Original Article

Fear and Anxiety in Social Setting

An Experimental Study

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Abstract: The purpose of this study was to examine the effects of dispositional and situational factors on cognitive biases. The theoretical background was based on Kimbrel's Mediated Model of Social Anxiety and the revised reinforcement sensitivity theory by Gray and McNaughton. Two experiments were conducted. Study 1 (78 participants [85.9% females, aged 19–21 years]) included the induction of potential social threat, while in Study 2 (121 participants [85.1% females, aged 19–23 years]) real threat was used. The Reinforcement Sensitivity Questionnaire was employed as a measure of personality traits (Behavioral Inhibition System [BIS], Behavioral Approach System [BAS], Fight, Flight, and Freeze). Cognitive biases were assessed with the Dot Probe Task (attentional bias), Incidental Free Recall Task (memory bias), and Social Probability Cost Questionnaire (judgmental bias). The probability of occurrence of negative events was higher in the experimental group. BIS contributed positively to the prediction of probability of occurrence of negative events; and Freeze was positively related to attention bias toward pleasant stimuli. The results of the second study showed that experimentally induced circumstances of social threats did not affect cognitive biases. BIS and Freeze contributed positively to prediction of probability and distress in social context, while BIS was positively related with probability of occurrence of negative social events.

Keywords: revised reinforcement sensitivity theory, social threat, potential versus real threat, cognitive biases

In its attempt to explain a wide range of behavioral outputs, the Reinforcement Sensitivity Theory, in both its original (RST; Gray, 1987) and revised (rRST; Gray & McNaughton, 2000) versions, has focused on the interplay between dispositional personality factors and situational parameters (constraints and affordances). RST is a biologically-based theory of personality that postulates three major subsystems of the brain underlie many of the individual differences seen in cognitive, emotional, and motivational reactions. Corr and McNaughton (2012) highlighted that the reinforcing properties of inputs are dependent on a process of evaluation. According to Gray's RST (Gray, 1987) there are three emotional systems: Behavioral Approach System (BAS), Behavioral Inhibition System (BIS), and Fight-Flight System (FFS). BAS is responsible for activation of behavior elicited by incentives; BIS is related to avoidance of conditioned aversive stimuli; while FFS is related to avoidance of unconditioned aversive stimuli. BIS and BAS are related to anxiety and impulsivity (Gray, 1981; Pickering, Corr, & Gray, 1999), while FFS is related to aggressiveness (Mitrović, Smederevac, & Čolović, 2008). In the revised model (Gray & McNaughton, 2000), the systems were modified: the expanded Fight-Flight-Freeze System (FFFS) is now responsive to all punishing and threatening stimuli; whereas the BIS is now sensitive to goal conflict (of all kinds) – it is engaged in direction of attention to conflicting stimuli, and has the task of attempting to resolve conflict by inhibiting ongoing action and biasing action toward the FFFS to facilitate defensive behavior (Gray & McNaughton, 2000). The BAS is now sensitive to all forms of rewarding (including relieving) stimuli.

Cognitive biases refer to the selective processing of emotionally relevant information (Mineka & Tomarken, 1989). Biased cognitive processing is related to different stages of information processing (e.g., perception, attention, memory, judgment, interpretation) as well as to different types of stimuli (negative or threatening stimuli, positive or pleasant stimuli). Bias occurring in the processing of information on social danger plays an important role in social anxiety experience. In socially-anxious individuals, bias in attention implies directions of attention toward threat during early, automatic stages of processing, whereas during later stages of processing, this type of bias includes direction of attention away from threat (Amir, Foa, & Coles, 1998). Memory bias refers to encoding, memorizing, and recalling negative or positive stimuli. Socially-anxious individuals exhibit memory biases for threatening social information (Mansell & Clark, 1999). Judgmental bias refers to the overestimation of the costs and/or probability of a negative event (Foa, Franklin, Perry, & Herbert, 1996). Foa and Kozak

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(1986) proposed that social fears are characterized by high negative valence (cost) for social scrutiny and criticism as well as overestimation of their likelihood (probability).

