (2-tailed)	,041
	N	87
friend	Pearson Correlation	-,089
	Sig. (2-tailed)	,414
	N	87
certain	Pearson Correlation	-,029
	Sig. (2-tailed)	,788
	N	87
focuspast	Pearson Correlation	,112
	Sig. (2-tailed)	,302
	N	87
focuspres	Pearson Correlation	-,211
	Sig. (2-tailed)	,050
	N	87
focusfut	Pearson Correlation	-,201
	Sig. (2-tailed)	,062
	N	87
time	Pearson Correlation	,077
	Sig. (2-tailed)	,481
	N	87
work	Pearson Correlation	-,026
	Sig. (2-tailed)	,814
	N	87
leisure	Pearson Correlation	,219*
	Sig. (2-tailed)	,041
	N	87
home	Pearson Correlation	,028
	Sig. (2-tailed)	,798
	N	87
money	Pearson Correlation	,029
	Sig. (2-tailed)	,791
	N	87
relig	Pearson Correlation	-,220*
	Sig. (2-tailed)	,041
	N	87
death	Pearson Correlation	,193
	Sig. (2-tailed)	,074
	N	87
swear	Pearson Correlation	,119
	Sig. (2-tailed)	,271
	N	87

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		MEAN_BASFun
MEAN_BASFun	Pearson Correlation	1
	Sig. (2-tailed)	
	N	55
Word per sentence	Pearson Correlation	-,018
	Sig. (2-tailed)	,894
	N	55
SIX	Pearson Correlation	,131
	Sig. (2-tailed)	,339
	N	55
PPRON	Pearson Correlation	,037
	Sig. (2-tailed)	,789
	N	55
i	Pearson Correlation	-,055
	Sig. (2-tailed)	,689
	N	55
we	Pearson Correlation	,147
	Sig. (2-tailed)	,285
	N	55
adverb	Pearson Correlation	-,123
	Sig. (2-tailed)	,373
	N	55
negate	Pearson Correlation	-,124
	Sig. (2-tailed)	,367
	N	55
affect	Pearson Correlation	,101
	Sig. (2-tailed)	,461
	N	55
posemo	Pearson Correlation	,014
	Sig. (2-tailed)	,922
	N	55
negemo	Pearson Correlation	,138
	Sig. (2-tailed)	,315
	N	55
anx	Pearson Correlation	,286*
	Sig. (2-tailed)	,034
	N	55
anger	Pearson Correlation	-,001
	Sig. (2-tailed)	,993
	N	55
sad	Pearson Correlation	-,138
	Sig. (2-tailed)	,316
	N	55
social	Pearson Correlation	,078
	Sig. (2-tailed)	,571
	N	55
family	Pearson Correlation	-,067
	Sig. (2-tailed)	,629
	N	55
friend	Pearson Correlation	-,108
	Sig. (2-tailed)	,432
	N	55
certain	Pearson Correlation	,285*
	Sig. (2-tailed)	,035
	N	55
focuspast	Pearson Correlation	,083
	Sig. (2-tailed)	,547
	N	55
focuspres	Pearson Correlation	-,034
	Sig. (2-tailed)	,806
	N	55
focusfut	Pearson Correlation	-,141
	Sig. (2-tailed)	,306
	N	55
time	Pearson Correlation	,053
	Sig. (2-tailed)	,701
	N	55
work	Pearson Correlation	,218
	Sig. (2-tailed)	,111
	N	55
leisure	Pearson Correlation	-,132
	Sig. (2-tailed)	,338
	N	55
home	Pearson Correlation	-,133
	Sig. (2-tailed)	,332
	N	55
money	Pearson Correlation	,073
	Sig. (2-tailed)	,597
	N	55
relig	Pearson Correlation	,043
	Sig. (2-tailed)	,754
	N	55
death	Pearson Correlation	-,123
	Sig. (2-tailed)	,371
	N	55
swear	Pearson Correlation	,041
	Sig. (2-tailed)	,767
	N	55

