The interaction effect of Effortful Control and Neuroticism on Problem-Solving Coping.

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Abstract

The primary purpose of this study was to establish an interaction effect between effortful control and neuroticism on problem-solving coping. The secondary purpose was to examine the relationships between all three variables by establishing a correlation matrix. The sample consisted of 64 individuals, 18-25 years old. The scores on the variables neuroticism and effortful control were used to create four different subtypes with high and low combination of the two variables. A two-way ANOVA showed no significant interaction effect and no main effect of the two variables on problem-solving coping. The correlation matrix showed a medium strong correlation between effortful control and problem-solving coping. The low reliability for the scales measuring effortful control and problem-solving coping makes the results difficult to interpret.
Introduction

There is a well known established negative relation between neuroticism and the use of problem-solving coping (DeLongis & Holtzman, 2005). But there is also a growing body of literature that have shown the moderating effect effortful control has on neuroticism when it comes to emotional stability, anxiety and behavioral problems (Oldehinkel, Hartman, Ferdinand, Verhulst & Ormal, 2007). In line with this it is reasonable to expect that effortful control should have a moderating effect on neuroticism when it comes to problem-solving coping. The purpose of this study is to examine whether effortful control has a modifying effect on the trait neuroticism when it comes to the use of problem-solving coping. This is done by creating four different subtypes of participants with the combinations of high neuroticism/high effortful control, high neuroticism/low effortful control, low neuroticism/high effortful control and low neuroticism/low effortful control and then testing the effects of these combinations on problem-solving coping. Also to further explore the relationship between the variables effortful control, neuroticism and problem-solving coping, a correlation analyses will be performed in this study between the variables. Following is a more detailed description of the factors and their relationship to each other.

Coping

The broader definition for coping is: a cognitive or a behavioral response to a stressor with the intention to reduce the emotional response it evokes, or to solve the situation itself that emits the stressor (Jang, Thordarson, Stein, Cohan & Taylor, 2007). Coping styles have been defined in many different ways, with equally as many different subcategories but the specific focus of this study is on the problem-solving approach. Within the body of coping literature two main types of coping emerge: engagement coping (dealing with the problem) and disengagement coping (avoiding the problem) (Valiente, Lemery-Chalfant & Swanson, 2009). Engagement coping is widely regarded as a positive way of dealing with stress while disengagement coping is regarded as a negative way of dealing with stress. Although, it should be mentioned that DeLongis and Holtzman (2005) found in their study that negative coping style, such as withdrawal, provided short-term positive effects but not long-term. The opposite applied for positive coping styles; they provided short-term negative effects but long-term positive effects. Using the definition mentioned above, problem-solving coping
falls into one of the sub-categories of engagement coping. Mainly because problem-solving coping is an active coping style where the individual focuses on the stressor/problem and tries to solve it.

**Neuroticism**

A simple description of the neuroticism variable according the Big Five theory is “that people respond emotionally to information and events or they do not” (Brebner, 2001, p.318). Individuals with high neuroticism tend to use poorer coping strategies that produce short positive effect but negative long-term effect. In a meta-analysis there was found strong evidence linking neuroticism with the coping behavior classified as disengagement coping (Connor-Smith & Flachsbart, 2007). Plenty of other studies have also found evidence for the positive relation between neuroticism and ineffective (disengaging) forms of coping, such as wishful thinking, passivity, self-blame, sedation, withdrawal, indecision (Bishop, Tong, Dions, Enkelmann, Why, Khader & Ang, 2001; Geisler, Wiedig-Allison & Weber, 2009; Kardum & Hudek-Knezevic, 1996; Kardum & Krapic, 2001; Murberg, Bru & Stephens, 2002; Uehara, Sakado, Sat & Someya, 1999) and a negative relation with active (engaging) coping styles, such as problem-solving (Pook, Tuschen-Caffier, Kubek, Schill & Krause, 2004; Vollrath, Torgersen & Alnaes, 1995). Vollrath and Torgersen (2000) found that it was the combination of high neuroticism and low conscientiousness that best predicted the reduced use of problem-solving coping. Several other studies have found a positive relation between conscientiousness and problem-solving coping (Brebner, 2001; Bishop et al., 2001).