To date, few studies have addressed the problem of the specific impacts of situational factors and personality traits on a wider range of cognitive biases. Conceptual differences between the original and the revised RST (rRST; Corr, 2008), as well as the multitude of cognitive biases that have to be taken into account, add to the complexity of this task. There are still no conclusive answers to a number of questions concerning the relations between situational factors such as potential and real threats, dispositions (personality traits), and cognitive biases – namely, attention, memory, and judgmental biases.

Cognitive Biases – The Original Reinforcement Sensitivity Theory Perspective

The studies stemming from the original RST point to significant relations between personality traits and cognitive biases, consistent with the "trait-congruency hypothesis" (Rusting, 1998). According to this conceptual framework, the behavioral approach system (BAS) is positively related to cognitive biases toward pleasant stimuli, while the behavioral inhibition system (BIS) predicts biases toward unpleasant or threatening stimuli. A number of authors (Carver & White, 1994; Gray, 1981, 1987; Tellegen, 1985; Tomarken & Keener, 1998; Watson, Wiese, Vaidya, & Tellegen, 1999) suggest that BIS and BAS are related to positive and negative affectivity, and thus related to selective processing of emotionally relevant stimuli. It has been shown that the BAS is positively related to positive memory bias, and BIS to negative memory bias (Gomez, Cooper, McOrmond, & Tatlow, 2004; Gomez & Gomez, 2002). The results of some less recent studies, not stemming from the RST framework, support the notion that anxiety is related to negative memory bias (Breck & Smith, 1983; Claeys, 1989; Cloitre & Liebowitz, 1991; Eysenck & Byrne, 1994; O'Banion & Arkowitz, 1977).

A number of studies explored the relations between the BIS and attentional biases, but this has proved inconclusive. For example, there is evidence that the BIS does not correlate with attentional biases (Putman, Hermans, & van Honk, 2004), and also that it is negatively correlated with the propensity to divert attention away from negative stimuli (Ávila & Torrubia, 2008). Some studies do indicate that anxious individuals show attentional bias to threatening stimuli and that this phenomenon is less typical of non-anxious persons (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007; Mogg & Bradley, 1998; Williams, Mathews, & MacLeod, 1996). Ávila and Parcet (2002) suggested that, in anxious individuals, anterior attentional network is activated by noninformative threat-related stimuli – an effect which does not occur in non-anxious individuals. This finding points to the possible effect of contextual factors on the relation between the BIS and attention processes.

Based on Gray's and McNaughton's work (Gray & McNaughton, 2000), Kimbrel (2008) assumed that the cognitive biases for negative stimuli are caused by heightened BIS sensitivity. Therefore, it is expected that judgmental bias or perception of threat would be positively related to BIS and FFFS under conditions of social threat. Results of previous research (e.g., Kimbrel, 2009; Kimbrel, Nelson-Gray, & Mitchell, 2012) are consistent with this hypothesis. Namely, BIS sensitivity is positively correlated with perception of threat, while BAS is negatively related to perception of threat.

The Revised Reinforcement Sensitivity Theory Perspective

Within the revised RST, social situations have been recognized as particularly relevant triggers of neuropsychological systems activation. Some social situations comprise a combination of potential reward and punishment (i.e., approach-avoidance conflict; Gray & McNaughton, 2003) such as situations of social interaction (e.g., conversation with attractive person), which if sufficiently intense should lead to the activation of the BIS. Besides the approach-avoidance conflict, some social situations (e.g., public speaking) include actual threats to a person's self-esteem and, thus, can trigger the activity of the fight/flight/freeze system (FFFS; i.e., fear-related reactions; Smederevac, Mitrović, Čolović, & Nikolašević, 2014). Gray and McNaughton (2000) suggest that majority of specific phobias do not stem from classical conditioning, but rather from unconditioned reactions to innate fear stimuli, which include elevated activity of the FFFS. Supporting this distinction, Kimbrel (2008) pointed to the distinction between two classes of social situations, namely the "innate anxiety stimuli" and "innate fear stimuli." The former imply the approach-avoidance conflict, while the latter comprise high likelihood of negative evaluation along with the low likelihood of reward, provoking reactions of fear (Kimbrel, 2008). However, the specific effects of situational and dispositional features on cognitive biases have not explored in any detail yet.

