Thinking about thinking – a study of anxiety, neuroticism and Need for Cognition.

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Previous studies have shown that the FFM factor neuroticism was negatively correlated with Need for Cognition. Anxiety has been shown to be highly correlated with neuroticism. It has also been shown that women tend to score higher on both neuroticism and anxiety. Need for Cognition has been shown to predict long term academic success. This study aims to contribute to the current understanding of anxiety, neuroticism and Need for Cognition by examining these three constructs together. The study will also analyze how gender can affect the relationships between the constructs. 272 participants responded to three questionnaires measuring the constructs. 86 were men, 183 were women and 3 defined themselves as “other”. 246 of the respondents were university students and 26 responded did not currently study at university. Results indicate that anxiety is a negative predictor for Need for Cognition. This is speculated to be because anxiety has an effect on working memory which in turn is associated with Need for Cognition. Gender differences are significant regarding all three constructs. Findings are complicated by a negative suppressor effect. Results, limitations, and future research are discussed.


Thinking about the world and trying to understand it is something that seems to be uniquely human. Yet most of us know that one person who seems to prefer staying grounded, dealing with what is in front of them, instead of diving into abstract ideas. Like, did we come from the hands of a deity or did we walk out of the oceans? And when all comes around - does it even matter? Need for Cognition (NFC) is a personality trait that touches on this type of behavior. It is defined as “the tendency to engage in and enjoy thinking” (Cacioppo and Petty, 1982). It has been studied on its own (e.g. Steinhart & Wyer, 2009; Cacioppo et al., 1996; Cursel et al., 2013), together with intelligence (e.g. Furnham and Thorne, 2013; Hill et al., 2013), working memory (e.g. Hill, Foster, Sofko, Elliott, & Shelton, 2016) and with the Five Factor Model of personality (e.g. Furnham & Thorne, 2013). It has been shown to partly predict academic success in life (Cacioppo et al., 1996) and to be negatively associated with neuroticism (Bodling, & Martin, 2011; Tuten & Bosnjak, 2001). Neuroticism, in turn, has been shown to be closely linked to anxiety (e.g. Widiger et al., 2009; Vittengl, 2017). Anxiety has been shown to have a detrimental effect on working memory performance (e.g. Eysenck & Calvo, 1992; Eysenck, Derakshan, Santos, Calvo, 2007).

Seeing as NFC has a negative association with neuroticism it is possible that NFC has a negative association with anxiety as well. This link between NFC and anxiety has, to our knowledge, not been as researched as the link between NFC and neuroticism. It could be important to investigate this link because NFC partly predicts academic success, has a negative association with neuroticism, and because neuroticism is highly associated with anxiety. Gender has been shown to be associated with both neuroticism and anxiety. Hence, it could be important to investigate the association between gender and these constructs.
The present study investigates the associations between anxiety, neuroticism, NFC and gender. A deeper understanding of how these three constructs are associated could help further the knowledge within the field and of the constructs, and perhaps also contribute to an understanding of how to facilitate NFC. This could highlight the need to help students with anxiety so that they can achieve higher academic success (Cacioppo et al., 1996). On a side note, there was a limited amount of studies made on a Swedish population and it would be interesting to see if the results of a Swedish sample is in line with the predicted results.

### Theoretical basis

#### Anxiety

Anxiety can be defined as a bodily warning system that is able to prepare the body to react to potentially dangerous situations. Muscle tension is increased and the sympathetic nervous system is activated. This leads to increased heart rate, blood pressure, sweat gland activity, respiration as well as increased gastrointestinal and bladder activity. The individual may feel tense and flushed, have palpitations, shortness of breath, increased perspiration - and, sometimes, even the need to defecate or urinate. Endocrine responses increase epinephrine, norepinephrine, cortisol, prolactin, and growth hormones. This can be useful by directing the individual’s attention to danger and motivate an appropriate threat reaction. However, when severe, this response can become disorganizing and counterproductive (Hoehn-Saric & McLeod, 2000; Tsigos & Chrousos, 2002).

It was Spielberger (1966) who first suggested that anxiety can be divided into two different categories: state anxiety and trait anxiety. Anxiety states are short term states characterized by feelings of apprehension and tension, together with arousal of the autonomic nervous system. Trait anxiety, on the other hand, is a person’s general tendency to perceive circumstances overall as more threatening and responding to these with state anxiety reactions. As such, if one has high trait anxiety, the person might perceive an objectively safe situation as very dangerous and respond to it with strong state anxiety reactions disproportionate to the actual danger at hand. Thus, anxiety can be a normal reaction to an event, but can also become problematic when too prevalent or manifesting with too much intensity (Spielberger, 1966; Holt et al., 2009). Furthermore, there is a biological basis for unconscious emotional vigilance, which is a characteristic of trait anxiety. Etkin et al. (2004) found that responses to threat-related stimuli were influenced by conscious and unconscious processes. This was discovered by mapping the neural systems underlying these processes. It was shown that differences in trait anxiety was correlated to the subject’s reaction time when faced with threat. The conclusion was that there is indeed unconscious emotional vigilance; trait anxiety - and a biological basis for it (Etkin et al., 2004). Finally, in a meta-analysis by Mitte (2008), comprehensive evidence of memory enhancement for threat-related information, that affected both implicit and explicit processes in high-anxious individuals. This shows that people with higher levels of both trait and state anxiety are more inclined to pick up and remember threat-related information than people with lower levels of anxiety.