**Effortful Control**

One particular study found a positive correlation between effortful control and conscientiousness (Jensen-Campbell, Rosselli, Workman, Santisi, Rios & Bojan, 2002). “Self-regulation, termed effortful control appears at approximately 6-12 months of age and continues to develop throughout the preschool” (Jensen-Campbell et al., 2002, p.477). The system is located in the frontal lobes and is part of a higher level system where information is more processed and allows more voluntary control (Derryberry, Reed & Pilkenton-Taylor, 2003). Effortful control can be divided into two separate systems: the inhibitory control and attention regulation system (Muris, 2006). But this study’s definition of effortful control is based on the Rothberg’s model that also consists of a third system called activation control;
ability to perform an action when there is strong tendency not to (Oldehinkel et al., 2007). A practical example of the activation control system at work would be that of an individual starting right away with a tough home assignment instead of doing some other more attractive activity. The inhibitory system, as the name inclines, serves to inhibit behavior and emotional responses deemed inappropriate. The inhibitory control system fits well the widely used description of effortful control as “the ability to inhibit a dominant response to perform a subdominant response” (Rothbart & Bates, 1998, p. 137 as cited in Moriya & Tanno, 2008). A more practical example of the inhibitory system at work would be at a time when an individual receives an unpleasant gift but still responds with thanking for the gift and smiles. The last system is called the attentional regulation system and controls the ability to shift ones attention and the ability to focus. The attentional regulation system can serve as means to highlight positive aspects of a situation, divert attention from the negative cues in the surroundings (Derryberry & Rothbart, 1997). A practical example is that of a child focusing on the potential fun a playground might bring, instead of focusing on all the potential hazards. The attentional regulation system is especially important for individuals with high levels of neuroticism, which makes them sensitive for negative cues in their surroundings.

The present study

Recent studies have shown that high effortful control could be one of the answers to why some individuals with high levels of neuroticism don’t develop anxiety syndromes (Lonigan, Vasey, Philips, & Hazen, 2004). Effortful control seems to be hindering the negative behavior reactions on stress that people with high neuroticism exhibit. The findings in Cumberland-Li, Eisenberg and Reiser (2004) study suggest that high effortful control in children helps them to deal better with stressful situations. To develop anxiety problems there is a need for high neuroticism but also low effortful control, according to Lonigan and Vasey (2009). In their study they found an interaction effect between negative effect⁠¹ and effortful control when it came to attention bias towards threat cues; further establishing the connection between effortful control and neuroticism. Moreover, Oldehinkel, Hartman, Ferdinand, Verkhuist and Ormal (2007) showed the significance of effortful control for a successful emotional and

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¹ Negative effect was the term used by the authors of the study but the term describes the same construct as neuroticism
behavior development for preadolescence. There were additive main effects for both
effortful control and negative emotionality when it came to internalizing and externalizing
problems. Effortful control was the moderator for the outcomes of negative emotionality.

Finally, Muris (2006) found neuroticism positively correlating with
psychopathological symptoms, while effortful control correlated negatively with
psychopathological symptoms. But the interesting finding was an interaction effect between
effortful control and neuroticism on psychopathological symptoms. It was a combination of
high neuroticism and low effortful control that led to the highest levels of
psychopathological symptoms. The same study found support for a reverse relation where
the combination of low neuroticism and high effortful control protected against
psychopathological symptoms, and also behavioral problems. When it comes to stressful
situations, effortful control acts perhaps as a tool that gives more insight into the width of
the situation. Maybe effortful control also provides a more efficient use of time to better
analyze the stressful situation. Simply put, when encountering stressful situations, high
effortful control would allow individuals to better screen all the coping options available for
them (Derryberry et al., 2003). Effortful control can be used as means to override the notion
of avoiding the fear-arousal stimuli in individuals with high neuroticism and deal with the
situation in a more appropriate way (Lonigan et al., 2004; Derryberry & Rothbart, 1997).

I have presented several studies supporting that effortful control acts as a
moderator for neuroticism when it comes to a series of mental health and behavior factors. I
have also presented the heavily supported notion that neuroticism has a negative
correlation with positive coping styles such as problem-solving coping. Through
conscientiousness I have also established for effortful control a link to problem-solving
coping. Conscientiousness has a positive correlation with problem-solving coping and
effortful control correlates positively with conscientiousness. A simplistic way of describing
conscientiousness is that people “…are careful, organized and ethical in their behavior or
they are not” (Brebner, 2001, p.318). It is not hard to imagine effortful control being
connected to the trait, as being careful might include processing more information on the
surroundings, therefore being able to shift ones attention with more ease. The link needs
further studies to get more clarified but at this point it provides enough of a basis for
conducting this study.