Judgmental bias, in particular, is considered to be one of crucial factors in the development and maintenance of social anxiety (e.g., Rapee & Heimberg, 1997; Rheingold, Herbert, & Franklin, 2003). Results have shown that socially anxious individuals tend to overestimate the likelihood and potential consequences of negative social events (e.g., Amir, Beard, & Bower, 2005; Foa et al., 1996; Poulton & Andrews, 1996; Rheingold et al., 2003; Smári, Pétursdóttir, & Porsteinsdóttir, 2001; Zou & Abbott, 2012). Attentional bias for negative social information implies selective direction of attention toward the threat (Bar-Haim et al., 2007; MacLeod, Mathews, & Tata, 1986; Mogg & Bradley, 1998); and results point to selective direction of attention to threatening social information in socially anxious individuals (Chen, Ehlers, Clark, & Mansell, 2002; Mogg & Bradley, 2002; Mogg, Philippot, & Bradley, 2004; Pishyar, Harris, & Menzies, 2004; Sposari & Rapee, 2007). The results of a study by Amir, Foa, and Coles (2000) suggest that memory biases in word recall and word memorizing occur in socially anxious participants. However, although studies (not necessarily stemming from rRST) have demonstrated the relevance of social situations for several classes of cognitive biases, the results are not thoroughly consistent. Kimbrel (2009) found that attentional bias is not significantly related to other variables in the model, including BIS and BAS sensitivity (conceptualized according to the original RST). However, a number of empirical findings suggest that attention bias is related to dispositional features (e.g., Amir & Foa, 2001; Asmundson & Stein, 1994; Becker, Rinck, Margraf, & Roth, 2001; Hope, Rapee, Heimberg, & Dombeck, 1990; Lundh & Öst, 1996; Mattia, Heimberg, & Hope, 1993), as well as to hypersensitivity of the amygdala (Fox, Hane, & Pine, 2007; Hariri et al., 2005). These inconsistencies may, at least partly, be attributed to methodological factors. To examine attention, Kimbrel used verbal stimuli, which can decrease the ecological validity. Images of human faces with specific emotional expressions are considered to be more appropriate stimuli than verbal material in studies of relations between attentional processes and emotions (Calamaras, 2010; Kindt & Brosschot, 1997). Besides being more ecologically valid (Foa & Kozak, 1986; Lang, 1979), visual stimuli do not trigger semantic information processing, and thus do not cause the confounding of semantic and attentional processes (Weierich, Treat, & Hollingworth, 2008). One of Kimbrel's methodological recommendations is to use dot-probe tasks for the estimation of attentional biases (Kimbrel, 2009).

Current Study – Conceptual and Methodological Issues

Kimbrel et al.'s study (2012) is so far the only one that offers a more detailed insight into the relations between RST constructs, perception of threat, and cognitive biases. However, several issues still remain unresolved. Kimbrel's (2008) model includes cognitive biases as mediators between traits and socially anxious reactions, and thus does not directly respond to the issue of effects of situational and dispositional features on cognitive processes. The results (Kimbrel et al., 2012) show positive effect of BIS-FFFS sensitivity on cognitive bias, as well as the negative effect of BAS. However, the specific impacts of BIS and FFFS were not examined. Perception of threat was shown to load on the same latent dimension as several cognitive biases, but the actual effects of different kinds of threat (actual vs. potential) were not investigated (Kimbrel et al., 2012).