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		MEAN_BASReward
MEAN_BASReward	Pearson Correlation	1
	Sig. (2-tailed)	
	N	87
Word per sentence	Pearson Correlation	,133
	Sig. (2-tailed)	,220
	N	87
SIX	Pearson Correlation	,082
	Sig. (2-tailed)	,448
	N	87
PPRON	Pearson Correlation	,009
	Sig. (2-tailed)	,931
	N	87
i	Pearson Correlation	,047
	Sig. (2-tailed)	,666
	N	87
we	Pearson Correlation	-,056
	Sig. (2-tailed)	,608
	N	87
adverb	Pearson Correlation	,120
	Sig. (2-tailed)	,270
	N	87
negate	Pearson Correlation	,077
	Sig. (2-tailed)	,479
	N	87
affect	Pearson Correlation	-,263*
	Sig. (2-tailed)	,014
	N	87
posemo	Pearson Correlation	-,053
	Sig. (2-tailed)	,624
	N	87
negemo	Pearson Correlation	-,303**
	Sig. (2-tailed)	,004
	N	87
anx	Pearson Correlation	-,294**
	Sig. (2-tailed)	,006
	N	87
anger	Pearson Correlation	-,074
	Sig. (2-tailed)	,497
	N	87
sad	Pearson Correlation	-,118
	Sig. (2-tailed)	,277
	N	87
social	Pearson Correlation	,053
	Sig. (2-tailed)	,625
	N	87
family	Pearson Correlation	,181
	Sig. (2-tailed)	,093
	N	87
friend	Pearson Correlation	,037
	Sig. (2-tailed)	,736
	N	87
certain	Pearson Correlation	-,062
	Sig. (2-tailed)	,571
	N	87
focuspast	Pearson Correlation	,052
	Sig. (2-tailed)	,635
	N	87
focuspres	Pearson Correlation	-,019
	Sig. (2-tailed)	,859
	N	87
focusfut	Pearson Correlation	-,181
	Sig. (2-tailed)	,094
	N	87
time	Pearson Correlation	-,002
	Sig. (2-tailed)	,986
	N	87
work	Pearson Correlation	,190
	Sig. (2-tailed)	,078
	N	87
leisure	Pearson Correlation	,124
	Sig. (2-tailed)	,253
	N	87
home	Pearson Correlation	-,178
	Sig. (2-tailed)	,099
	N	87
money	Pearson Correlation	-,217*
	Sig. (2-tailed)	,043
	N	87
relig	Pearson Correlation	-,357**
	Sig. (2-tailed)	,001
	N	87
death	Pearson Correlation	,140
	Sig. (2-tailed)	,195
	N	87
swear	Pearson Correlation	,035
	Sig. (2-tailed)	,746
	N	87

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		MEAN_BASReward
MEAN_BASReward	Pearson Correlation	1
	Sig. (2-tailed)	
	N	55
Word per sentence	Pearson Correlation	,016
	Sig. (2-tailed)	,906
	N	55
SIX	Pearson Correlation	-,166
	Sig. (2-tailed)	,226
	N	55
PPRON	Pearson Correlation	,427**
	Sig. (2-tailed)	,001
	N	55
i	Pearson Correlation	,421**
	Sig. (2-tailed)	,001
	N	55
we	Pearson Correlation	,054
	Sig. (2-tailed)	,696
	N	55
adverb	Pearson Correlation	-,046
	Sig. (2-tailed)	,741
	N	55
negate	Pearson Correlation	-,016
	Sig. (2-tailed)	,907
	N	55
affect	Pearson Correlation	,145
	Sig. (2-tailed)	,290
	N	55
posemo	Pearson Correlation	,082
	Sig. (2-tailed)	,550
	N	55
negemo	Pearson Correlation	,124
	Sig. (2-tailed)	,366
	N	55
anx	Pearson Correlation	,181
	Sig. (2-tailed)	,186
	N	55
anger	Pearson Correlation	,075
	Sig. (2-tailed)	,586
	N	55
sad	Pearson Correlation	-,117
	Sig. (2-tailed)	,394
	N	55
social	Pearson Correlation	,050
	Sig. (2-tailed)	,715
	N	55
family	Pearson Correlation	,018
	Sig. (2-tailed)	,896
	N	55
friend	Pearson Correlation	,179
	Sig. (2-tailed)	,192
	N	55
certain	Pearson Correlation	,044
	Sig. (2-tailed)	,750
	N	55
focuspast	Pearson Correlation	,012
	Sig. (2-tailed)	,929
	N	55
focuspres	Pearson Correlation	,103
	Sig. (2-tailed)	,456
	N	55
focusfut	Pearson Correlation	,029
	Sig. (2-tailed)	,836
	N	55
time	Pearson Correlation	,034
	Sig. (2-tailed)	,807
	N	55
work	Pearson Correlation	-,051
	Sig. (2-tailed)	,712
	N	55
leisure	Pearson Correlation	-,160
	Sig. (2-tailed)	,243
	N	55
home	Pearson Correlation	-,154
	Sig. (2-tailed)	,263
	N	55
money	Pearson Correlation	-,153
	Sig. (2-tailed)	,263
	N	55
relig	Pearson Correlation	-,099
	Sig. (2-tailed)	,474
	N	55
death	Pearson Correlation	,025
	Sig. (2-tailed)	,856
	N	55
swear	Pearson Correlation	,111
	Sig. (2-tailed)	,419
	N	55

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix I: nationality correlations with LIWC (Italian and Dutch)