With all this bearing in mind I conducted this study, trying to find an interaction
effect between neuroticism and effortful control when it comes to problem-solving coping. Seeking also to establish how the correlations between the variables are, especially between effortful control and problem-solving coping. Based on the earlier research presented, the specific hypothesis for this study were (H1) that there is an interaction effect between neuroticism and effortful control on problem-solving coping, (H2) that there is a positive correlation between effortful control and problem-solving coping and (H3) there is a negative correlation between neuroticism and problem-solving coping.

Method

Participants

The majority of the participants were students at Lund University while the rest were in the appropriate age but did either not attend Lund University or attended a different university. The original sample consisted of 80 students. A total of 16 participants were dropped out of the study. Of the 16 participants seven were dropped because they failed to complete the entire questionnaire and nine because they were older than the chosen age category, 18-25 years. The final sample consisted of 64 individuals. In the final sample the mean age was 21.5 (SD = 1.8) and women were slightly overrepresented with 37 women and 27 men.

Measurements

A single questionnaire was formed using the parts from the following questionnaires.

Effortful control. Following Rothberg’s three dimensions of effortful control, I used the inhibitory control, attention control, and activation control subscales of the short version of the Early Adolescent Temperament Questionnaire-Revised (EATQ-R) for measuring effortful control. The reported Cronbach’s alpha for the five items making up activation control was .76. The Cronbach’s alpha for inhibitory control, which consisted of five items, was .69, just below the recommended minimum Cronbach’s alpha of .70. The Cronbach’s alpha value for attention, which consists of six items, was .67, also below what is recommended. Even though two of the three scales, attention and inhibitory control, had questionable reliability, all three scales were used in the final questionnaire. The reason behind this is that Cronbach’s alpha tends to be low for scales with less than ten items and that there is also a lack of other validated and reliable questionnaires for measuring effortful control.
control. Because EATQ-R’s primary use is for adolescence, some changes were made to the questions and one item (“it’s hard for me not to open presents before I’m supposed to.”) was removed as whole from the inhibitory scale. The item was deemed (by author) to be difficult to translate into something more appropriate for older individuals without taking too much liberty with the content. Inhibitory control (four items), attention (six items) and activation control (five items) made together up 15 items for the measurement for effortful control. All 15 items were also translated (by author) to Swedish and included into the single questionnaire used in this study. The answering alternatives ranged from 1 (=Almost always untrue) to 5 (=Almost always true) with some items reversed. The available score range for the test was 15-75 points.

**Neuroticism.** Neuroticism was measured using ten items designed to measure neuroticism according to the Big Five model. The ten items came from a Swedish translated short version IPIP five-factor inventory, which consisted originally of 100 items. The other items discarded were designed to measure conscientiousness, openness to new experience, extrovert-introvert and agreeableness. The reported Cronbach’s alpha for neuroticism on the original short IPIP five-factor inventory was .93 (Bäckström, 2007). The answering alternatives ranged from 1 (=Almost always untrue) to 5 (=Almost always true) with some items reversed. The available score range for the test was 10-50 points.

**Problem-solving coping.** Problem-solving coping was measured using Persson’s (1985) coping questionnaire. The questionnaire was developed at the Department of Psychology, in the University of Gothenburg, in Sweden and consists of 61 items designed to measure 13 different types of coping strategies. The reported mean reliability for all 13 subscales averages around .70 Cronbach’s Alpha. The only relevant subscale for this study was the “active problem solving” scale. Defined as attempts to actively solve a problem with some kind of plan and also prepares in advances for the consequences of a problem. This subscale consisted of six items and was used to make up the final questionnaire used in this study. A slight modification was made (by author) to the original answer alternatives which had a range 1-4 (1=Usually react that way described, 2=React to some degree the way described, 3=Hardly react the way described, 4=Definitely don’t react the way described) to have a range of 1-5 (1=Almost always untrue, 2=Usually untrue, 3=Sometimes true, sometimes untrue, 4=Usually true, 5=Almost always true. This was made to better fit with
the other items measuring neuroticism and effortful control, which already used the same 1-5 scale and to make the final combined questionnaire easier to make. The available score range for the test was 6-30 points.