In addition, Liebert and Morris (1967) have proposed there are two separate components to experiencing anxiety: an emotional component and a cognitive component. Emotional factors refer to autonomic arousal such as nervousness and tension, reflecting the immediate uncertainty of the situation. Cognitive factors include worry or lack of confidence - thinking about what would happen if one would fail (Liebert & Morris, 1967; Morris, Davis, Hutchings, 1981). However, Hoehn-Saric and McLeod (2000) points out that individuals with chronic anxiety do not have increased emotional, autonomic levels (e.g. increased blood pressure, respiration, heart rate) while at rest, although they react more often and more severely than people who do not have chronic anxiety.

Anxiety has been shown to have an effect on performance (Yerkes & Dodson, 1908; Broadhurst, 1957; Oxendine, 1970; Altenmüller, Ioannou, Raab, Lobinger, 2014), regarding both emotional and cognitive components. Distraction theories suggest that both factors of anxiety will occupy a person’s working memory which makes it harder to process the task at hand. A highly anxious person will have to exert more effort to do the same job as a person with low anxiety (Eysenck & Calvo, 1992; Eysenck, 1998). This is further supported by findings that focusing attention inwardly when anxious also is associated with reduced performance, since this disrupts automated skills (Baumeister, 1984).

McLean and Anderson (2009) report that there is substantial evidence indicating that women report greater levels of fear and are more likely to develop anxiety disorders than men (Bourdon et al., 1988; Weissman & Merikangas, 1986). Kelly, Forsyth, Karekla (2006) reported that women are twice as likely as men to develop a panic disorder during their lifetime. However, Bander and Betz (1981) did not find many differences between genders when using a measure of trait anxiety that emphasizes physiological indicators, but that women did score higher than men on the State-Trait Anxiety Inventory (STAI). Thus,
there seems to be a tendency for women to manifest anxiety with cognitive or affective means rather than in a physiological way, where gender differences could not be distinguished (Kelly, Tyrka, Anderson, Price & Carpenter, 2008).

The Five-Factor model

Personality traits are relatively stable sets of emotional, cognitive and behavioural characteristics (Holt et al., 2012). Trait theory seeks to define personality on a dimensional scale where, for example, a person can be anywhere from very neurotic to not neurotic at all (Holt et al., 2012). There are several different taxonomies of personality traits. This study uses the Five-Factor model, which is a thoroughly researched taxonomy (McCrae & Costa, 1987) that is well established in the field of psychology (Holt et al., 2009; Pervin & John, 1999). This taxonomy was taken through thorough analysis of different personality measures which showed that the variation from different instruments can be summarized in the five dimensions of personality that the Five-Factor model uses (Zakrisson, 2010). This is reinforced by McCrae and Costa (2003) who claim that the five dimensions of the Five-Factor model are all that are needed to capture the basic structure of personality.

The Five-Factor model consists of neuroticism, Extraversion, Agreeableness, Conscientiousness and Openness (McCrae, R. & John, O., 1992). Measurements of these personality traits show that results from self-reports and observer reports are strongly correlated (McCrae & Costa, 1987) which suggests that the Five-Factor model can be assessed by using a self-report questionnaire. It’s also proven to be a robust and valid taxonomy in analyses of both children and adults (Digman, 1997) and in analyses from different cultures with different languages (Allik, 2005; McCrae & Costa, 1997).

Neuroticism

Out of the five dimensions of the Five-Factor model, neuroticism is the factor of interest for this article due to its strong and thoroughly researched association with anxiety (Widiger et al., 2009; Vittengl, 2017). Neuroticism concerns the tendency to experience negative emotions, where high scores on the scale indicates an increased tendency to experience negative emotions and low scores suggests a more emotionally stable personality (Zakrisson, 2010; Holt et al, 2012; McCrae & Costa, 2987; McCrae, R. R. & John, O. P., 1992). Watson and Clark (1984) highlight that people scoring high on neuroticism can be experiencing chronic negative emotions. High scorers are emotional, unsure and nervous people that worry a lot (Zakrisson, 2010).

Neuroticism has been linked to many different forms of psychopathology where depression and anxiety are but two examples (Widiger et al., 2009; Vittengl, 2017). As further evidence for this relationship, a meta-analysis by Kotov, Gamez, Schmidt and Watson (2010) highlighted neuroticism as the personality dimension most strongly connected to psychopathology. On an amusing side note, they mention that the connection between neuroticism and psychopathology was so strong the results were rare for social sciences (Kotov et al., 2010). Neuroticism and GAD (Generalized Anxiety Disorder) have a large descriptive overlap with each other (Hettema, Prescott & Kendler, 2004). Hettema et al., (2004) also shows that GAD and neuroticism share a significant amount of genetic liability, showing a biological relationship between the two. Many articles have shown that neuroticism is a prominent risk factor for psychopathology and specifically for anxiety disorders (Kotov et al., 2010; Widiger et al., 2009; Vittengl, 2017; Watson & Clark., 1984; Trull & Sher, 1994).

In order to understand neuroticism as a construct, Perkins, Arnone, Smallwood and Mobs (2015) theorized about the nature of the neurotic mind by highlighting Self Generated Thoughts (SGT) as the engine of the neurotic mind. This was also an attempt to explain why neuroticism and creativity has been shown to have a positive relationship (Batey, Furnham & Safiullina, 2010). This supposed relationship, however, is in conflict with Wolfradt and Pretz (2001) results which showed a negative relationship between neuroticism and creativity. Nevertheless, SGTs are thought processes that are active and independent from current ongoing stimulus (Andrews-Hanna, Smallwood & Spreng, 2014). This form of cognitive activity has clear physiological responses as the thoughts affect for example heart rate (Smallwood, 2013). Perkins et al. (2015) concludes that SGT is a core mechanism in neuroticism as it can explain the tendency for neurotic people to experience negative emotions in the absence of stimuli.