The current study attempts to address the problem of particular effects of situational features (potential and actual social threats) and personality traits (rRST constructs) on three classes of cognitive biases: memory, attentional, and judgmental biases. The study builds on Kimbrel et al.'s (2012) work both in conceptual and methodological respects. Namely, the conceptual framework of these studies is the Mediated Model of Social Anxiety (MMSA; Kimbrel, 2009; Kimbrel et al., 2012) which is based on Gray's reinforcement sensitivity theory. MMSA is unique because it integrates a different factor (e.g., personality, environmental, cognitive) into a unified model. Because MMSA has not yet been tested extensively and research on this model has emerged in recent years (Kimbrel, 2009; Kimbrel et al., 2012; Ranđelović, 2016), the purpose of the present study is to provide an initial investigation into new aspects of the model. One of the basic assumptions of MMSA is that cognitive biases would be most pronounced under conditions of social threat because these conditions should activate defensive systems of personality (BIS and FFFS; Kimbrel, 2008). However, the design of Kimbrel's study, which is correlative in nature, limits a direct test of the mentioned hypothesis. As theoretical and empirical data predicted, cognitive biases would be emerged under different social circumstances. Hence, the main goals in this study are: (1) to examine the effects of BIS, BAS, FFFS, and potential social threaten biases in attention, memory, and judgment; and (2) to examine the effects of BIS, BAS, FFFS, and actual social threat on biases in attention, memory, and judgment. In Study 1 we assumed that (a) the potential social threat would have significant effect on judgmental biases. Specifically, assessment of probability of occurrence of negative events and distress would be higher in the group who faced potential social threat than the control group. We assumed that there are no significant effects of potential social threat on biases in attention and memory, which is consistent with the results of some previous studies (e.g., Finucane, Whiteman, & Power, 2010; Mansell & Clark, 1999). Furthermore, (b) BIS and FFFS would have significant effects on biases in attention, memory, and judgment. In Study 2 our hypotheses are as follows: (a) there are no significant effects of actual social threat on cognitive processing (attention, memory, and judgment);

(b) BIS and FFFS would have significant effects on biases in attention, memory, and judgment.

The novel aspects of this research in comparison with Kimbrel et al.'s study (2012) are: (a) application of experimental research design; (b) examination of the effects of important situational factors, specially the effects of actual social threat which employed different valences of nonverbal feedback (negative, positive, and neutral) given by the professors; (c) using rRST constructs; and (d) assessing attention bias with dot-probe task. Thus, to examine the effect of situational factors on cognitive biases, we employed two experimental procedures which included potential and actual social threat. In order to address the issue of effects of personality traits, we included the measures of rRST constructs. To avoid confounds and to ensure better ecological validity, several methodological recommendations made by Kimbrel were also adopted, such as the use of dot-probe task, and the use of nonverbal measures of attentional biases (pictures of human faces expressing emotions of joy and fear; Calamaras, 2010; Kindt & Brosschot, 1997). According to the theoretical framework and the results of previous studies (Gray & McNaughton, 2003; Kimbrel et al., 2012), positive effects of BIS on cognitive biases may be expected in a situation of potential social threat, while positive effects of FFFS are more likely to occur in a situation of actual threat. According to the theoretical framework and the results of previous studies (Gray & McNaughton, 2003; Kimbrel et al., 2012), positive effects of BIS on cognitive biases may be expected in a situation of potential social threat (Experiment 1), while positive effects of FFFS are more likely to occur in a situation of actual threat (Experiment 2).