**Procedure and data analyses**

The majority of participants were recruited directly while attending different classes at the Lund’s university. The rest were recruited on campus to obtain a sample of 80 participants. All participants were asked to fill out a short questionnaire that inquired about their usual reactions and behavior during stressful moments and, respond to different statements about their personality. No compensation was given for participating. Using the two first factors measured by the questionnaire, neuroticism and effortful control, participants were divided into four different subtypes groups. Using a median split, the four subtypes groups of participants consisted of 17 participants with high neuroticism/high effortful control, 15 participants with high neuroticism/low effortful control, 18 participants with low neuroticism/high effortful control and 14 participants with low neuroticism/low effortful control. A two-way independent ANOVA was performed with the score on the last factor of the questionnaire, problem-solving coping, as the dependent variable. A correlation analyses was performed between all the factors with the sums for each factor. All scales were also tested for their reliability.

**Results**

The descriptive statistics for the variables effortful control, neuroticism and problem-solving coping are shown in Table 1. The standard deviation for neuroticism was quite high but no outliers were found. Table 2 presents the descriptive statistics for the 2x2 design. As mentioned before, participants are not entirely equally distributed across all of the conditions. The two-way independent ANOVA showed no significant interaction effect \( F(3,60) = 0.095, p>.05 \) for neuroticism and effortful control on the dependent variable problem-solving coping. There was no significant main effect for neuroticism \( F(3,60) = 0.255, p>.05 \) but there was a significant main effect for effortful control \( F(3,60) = 4.784, p<.05 \). Unfortunately, this result is not valid because the Levene’s Test for Equality of Error Variances was significant and the proper recommended procedure when this happens is to lower the level of significance to .01 (Pallant, 2007). The main effect for effortful control was
exactly $p=0.033$ and the results of the lowered level of significance to avoid Type I Error results in the main effect for effortful control not being significant ($p>0.01$). With other words, the results from the two-way independent ANOVA failed to support the first research hypothesis (H1) stating that there would be an interaction between neuroticism and effortful control on problem-solving coping.

The correlation analyses revealed only one significant correlation ($p<0.01$), it was between effortful control and problem-solving coping. The correlation was positive and of medium strength ($r = 0.395$), following Cohen’s guidelines. This correlation was expected and confirms the second hypothesis (H2) of this study. Surprisingly, no negative correlation was found between neuroticism and problem-solving coping, which was expected according to previous studies. This (lack of) finding fails to support the third hypothesis (H3) stating that there would be a negative correlation between neuroticism and problem-solving coping. All the items measuring the three different factors were also tested for reliability. There were only six items measuring problem-solving coping which makes using Cronbach’s Alpha not suitable for measuring the reliability of the scale, instead using the inter-item correlation mean is more appropriate. The inter-item correlation mean is recommended to be used when there is less than ten items that are tested for reliability (Pallant, 2007). The recommended optimal range for the inter-item correlation mean is $0.2$ to $0.4$ (Pallant, 2007). The inter-item correlation mean for the six items measuring problem-solving coping was $0.199$. A possible explanation to this; the reported reliability for the original test was around $0.70$ Cronbach’s alpha which is already close to being too low and there were made (by author) some slight changes to the range of possible answer for the six items measuring problem-solving coping. This slight change could have affected the reliability in a negative way and pushed it to being just under what is the recommended reliability.

The 15 items consisting of the three subscales, activation control, inhibitory control and attention making up the factor effortful control showed poor results when measured for reliability, Cronbach’s alpha = $0.612$. This could be interpreted in many ways; it could mean that there is a need for better instruments for the measuring of the effortful control or that the three subscales are not all equally strongly connected to effortful control. But the most likely explanation is perhaps that the original test, EATQ-R, was made for testing of adolescence, not students and the modification and translation made (by author) had an negative effect on the reliability. The low Cronbach’s alpha for effortful control
prompted for deeper analyses. When the subscales of effortful control were tested separately for reliability the following results were found; activation control with five items had an acceptable inter-item correlation mean of .227 (Cronbach’s alpha = .595), attention with six items had attained a poor .143 (Cronbach’s alpha = .486) inter-item correlation mean and inhibitory control with four items did also poorly with a .058 (Cronbach’s alpha = .198) inter-item correlation mean. This shows that the reliability for attention and inhibitory control suffered the most when comparing to the subscales original reliability. As mentioned, this was probably caused by the modification and translation (by author) of the subscales. The ten items used for measuring neuroticism remained unmodified from the original test, short IPIP five-factor inventory, and retained an acceptable reliability of a .895 Cronbach’s alpha.