Concerning gender, there is a clear tendency for women to score significantly higher on neuroticism than men (Weisberg, DeYoung, Hirsh, 2011; Lynn & Martin, 1997; Chapman, Duberstein, Sörensen & Lyness, 2007; Schmitt, Realo, Voracek & Allik, 2008). In the Chapman et al. (2007) study, older women (aged over 65) scored moderately higher on neuroticism than men from the same age cohort and Lynn and Martin (1997) showed that women from 37 different countries all scored higher than men on neuroticism. Furthermore, in the Schmitt et al. (2008) study women reported significantly higher levels
of neuroticism than men in 49 out of 55 different nations where the size of the differences ranged from large to negligible.

Need for Cognition

Researchers have used different terms to describe the personality trait today referred to as “Need For Cognition” (Murphy, 1947; Katz, 1960). NFC has been described as “[...]a need to structure relevant situations in meaningful, integrated ways. It is a need to understand and make reasonable the experiential world[...]” (Cohen, Stotland, & Wolfe, 1955 p.291). NFC can be also be seen as a need that can be satisfied by internal goal-oriented behaviour; the individual doesn’t need to seek satisfaction from the outside world, which is done to satisfy other human needs (Cohen, Stotland & Wolfe, 1955). Cacioppo and Petty (1982) defined NFC as a trait of the individual difference in the “tendency to engage in and enjoy thinking”. A manifestation of NFC is shown by Shehab and Nussbaum (2014) in that college students with higher NFC report more mental effort when having a discussion and presenting arguments than those with lower NFC. Another difference between an individual who scores high on NFC and one who scores low is manifest in that the high scorer tend to think more carefully and be more influenced by the strength and quality of arguments than the low scorer, who instead focus more on peripheral cues such as the credibility of the source (Cacioppo et al., 2009). In a somewhat extreme (but helpful) example, low scorers could conclude that, because they score a high grade on an English exam, they will also score high on a Math exam. In this example, a high scorer would not infer this relationship, but instead gather more information before drawing a conclusion.

NFC has been shown to be a trait that is stable over time and that is able to partly predict academical achievements (Cacioppo et al. 1996). People with high scores on NFC have a tendency to adapt their performance in accordance to the difficulty of a task (Steinhart & Wyer, 2009). With the definition of NFC being a “tendency to engage in and enjoy thinking”, it is understandable that high scorers are more intellectually curious and take it upon themselves to search for and analyze information in order to better understand the relationships between things both big and small (Cacioppo et al., 1996). This is in contrast to low scorers who rely more on cognitive heuristics and well known people of authority to understand the world (Cacioppo et al., 1996). The difference in ways of thinking can also be seen in group situations (Curşeu, 2011). For example, people with higher scores on NFC tend to bridge the gender gap in communication in small groups more often than low scorers (Curşeu, 2011). High scorers on NFC would try to gather information from as many group members as possible, even from those who have different opinions and gender than they have, whereas low scorers would work to get done as quickly as possible without the need to gather “unnecessary information”.

There are significant relationships between NFC and three of the Five Factor Model personality dimensions. NFC is positively correlated to both Openness and Conscientiousness and negatively correlated to neuroticism (Furnham & Thorne, 2013). This trend is supported by Tuten and Bosnjak (2001), concerning web usage and personality and by Dornic, Ekehammar & Laaksonen (1991) concerning the relationship between Mental Effort Tolerance Questionnaire (METQ) and neuroticism measured by Eysenck’s Personality inventory (Bodling, & Martin, 2011). Sadowski and Cogburn (1997) shows that NFC and neuroticism have a first-order negative correlation but also found that the relationship between NFC and neuroticism was virtually eliminated when the other personality dimensions of the Five Factor Model were controlled for.

In summary high trait anxiety can lead to dysfunctional reactions were the responses meant to help instead lead to a disorganising and counterproductive reaction (Hoehn–Saric & McLeod, 2000; Tsigos & Chrousos, 2002). Scoring high on neuroticism has been strongly linked to high trait anxiety in several studies (Dornic et al. 1991; Widiger et al., 2009; Vittengl, 2017; Kotov et al., 2010; Hettema et al. 2004). NFC and neuroticism have a negative correlation. To our best knowledge, there are few studies regarding the relationship between anxiety and NFC. However, previous research suggests that there could be a negative correlation between anxiety and NFC (e.g. Dornic et al. 1991; Hoehn-Saric & McLeod, 2000; Furnham & Thorne, 2013).

Study purpose

The relationship between NFC and neuroticism has not been extensively explored in a Swedish population. Nor has NFC been researched in depth related to anxiety. Furthermore, gender differences have been found for anxiety and neuroticism (e.g. Bourdon et al., 1988; Lynn & Martin, 1997). Therefore, the present study investigates the associations between anxiety, neuroticism, NFC and gender. A deeper understanding of how these three constructs are associated could help further the knowledge within the field and of the constructs, and perhaps also contribute to an understanding of how to facilitate NFC.
This could help students achieve higher academic success and highlight the need to help people with anxiety (Cacioppo et al., 1996). The study also intended to compare the relationship between these factors in relation to gender, seeing as women tend to score higher on anxiety and neuroticism measures. The study will also try to ascertain whether the relationships between the traits can be explained in light of previous research. With regard to aforementioned studies we expect that:

1. There is a positive association between anxiety and neuroticism.
2. There is a negative association between anxiety and Need for Cognition.
3. There is a negative association between neuroticism and Need for Cognition.
4. There are significant gender differences with regard to anxiety, neuroticism and Need for Cognition.
5. Anxiety will be negatively associated with Need for Cognition when controlled for gender.
6. Neuroticism will be negatively associated with Need for Cognition when controlled for gender.