Experiment 1

Participants

One hundred and eighteen first and second year psychology students from the Faculty of Philosophy in Novi Sad (83.1% females) participated. They were randomly assigned to conditions (experimental and control group). After the experimental phase of the study, 8 (9.4%) participants who "saw through" the experimental situation were excluded, while 20 (23.6%) participants were excluded due to an extensive number of errors (above 15%; according to previous research, e.g., Dinić, 2014) on the dot-probe task, and additional 12 (14.6%) due to incomplete data. These 78 participants (85.9% females), aged 19–25 years (M = 20.03, SD = 1), were included in the final sample. Each group included 39 participants. The groups did not differ with respect to gender ($\chi^2_{(1)}$ = .43; p = .52), year of study ($\chi^2_{(1)}$ = .43; p = .52) or personality traits (BIS: $t_{(73)}$ = 1.52; p = .13; BAS: $t_{(73)}$ = −1.13; p = .26; Fight: $t_{(73)}$ = 0.48; p = .63; Flight: $t_{(73)}$ = −0.66; p = .51; Freeze: $t_{(73)}$ = 1.15; p = .26). There were no multivariate outliers, while 17 univariate outliers (z > ±2.50) were retained due to relatively small size of the groups. Participants provided written consent to participate in the study. The study was approved by the Departmental Ethical Committee.

In order to estimate the optimal sample size for the experiment, *a priori* power analysis was conducted in G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007), according to recommendations by Dattalo (2008). Tests for multivariate analysis of variance (MANOVA) global effects (F tests), adjusted for MANCOVA, were performed. The results showed that, with two groups, five covariates, and five response variables, assuming α = .05, in order to detect an effect of medium size ($f^2(U)$ = .15) with 80% power, total sample size of N = 49 would be needed, with f_c (30, 154) = 1.53, λ = 29.4, Wilks U = .57.

In order to check effectiveness of experimental manipulation the state of anxiety was assessed with the state version of the State-Trait Anxiety Inventory (State-Trait Anxiety Inventory for Adults – STAI; Spielberger, Gorsuch, & Lushene, 1970; Tovilović, Novović, Mihić, & Jovanović, 2009). The results show that there were significant effects of experimental manipulation on state of anxiety. Assessment of level of anxiety was higher in the group who faced potential social threat than the control group (experimental group: M = 2.58; SD = 0.66; control group: M = 1.90; SD = 0.65; $t_{(76)}$ = 4.572; p < .001). In debriefing phase, participants who "saw through the experimental situation" informed experimenter that they did not believe in experimental manipulation. All of them were in experimental group. Results showed that participants who "saw through the experimental situation" had lower level of anxiety (M = 1.75; SD = 0.79) in comparison with experimental group ($t_{(45)}$ = 3.145; p < .001), while there was no difference between first mentioned group and control group ($t_{(45)}$ = 0.592; p = .557). This result indicated how far the experimental manipulation did not work.

Measures

The Reinforcement Sensitivity Questionnaire (RSQ; Smederevac et al., 2014)

The questionnaire was designed as a measure of the revised Reinforcement Sensitivity Theory constructs. In the initial and subsequent studies, the scale showed adequate internal and convergent validity (Krupić, Corr, Ručević, Križanić, & Gračanin, 2016; Smederevac et al., 2014). The questionnaire consists of 29 items with 4-point rating scales ranging from 1 (= *completely disagree*) to 4 (= *completely agree*): BIS (7 items; item example: "I often worry that I may be criticized"), BAS (6 items; item example: "I readily accept new and exciting