Discussion

The purpose of this study was to examine the relationship between the factors neuroticism, effortful control and problem-solving coping. More specifically, the primary aim was to establish an interaction effect between neuroticism and effortful control on the use of problem-solving in stressful situation, with a secondary aim to examine the relationship between all three variables with a correlation analyses. Individuals with high levels of neuroticism were hypothesized not to exhibit the lack of use of problem-solving coping when combined with high levels of effortful control. Unfortunately, the results of this study failed to support this notion. The main hypothesis (H1) that there would be an interaction effect between neuroticism and effortful control on problem-solving was not supported by the results of this study. This could have several different explanations. A possibility is that there is an interaction effect between neuroticism and effortful control on coping present, but not specifically on problem-solving coping. Problem-solving coping is only one of many other active positive coping strategies, all part of engagement coping style. An interaction effect may be present on a different dependent coping strategy variable. Another possibility is that the instruments used to measure effortful control and problem-solving were not valid enough to discover the interaction effect do to their lack of reliability.

Although the main hypothesis (H1) was not supported, this study contributes to the current research on effortful control by confirming the second hypothesis (H2). The data analyses discovered a positive correlation between effortful control and problem-
solving coping with a correlation of medium strength. The confirmation of the second hypothesis is important because it provides a direct link from effortful control to problem-solving. With the previous research only providing evidence for an indirect link with conscientiousness correlating positively with both effortful control and problem-solving coping. Although, this result should be interpreted cautiously do to the low reliability of the measuring instruments. The result nevertheless at least points to a connection between effortful control and problem-solving coping. With this kind of positive correlation it is surprising to not being able to find an interaction effect between neuroticism and effortful control on problem-solving coping. Mainly because neuroticism have been well established to correlate negatively with problem-solving coping in many different studies, (Bishop et al., 2001; Geisler et al., 2009; Kardum & Hudek-Knezevic, 1996; Kardum & Krapic, 2001; Murberg et al., 2002; Uehara et al., 1999). But there is a possible explanation for this lack of interaction also, consisting of that the data failed to support the third hypothesis (H3) of this study. In the third hypothesis of this study it was assumed that neuroticism would correlate negatively with the problem-solving coping. The failure to support this hypothesis is very likely due to the shortcomings of this study when it comes to its measuring instruments. For example, there is a need for more items measuring problem-solving which in this study only consisted of six item total. These shortcomings could also explain the lack of interaction effect in the present study between neuroticism and effortful control on problem-solving coping while there still being a medium strong positive correlation between effortful control and problem-solving coping. Nevertheless, the implications of the results provide enough of a basis for continued studies in this area.

A more fruitful way of conducting this type of study in the future would be to include more coping strategies as dependent variables, and also to include negative coping strategies. With the indication in this study that effortful control positively correlates with problem-solving coping, including conscientiousness as another independent variable could give more insight to the relationship that effortful control, conscientiousness and problem-solving coping seem to share. Basically, instead of creating only four subtypes, as in this study, using the low and high scores of two variables, neuroticism and effortful control, a 2x2x2 study would be conducting creating eight subtypes; using the high and low scores on conscientiousness as the third independent variable.
Limitations of the study

The greatest limitation of this study is the lack of reliability for the instruments measuring problem-solving coping and three subscales, activation control, inhibitory control, attention making up the factor effortful control. Especially inhibitory control and attention had an unacceptable low reliability. This seriously undermines the validity of the measuring instruments and therefore makes it very hard to interpret the results of this study. Another limitation is the sample used for the study. The samples majority consisted of students making generalizing the results hard.

Acknowledgements

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References


Table 1

Descriptive statistics for each variable

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<th>Variables</th>
<th>Mean</th>
<th>Std. Deviation</th>
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<tr>
<td>Problem-solving Coping</td>
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<td>3.099</td>
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<tr>
<td>Effortful Control</td>
<td>51.17</td>
<td>5.551</td>
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<tr>
<td>Neuroticism</td>
<td>25.56</td>
<td>7.365</td>
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**Table 2**

Descriptive statistics of the 2x2 research design

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<th>Std. Deviation</th>
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<td>Low neuroticism</td>
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<td>2,098</td>
<td>14</td>
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<tr>
<td></td>
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<td></td>
<td>Total</td>
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<tr>
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<tr>
<td></td>
<td>High neuroticism</td>
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<td>17</td>
</tr>
<tr>
<td></td>
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