Method

Participants

The participants were recruited during a three week period. The recruitment process consisted of advertising the study on online social media with links to the questionnaires available on various pages. There were two sets of questionnaires: one for university students and one for people not currently studying at university. The reason for this was to make the sample more representative for a normal population. The difference between the two versions was that one background question was changed (from “What do you study?” to “What is your occupation?”) and one was removed (“What term do you study?”). In total 272 participants responded to the questionnaire, where 86 were men, 183 were women and 3 defined themselves as “other”. Ages ranged between 17-60 (mean between 23-25). 246 of the respondents responded to the set for university students and 26 responded to the set for people not studying at university.

Instruments

Three different self report questionnaires were used in the survey to measure the three different aspects of personality. As questionnaires were administered online, Cronbach’s α was used to estimate internal consistency in the present sample.

STAI-T. A Swedish version of State-Trait Anxiety Inventory - T (STAI-T) was used to measure the participants Trait Anxiety (Spielberger, Gorsuch & Lushene, 1970). The STAI-T questionnaire consists of 20 items rated on a 4 point Likert-like scale (1 = Almost never, 2=Sometimes, 3=Often, 4 =Almost always), 7 items on the scale are reversed and therefore requires reverse scoring in order to show that high scores on the questionnaire indicate higher levels of trait anxiety. STAI-T has cut-of values for normal control groups Men: M = 34.89, SD = 9.19 and Women: M = 34.79, SD = 9.22 (Spielberger et al., 1970). Cronbach’s α has been shown to be .81 (Schmader, 2002). For men in our sample, M = 41.94, SD = 11.21, and for women M = 45.81, SD = 11.84 and Cronbach’s α for the sample was .93. The range for the sample was 57 out of maximum 80.

BFI. The full version of the Swedish Big Five Inventory (BFI) scale (Claesson, Persson, & Akrami, 2001) consists of 44 items, designed to measure personality using the Five-Factor model of personality. The items are rated on a 5 point Likert-like scale (1=totally disagrees to 5= totally agrees). For this survey only the 8 items measuring neuroticism were used. Out of the 8 items 3 items items on the scale are reversed and therefore requires reverse scoring in order to show that high scores on the questionnaire indicate higher neuroticism. Mean scores on neuroticism are 18.8 (SD = 4.82) for men and 21.33 (SD = 5.52) for women for a normal population in Sweden. Cronbach’s α for the scale was .80 (Zakrisson, 2010). For men in our sample, M = 20.33, SD = 5.95, and for women M = 23.35, SD = 6.01 and Cronbach’s α was .86. The range for the sample was 30 out of maximum 40.

METQ. NFC was measured with the short Swedish Mental Effort Tolerance Questionnaire (METQ) scale (Dornic, Ekehammar & Laaksonen, 1991). The scale consists of 30 items rated on a 5 point Likert-like scale (1 = strongly disagree, 3 = neutral, and 5 = strongly agree). 18 items on the scale are reversed and requires reverse scoring in order to show that high scores on the questionnaire indicate high NFC. The scale to measure NFC was constructed from Cacioppo and Petty’s definition in 1982 (Cacioppo and Petty, 1982) and was validated by Cacioppo, Petty, Feinstein and Jarvis (1996) and was shown to be reasonably reliable and valid as a measurement of NFC. The Swedish version of the NFC scale (METQ)
was developed by Dornic et al. (1991) and later had its reliability and validity tested by Stenlund and Jonsson (2017) which showed that METQ was acceptable in an educational context. Stenlund and Jonsson (2017) showed that the shortened questionnaire have a good test retest reliability with an average intra class correlation at .88 (.83; .92) and a Cronbach’s α at .88. The mean score on METQ from Stenlund and Jonsson (2017) is 102.64, SD = 15.51 with a range of 85 according to B. Jonsson (Personlig kommunikation, 28th March 2017). For men in our sample, M = 115.35, SD = 13.54, and for women M = 111.22, SD = 13.31. In our sample, Cronbach’s α was ,86. The range for the sample was 84 out of maximum 150.

Data analysis

Statistical analyses were done with IBM SPSS Statistics 23. Descriptive analyses were made regarding Frequency, SD, Mean, Range, Skewness and Kurtosis for the questionnaire variables ‘STAI-T’, ‘BFI’ and ‘METQ’. This showed that the METQ ranged from 61 to 145. This means that even though the Kurtosis and Skewness results were within acceptable margins (Skewness = -.411, Kurtosis = .52), extra caution is advised when drawing conclusions from these results. The results did show that the different scales are normally distributed for the sample. The gender group “Other” was small (N= 3) and was therefore not taken into account when gender was used as a grouping or controlling variable. There was no missing data.

Bivariate correlation analysis (Pearson’s r) was used to analyse the associations between the different constructs.

To analyze potential gender differences an independent samples t-test with Gender as the grouping variable was used. If significant, Gender was controlled for in a linear regression model (step 1), with METQ as the dependent variable, and BFI and STAI-T as independent predictors (step 2).