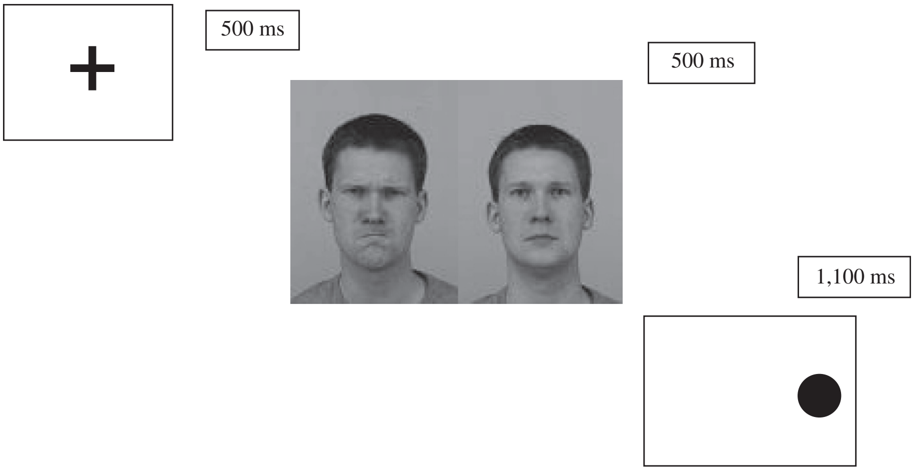

Figure 1. The trial timing of dot probe task (Figure courtesy of Lundqvist, Flykt, & Öhman, 1998; KDEF figure IDs: AM11ANS, AM11NES).

situations"), Fight (6 items; item example: "Whenever I am attacked, I fight back without hesitation"), Flight (5 items; "Whenever I am in a dangerous situation, I do my best to get out of it"), and Freeze (5 items; item example: "I tend to "freeze" in threatening situations").

Dot Probe Task (DPT)

The Dot Probe Task is a measure of attention biases by means of reaction time (RT). The task applied in this study was developed according to procedures applied in previous studies (e.g., Calamaras, 2010; Mogg & Bradley, 1999; Tran, Lamplmayr, Pintzinger, & Pfabigan, 2013). The tasks consisted of 150 picture stimuli acquired from the Karolinska Directed Emotional Faces (KDEF) base (Lundqvist, Flykt, & Öhman, 1998). The choice of stimuli was made according to the original KDEF validation study (Goeleven, De Raedt, Leyman, & Verschuere, 2008). The pictures show 50 models (25 females and 25 males, aged 20–30 years), whose faces were photographed in three different emotional expressions: anger, joy, and neutral. Therefore, there were 50 pictures with threatening facial expressions, 50 with joyful expressions, and 50 neutral. Experimental trials involved paired pictures, whereby each picture of anger/joy was paired with a neutral picture. The overall procedure included 250 trials. Each pair of pictures (anger – neutral and joyful – neutral) was presented twice (on the left and on the right side of the screen), adding up to 200 trials. Besides these, there were 50 filler trials consisting of neutral/neutral pairs. The pictures were presented on the computer one next to another, while the sequence of pictures was randomized for each participant. Before each trial, a focal stimulus ("+") appeared in the center of the screen, and the stimulus followed 500 ms later. The exposition of stimuli lasted 500 ms (see Figure 1). The dot retrieval took place immediately after the disappearance of the stimulus. The dot was exposed for 1,100 ms. The dot appeared the same number of times on the left and on the right side of the screen. Thus the dot was once on the side of a valent (emotionally charged) stimulus (congruent, RTC trials), and the second time on the side of a neutral stimulus (incongruent, RTI trials). Bias indexes (BI) for threatening and pleasant stimuli were calculated, according to the formula BI = RTI − RTC (Tran et al., 2013). The positive BI score points to higher bias, more precisely to more pronounced direction of attention to stimuli of certain valence (attention vigilance). The opposite case points to diverting of attention, in other words to diverting from further processing the information.