Correlations

		SUM_ANX
SUM_ANX	Pearson Correlation	1
	Sig. (2-tailed)	
	N	58
Word per sentence	Pearson Correlation	-,137
	Sig. (2-tailed)	,307
	N	58
SIX	Pearson Correlation	-,231
	Sig. (2-tailed)	,081
	N	58
PPRON	Pearson Correlation	,047
	Sig. (2-tailed)	,727
	N	58
i	Pearson Correlation	-,014
	Sig. (2-tailed)	,916
	N	58
we	Pearson Correlation	-,003
	Sig. (2-tailed)	,982
	N	58
adverb	Pearson Correlation	-,027
	Sig. (2-tailed)	,843
	N	58
negate	Pearson Correlation	,426**
	Sig. (2-tailed)	,001
	N	58
affect	Pearson Correlation	-,260*
	Sig. (2-tailed)	,049
	N	58
posemo	Pearson Correlation	-,397**
	Sig. (2-tailed)	,002
	N	58
negemo	Pearson Correlation	,124
	Sig. (2-tailed)	,352
	N	58
anx	Pearson Correlation	-,145
	Sig. (2-tailed)	,277
	N	58
anger	Pearson Correlation	,279*
	Sig. (2-tailed)	,034
	N	58
sad	Pearson Correlation	,335*
	Sig. (2-tailed)	,010
	N	58
social	Pearson Correlation	,053
	Sig. (2-tailed)	,692
	N	58
family	Pearson Correlation	,213
	Sig. (2-tailed)	,108
	N	58
friend	Pearson Correlation	-,113
	Sig. (2-tailed)	,399
	N	58
certain	Pearson Correlation	-,014
	Sig. (2-tailed)	,917
	N	58
focuspast	Pearson Correlation	-,003
	Sig. (2-tailed)	,985
	N	58
focuspres	Pearson Correlation	,118
	Sig. (2-tailed)	,377
	N	58
focusfut	Pearson Correlation	-,263*
	Sig. (2-tailed)	,046
	N	58
time	Pearson Correlation	-,193
	Sig. (2-tailed)	,148
	N	58
work	Pearson Correlation	-,037
	Sig. (2-tailed)	,784
	N	58
leisure	Pearson Correlation	-,104
	Sig. (2-tailed)	,438
	N	58
home	Pearson Correlation	-,005
	Sig. (2-tailed)	,972
	N	58
money	Pearson Correlation	,254
	Sig. (2-tailed)	,054
	N	58
relig	Pearson Correlation	,177
	Sig. (2-tailed)	,184
	N	58
death	Pearson Correlation	.c
	Sig. (2-tailed)	.
	N	58
swear	Pearson Correlation	-,025
	Sig. (2-tailed)	,854
	N	58

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

c. Cannot be computed because at least one of the varie

Correlations

		SUM_ANX
SUM_ANX	Pearson Correlation	1
	Sig. (2-tailed)	
	N	28
Word per sentence	Pearson Correlation	-,110
	Sig. (2-tailed)	,577
	N	28
SIX	Pearson Correlation	,174
	Sig. (2-tailed)	,375
	N	28
PPRON	Pearson Correlation	,215
	Sig. (2-tailed)	,272
	N	28
i	Pearson Correlation	,097
	Sig. (2-tailed)	,624
	N	28
we	Pearson Correlation	-,191
	Sig. (2-tailed)	,331
	N	28
adverb	Pearson Correlation	,068
	Sig. (2-tailed)	,731
	N	28
negate	Pearson Correlation	,114
	Sig. (2-tailed)	,562
	N	28
affect	Pearson Correlation	,017
	Sig. (2-tailed)	,930
	N	28
posemo	Pearson Correlation	-,184
	Sig. (2-tailed)	,347
	N	28
negemo	Pearson Correlation	,367
	Sig. (2-tailed)	,055
	N	28
anx	Pearson Correlation	,197
	Sig. (2-tailed)	,316
	N	28
anger	Pearson Correlation	,159
	Sig. (2-tailed)	,418
	N	28
sad	Pearson Correlation	,104
	Sig. (2-tailed)	,598
	N	28
social	Pearson Correlation	,423*
	Sig. (2-tailed)	,025
	N	28
family	Pearson Correlation	,072
	Sig. (2-tailed)	,716
	N	28
friend	Pearson Correlation	,004
	Sig. (2-tailed)	,985
	N	28
certain	Pearson Correlation	,254
	Sig. (2-tailed)	,192
	N	28
focuspast	Pearson Correlation	,091
	Sig. (2-tailed)	,646
	N	28
focuspres	Pearson Correlation	-,014
	Sig. (2-tailed)	,943
	N	28
focusfut	Pearson Correlation	-,322
	Sig. (2-tailed)	,094
	N	28
time	Pearson Correlation	,034
	Sig. (2-tailed)	,863
	N	28
work	Pearson Correlation	-,006
	Sig. (2-tailed)	,976
	N	28
leisure	Pearson Correlation	-,238
	Sig. (2-tailed)	,223
	N	28
home	Pearson Correlation	-,083
	Sig. (2-tailed)	,674
	N	28
money	Pearson Correlation	,002
	Sig. (2-tailed)	,990
	N	28
relig	Pearson Correlation	,074
	Sig. (2-tailed)	,708
	N	28
death	Pearson Correlation	,501**
	Sig. (2-tailed)	,007
	N	28
swear	Pearson Correlation	-,065
	Sig. (2-tailed)	,742
	N	28

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).