A very high correlation between the independent variables STAI-T and BFI r(.81) was found. This indicated a possible multicollinearity problem (Mansfield & Helms, 1982). Schroeder, Lander and Levine-Silverman (1990) specifies that an r > .85 could be a sufficient, albeit not necessary, condition for multicollinearity. Since the relationship between STAI-T and BFI was close to this level, it was deemed a possibility.

With regard to the high correlation between STAI and BFI it could be argued that a composite variable should be constructed from the variables. Since anxiety is linked to neuroticism but hierarchically separated and conceptually different from each other (e.g. Widiger et al., 2009; Vittengl, 2017), it was instead decided to run three separate hierarchical regression models. This setup made it possible to investigate the effects of multicollinearity, more specifically a potential negative suppressor effect. A negative suppressor effect is an effect where the variables compete against each other to explain the variance in the regression. This makes it more difficult to interpret the data (McFatter, 1979; Tzelgov & Henik, 1991). Such an effect would be displayed as changes in directions in beta weights and direction of the partial correlations (Pandey & Elliott, 2010; Tzelgov & Henik, 1991; Conger, 1974). In all models gender was entered in step 1 and METQ as the dependent variable. In Model 1 STAI-T and BFI were entered as predictors. In Model 2 only STAI-T was entered as a predictor in and in Model 3 only BFI was entered as a predictor.

Ethics

In order to make sure that the study was ethically sound we chose to follow the ethic principles for science in the humanities (Vetenskapsrådet, 2002). The participants were informed that participation was voluntary, that results would only be presented at group level, and that they could withdraw their participation at any time before submitting the data. The data was treated confidentially, with as much anonymity for the participants as possible. They were also informed that the data would only be used for scientific purposes.

Results

STAI-T and BFI showed a significant, very strong correlation as presented in table 1. STAI-T and METQ showed a significant, modest correlation. These results were in line with hypothesis one and two. BFI and METQ were not significantly correlated, although there was a tendency for them to be (r = -.11, p = 0.63). Therefore, hypothesis three was rejected, although there was a tendency for it to be supported. Gender was correlated with all three measures.
Table 1. Correlations

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. METQ</td>
<td>-</td>
<td>-.14*</td>
<td>-.11</td>
<td>-.12*</td>
</tr>
<tr>
<td>2. STAI-T</td>
<td>-</td>
<td>.81**</td>
<td>.19**</td>
<td>-</td>
</tr>
<tr>
<td>3. BFI</td>
<td>-</td>
<td>-.27**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Gender</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. METQ (Swedish Mental Effort Tolerance Questionnaire), STAI-T (State-Trait Anxiety Inventory – T), BFI (Big Five Inventory).

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 2 display the mean values, standard deviations and Cohens $d$ (Cohen, 1992) effect sizes. The independent samples t-test showed significant differences between genders for all three questionnaire. The results showed that women scored lower on METQ $t(267) = 2.36, p<.05$ and higher on STAI-T $t(267) = -2.54, p<.05$ and BFI $t(267) = -3.98, p<.01$. This result was in line with hypothesis four. Cohens $d$ indicated small to moderate effect sizes.

Table 2. Mean values, standard deviations and effect sizes

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean</th>
<th>SD</th>
<th>Cohens $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>METQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>115.35</td>
<td>13.54</td>
<td>0.31</td>
</tr>
<tr>
<td>Women</td>
<td>111.22</td>
<td>13.31</td>
<td></td>
</tr>
<tr>
<td>STAI-T</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>41.94</td>
<td>11.21</td>
<td>0.33</td>
</tr>
<tr>
<td>Women</td>
<td>45.81</td>
<td>11.84</td>
<td></td>
</tr>
<tr>
<td>BFI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>20.23</td>
<td>5.95</td>
<td>0.50</td>
</tr>
<tr>
<td>Women</td>
<td>23.35</td>
<td>6.01</td>
<td></td>
</tr>
</tbody>
</table>

Note. METQ (Swedish Mental Effort Tolerance Questionnaire), STAI-T (State-Trait Anxiety Inventory – T), BFI (Big Five Inventory). Cohens $d = 0.2$ small, $0.5$ moderate and $0.8$ large effect size.

For the regression analyses, Model 1 was significant, $F(3, 271) = 2.854, p < .05$. This was partially in line with hypothesis five and six. The analysis showed that the combined effect of STAI and BFI leads to lower METQ when controlling for gender. Hence, the model was significant, but no single predictor in the model was significant (see table 3). STAI-T and gender were negative predictors of METQ while BFI revealed a positive effect on METQ. This positive association was in contrast with the expected result that BFI should have a negative impact on METQ. Partial correlations for Model 1 show: BFI: $r = .03$; STAI: $r = -.10$, gender: $r = -.12$. To investigate the possibility of a negative suppressor effect, additional regression analyses (Model 2 & 3) with STAI-T and BFI analyzed separately with gender entered in step 1, were conducted.

Model 2 with STAI-T as a predictor was significant ($F(2, 271) = 4.19, p < .05$) with STAI-T as a significant, negative predictor for METQ. The partial correlations in Model 2 for STAI-T was -.10.

In Model 3 BFI was entered as a predictor. The model was significant ($F(2, 271) = 3.05, p < .05$). However, BFI as an individual predictor was non-significant in a negative direction. This is in contrast to the direction in Model 1 and in contrast to findings of Sadowski and Cogburn (1997). In addition, the STAI-T predictor lost some weight in the same process. Gender, however, remained stable across all three models (see table 3). The partial correlations of BFI in Model 3 added to the evidence of a negative suppressor effect. They showed the same tendencies as the beta weights, namely that the effect of BFI changed direction. Correlations, beta values, and partial correlations in the different models indicate a negative suppressor with BFI as the suspected suppressor variable (Pandey & Elliott, 2010; Tzelgov & Henik, 1991; Conger, 1974).
Table 3. Regression analyses

<table>
<thead>
<tr>
<th>Model</th>
<th>Step 1</th>
<th>Dependent variables</th>
<th>Independent variables</th>
<th>B (SE)</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>Partial η²</th>
<th>F (model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Step 1</td>
<td>METQ</td>
<td>Gender</td>
<td>-3.46 (1.69)</td>
<td>-.12</td>
<td>-2.05</td>
<td>.041</td>
<td>-.12</td>
<td>F (3, 271) = 2.854*</td>
</tr>
<tr>
<td></td>
<td>Step 2</td>
<td>METQ</td>
<td>Gender</td>
<td>-2.95 (1.75)</td>
<td>-.11</td>
<td>-1.69</td>
<td>.093</td>
<td>-.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BFI</td>
<td>.10 (.23)</td>
<td>.05</td>
<td>.45</td>
<td>.056</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STAI-T</td>
<td>-.18 (.12)</td>
<td>-.16</td>
<td>-.56</td>
<td>.120</td>
<td>-.09</td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>Step 1</td>
<td>METQ</td>
<td>Gender</td>
<td>-3.46 (1.69)</td>
<td>-.12</td>
<td>-2.05</td>
<td>.041</td>
<td>-.12</td>
<td>F (2, 271) = 4.19*</td>
</tr>
<tr>
<td></td>
<td>Step 2</td>
<td>METQ</td>
<td>Gender</td>
<td>-2.79 (1.71)</td>
<td>-.10</td>
<td>-1.63</td>
<td>.104</td>
<td>-.10</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>STAI-T</td>
<td>-.14 (1.71)</td>
<td>-.12</td>
<td>-.03</td>
<td>.043</td>
<td>-.10</td>
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</tr>
<tr>
<td>Model 3</td>
<td>Step 1</td>
<td>METQ</td>
<td>Gender</td>
<td>-3.46 (1.69)</td>
<td>-.12</td>
<td>-2.05</td>
<td>.041</td>
<td>-.12</td>
<td>F (2, 271) = 3.05*</td>
</tr>
<tr>
<td></td>
<td>Step 2</td>
<td>METQ</td>
<td>Gender</td>
<td>-2.81 (1.75)</td>
<td>-.10</td>
<td>-1.61</td>
<td>.110</td>
<td>-.10</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>BFI</td>
<td>-.19 (.14)</td>
<td>-.09</td>
<td>-.37</td>
<td>.171</td>
<td>-.08</td>
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Note. METQ (Swedish Mental Effort Tolerance Questionnaire), STAI-T (State–Trait Anxiety Inventory – T), BFI (Big Five Inventory).

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

Discussion

The purpose of this study was to examine the associations between anxiety, neuroticism, Need for Cognition and gender in a Swedish sample. Three questionnaires (STAI-T, BFI and METQ) designed to measure these constructs were administered online. There were 272 participants: 86 men, 183 women and three ‘other’. To investigate hypothesis one, two and three a correlation analysis was used. An independent samples T-test was used to investigate hypothesis four. Hypothesis five and six were investigated using hierarchical regression.

The initial correlation analysis showed significant correlations except for the non-significant association between METQ and BFI. BFI and STAI-T had a particularly high correlation. The independent samples t-test showed significant differences for all three variables regarding gender. Because of this, the hierarchical regression controlled for gender in step 1 (Model 1). Since there was a high correlation between BFI and STAI-T, there was a risk of multicollinearity, which might have an effect on Model 1. To investigate this risk, it was decided to run two additional regression analyses, Model 2 and 3, to check the Beta weights and partial correlations for the predictors in separate models. This indicated multicollinearity in the form of a small negative suppressor effect. Even though the observed suppressor effect was small, it was relatively large compared to the β effect sizes.

Model 1 was significant. STAI-T was a non-significant predictor with a negative association with METQ. BFI was a non-significant predictor with a positive association with METQ. This gave credence for a negative suppressor effect, since this direction was not in line with previous research (Furnham & Thorne, 2013; Tuten & Bosnjak, 2001). In Model 2, STAI-T was a significant predictor with a negative effect on METQ. In Model 3 BFI was a non-significant predictor with a negative effect on METQ. This change in direction indicated that BFI might be the negative suppressor variable.

Hypothesis one was supported by the strong, positive correlation between anxiety and neuroticism. This was in line with earlier research (e.g. Widiger et al., 2009; Vittengl, 2017; Kotov et al., 2010). Hypothesis two was supported by the negative correlation between anxiety and NFC. This association could be because high anxiety can have a detrimental effect on working memory and working memory in turn has an impact on NFC (e.g. Eysenck et al., 2007; Derakshan & Eysenck, 2009; Hill et al., 2016). This is speculation, but seems logical in the light of previous research since anxiety can occupy cognitive resources which can limit working memory (e.g. Eysenck et al., 2007; Derakshan & Eysenck, 2009; Hill et al., 2016). Hypothesis three was rejected because no significant correlation between NFC and neuroticism was found. This was in contrast to previous research (Bodling, & Martin, 2011; Tuten & Bosnjak, 2001). The reason for this discrepancy could be the high levels of neuroticism and NFC in our data. In other words, the correlations found in previous studies may not exist near the higher end in either of the scales. It could also be random chance; the correlations in previous studies were small and
with a p-value of .63 in the present dataset the constructs are close to being significantly correlated. In either case, this could indicate a weak association. The lack of a significant correlation between neuroticism and NFC could partly explain why neuroticism was a poor predictor for NFC in the regression models.

Hypothesis four was supported by the independent samples t-test, which showed significant gender differences for all three scales. This was in line with previous research regarding gender differences for neuroticism and anxiety (e.g., Weisberg, DeYoung, Hirsh, 2011; Lynn & Martin, 1997; Chapman et al., 2007; Schmitt et al., 2008). Caution is advised when interpreting these results, as the mean differences between genders for neuroticism, anxiety and NFC were reflected by small to moderate effects sizes. Still, the results are clear: women report higher levels of anxiety and neuroticism and men report higher levels of NFC. Furthermore, the difference between men and women on METQ indicate that men have a small but stable tendency to have higher NFC. This phenomenon could be explained by the tendency for women to be more anxious (e.g. Bourdon et al., 1988; Weissman & Merikangas, 1986; Kelly et al., 2008) given that anxiety has a negative effect on NFC as speculated above. This, however, is only one explanation. The gender differences could also be because of the tendency for men to rate themselves as more intelligent than women rate themselves (Bennett, 1996; Petrides, Furnham & Martin, 2004; Furnham, 2001), which could extend to NFC. It is worth mentioning that women’s mean score on STAI-T in the sample were more than one standard deviation higher than the mean of a normal population. This could indicate that the sample differs from the normal population.

Hypothesis five and six were more difficult to discern. The hierarchical regression analysis showed that Model 1 was significant. In step 1, gender was shown to be a significant predictor with $\beta = -1.2$. In step 2, STAI-T showed the expected negative association with METQ, though it was non-significant as a predictor. This was partly in line with hypothesis five, but since it was a non-significant result it can not be said to clearly support the hypothesis. This could indicate that anxiety may have an effect on NFC.

BFI showed a positive association with NFC in step 2. Though it was non-significant as a predictor. This goes against hypothesis six. The effect was in contrast to previous research (Furnham & Thorne, 2013; Tuten & Bosnjak, 2001), which complicated the interpretation of Model 1. This because it, in conjunction with the high correlation with STAI-T, indicated a possible multicollinearity problem.

Models 2 and 3 were used to analyze the suspected multicollinearity problem. In Model 2 STAI-T was a significant predictor that had a weak effect on METQ ($\beta = -.12$). This goes in line with hypothesis 5 and the idea that anxiety could have a negative effect on NFC. In Model 3 BFI was non-significant with $\beta = -.09$ and had a partial correlation of .08 as compared to its partial correlation of .03 from Model 1. The change of direction for BFI in Model 3 could be evidence of a negative suppressor effect where BFI suppresses the effect STAI-T has on NFC (McFatter, 1979; Tzelgov & Henik, 1991).

It could be argued that the negative suppressor effect is an artifact of the complexities of the constructs, and that neuroticism actually affects anxiety in a way that interferes with NFC in real life (McFatter, 1979; Tzelgov & Henik, 1991). However, neuroticism should not have the opposite effect of anxiety on NFC, which makes such an argument difficult to make. Since the correlation between the independent predictors was so strong, the beta weights and partial correlations in the models behaved as described, and since neuroticism and anxiety are conceptually different, the negative suppressor effect seems to be a statistical artifact. This makes it more difficult to interpret the results. However, the observed magnitude of the negative suppressor effect was small, as shown in the models.

All three regression models were significant. Correlations showed that anxiety and NFC have a negative association. This remained true when controlled for gender. Neuroticism did not have a significant association with NFC in any model. Hence, Model 1 seems to be largely driven by gender and anxiety. From this, it could be argued that the results show that higher levels of anxiety can lead to lower NFC and that men in general, score higher on NFC. This could be because of an effect of anxiety on working memory as previously described. It could also be because women and men tend to rate themselves differently. Gender differences were found on all three constructs and high levels of anxiety were found for both men and women compared to a normal population.

Limitations

The size of the study sample is large and could be viewed as a strength of the study. In addition, the study design is quite simple which should make the results easier to interpret and the study easier to replicate. It also has a well developed theoretical basis. The instruments used have all been tried and tested and shown to be reasonably reliable measurements. These factors increase the reliability and validity of the study.
The reader should keep the limitations of the study in mind. One limitation could be that the reliability of the study could have been compromised by administering the questionnaires online, since this form of administration has not been validated for the questionnaires. To check whether the reliability was affected by the administration procedure, Cronbach’s $\alpha$ was calculated for all measures. The results showed that Cronbach’s $\alpha$ values for the measures in the sample were close to what has been shown in previous studies, which gives credence to this form of administration.

The results from METQ showed higher mean scores than previously reported according to B. Jonsson (Personlig kommunikation 28 March 2017). Our sample’s scores are on average 10.65 higher compared to the sample used in Stenlund and Jonsson (2017). The STAI-T results showed mean scores that are higher than in a normal population. Regarding gender, only 86 males responded compared to 183 women. These deviations from the normal population could make the results more difficult to generalize to other populations. On the other hand, this could also be seen as a representative sample for university students in Sweden. Concerning the METQ results it is understandable that our sample, which mainly consisted of university students, scored higher compared to the sample from Stenlund and Jonsson (2017) that consisted of upper secondary school students. It could be possible that the effects of anxiety and neuroticism on NFC could be different with a more diverse sample.

The negative suppressor effect makes data more difficult to interpret. Instead of conducting separate regressions for the independent predictors other methods could have been implemented to handle this. For example, a composite variable could have been created and used in a regression model. Since neuroticism and anxiety are conceptually different, no composite variable was created for analysis. Furthermore, if a composite variable had been created this would mean that anxiety and neuroticism could not be investigated separately, which was part of the study purpose. Another way to deal with multicollinearity is by conducting a ridge regression instead of using a linear regression model (Schroeder, Lander & Levine-Silverman, 1990). This was unfortunately outside the scope of this paper.

Finally, there might’ve been other predictors that could also have been relevant, such as depression scores and the rest of the FFM factors, since they have been shown to be associated with anxiety, depression and NFC (e.g. Widiger et al., 2009; Vittengl, 2017; Kotov et al., 2010; Furnham & Thorne, 2013) and could play an important role for understanding how NFC is associated with other personality traits.

Implications

The present study indicates that anxiety can have an adverse effect on the tendency to engage in and enjoy thinking. This is important, because NFC has been shown to partly predict academic achievement (Cacioppo et al. 1996). If higher levels of anxiety lowers NFC, then it could be a good idea to lower people’s levels of anxiety. Not only to improve performance in test situations (Cassady & Johnson, 2002), but also to facilitate thinking about and trying to understand the world outside of structured test situations. After all, it is necessary to assume that tests predict performance outside of test situations, otherwise they would serve no real life function. Thus, this could be of even greater importance outside of structured test environments. If higher anxiety reduces NFC, then lowering anxiety could be beneficial both for the individual’s well being, as well as their academic and general performance.

The study also show results outside of its intended purpose. The mean score for anxiety in the sample (Men: $M = 41.94$, $SD = 11.21$; Women: $M = 45.81$, $SD = 11.84$) are higher than the cut-off values for normal control groups (Men: $M = 34.89$, $SD = 9.19$; Women: $M = 34.79$, $SD = 9.22$) by several points. This means that our sample was more anxious than a normal population. With this in mind, it has been discussed that the sample could be representative of a population of Swedish university students. This adds to the importance of addressing the problem of high anxiety in regard to facilitating NFC. If a large portion of university students in Sweden are very anxious, and anxiety has an indirect effect on academic performance through NFC, this is dire news. On the plus side, this also means that they could perform better if their anxiety levels were lower.

The results from this study also help in developing an understanding of how NFC, anxiety, and neuroticism interact, although there is much left to discover. Finally, it adds to the existing database of knowledge on all three factors from a Swedish sample.

Summary

Anxiety levels and levels of NFC were found to be higher than in a normal population. Because of this, the sample was not deemed fully representative of a normal population. The sample was however large and deemed representative of a population of university students. There was no missing data and the
study design was quite simple, which should make analysis easier and the study easier to replicate. It also has a well developed theoretical basis, which makes the interpretation of the data more reliable.

Results showed that anxiety had a strong, positive association with neuroticism and a negative association with NFC. Neuroticism was not shown to be significantly associated with NFC, though there was an inclination towards association. There were significant gender differences for all three measures. Regression model 1 was significant. Gender and anxiety seemed to be the most driving factors, though no predictor was significant on its own. Regression model 2 was significant as a whole, and anxiety was significant on its own when controlled for gender. Regression model 3 was significant as a whole, but neuroticism was not significant on its own when controlled for gender.

Anxiety seemed to have a negative effect on NFC. This was hypothesized to be because anxiety has a detrimental effect on working memory, which in turn could have a negative effect on NFC. NFC seemed to be associated with gender. This was theorized to be because women tend to have higher anxiety, which could in turn have a negative effect on NFC. It was also discussed that this could have been because of gender differences in self ratings. Some of the results showed that neuroticism had a small, negative association with NFC. Some of the results showed that neuroticism did not have a small, negative association with NFC. This was not in line with previous research and was hypothesized to be a result of sample characteristics, a negative suppressor effect and the lack of correlation found between neuroticism and NFC in the sample. Conclusions drawn from this study should be conservative because the effects seen were small and because of a small negative suppressor effect in the predictor variables.

Future research

For future research it is recommended that a larger, more generalizable sample is used to validate the findings in this study. To validate the speculated effect of anxiety on NFC via working memory, working memory should also be tested in future studies. Furthermore, depression should be analyzed in conjunction with anxiety and NFC, seeing as this construct is also closely linked to neuroticism, and neuroticism has been shown to have a negative correlation with NFC (e.g. Furnham & Thorne, 2013; Tuten & Bosnjak, 2001). The rest of the factors in the Five Factor Model could also be relevant to explore further, as previous research has found associations between Openness and Conscientiousness and NFC (Furnham & Thorne, 2013).

It is also recommended to see if it is possible to improve NFC and long term academic performance by reducing anxiety or make anxiety levels more manageable.

Finally, it is recommended that the high anxiety levels found in this sample are studied. This trend could be problematic in a wider perspective, both for students and, by extension, white collar employees. If these high levels carry on into work-life, it is no wonder so many people experience great levels of stress and burnout, which is very costly for today’s society (Arbetsmiljöverket, 2015).

References


Murphy, G. (1947). Personality: A biosocial approach to origins and structure. doi: http://dx.doi.org/10.1080/10759-000