The Incidental Free Recall Task (IFRT)

This task assesses memory bias by the average number of memorized words of positive/negative valence. There were 38 words in total, split into three lists to control for serial position effect (Kimbrel et al., 2012), whereby 30 words were stimuli (15 positive and 15 negative), while 8 words (4 positive and 4 negative) served as "buffers." The buffers were presented at the beginning/end of each list, in order to control for the effect of the serial position (the position of the word in the list). The buffers were not used in the statistical analyses (Mansell & Clark, 1999). The three word lists were assembled taking into account the condition that there are no more than two negative or positive words in a row (Mansell & Clark, 1999). According to recommendations from previous studies (Kimbrel et al., 2012), the categories of words of different valence were equal with regard to word length and frequency. The choice of words was based on the results of a pilot study where negative words (related to social anxiety and low social achievement) were detected, as well as the positive words which denoted social achievement and social success. Within each block, the words were shown on the screen in sequence. In the "encoding phase," the participant's task was to estimate whether the words describe the way that others see and

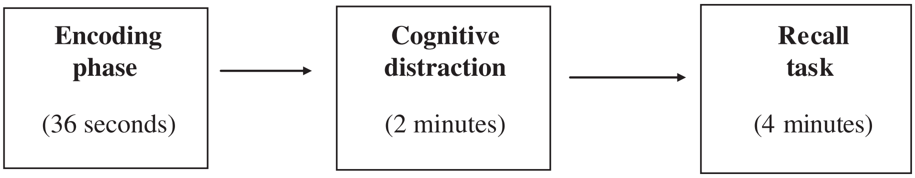

Figure 2. The trial timing of incidental free recall task.

estimate them during public appearances (by pressing the left mouse button for yes, and right for no). This phase was followed by a 2-minute cognitive distraction, where the procedure by Breck and Smith (1983) was applied. The participants were asked to mark ("strike through") letter E on a sheet of paper where letters were printed in a random order. Upon the end of this task, the participants were asked to write as many words as they remembered from the encoding phase, regardless of the order in which the words were shown. This phase lasted 4 min (see Figure 2). Within blocks, the list of words and the letter that had to be marked were varied, while the memory task was the same. The index of negative memory bias was calculated by subtracting the number of positive words from the number of negative words. Negative scores point to memory bias toward negative words (Kimbrel, 2009; Matthews, Mogg, May, & Eysenck, 1989).

The Social Probability Cost Questionnaire (SPCQ; McManus, Clark, & Hackmann, 2000)

The SPCQ is a measure of judgmental biases, and comprises two 33-item scales. On a scale from 0 to 100, the participants rate how bad or disturbing each of the given social events (in the near future) can be for them (0 = *not at all bad*, 100 = *really bad*), as well as how likely each ofthe events is to happen to them (0 = *not at all likely*, 100 = *almost sure to happen*). The items describe social events like *being criticized, saying something stupid, beginning to stutter, opinion will be ridiculed*, and so forth. Both scales have shown satisfactory internal consistency ($\alpha = .96$; $\alpha = .97$) in a study by McManus et al. (2000). Given that the SPCQ had not thus far been applied to the Serbian population, a validation study was conducted, which showed that the measure had satisfactory validity, reliability, representativeness, and homogeneity (Ranđelović & Ranđelović, 2014).

Procedure

Two weeks prior to the experimental procedure, participants completed the personality assessment measures. The experimental procedure included the induction of potential social threat, namely the "*Bogus-speech threat manipulation*" (BSTM), which was designed in accordance with similar procedures applied in previous studies (e.g., Lee & Telch, 2008; Singh, 2011). Participants were randomly assigned to two experimental conditions. In both groups, participants' task was to write up a design of an experimental study on a chosen topic (Violence, Corruption, and Proneness to risky behavior). Task completion time was limited to 10 min. Both groups were informed that the study designs would be rated by a three-member committee, consisting of university teachers. In the Experimental Group, participants were additionally "required" to give oral presentations of their designs before the committee. In the Control Group, there was no such requirement. Upon the completion of the written part of the task, study designs were "forwarded" to the committee, while the participants completed the computer-administered tasks and the questionnaires. After the dependent variables were assessed, written and oral debriefing was given to participants.

Results

Multivariate analysis of covariance (MANCOVA) was used in order to examine the relations between the independent variables (experimental conditions and personality traits) on cognitive biases. Experimental condition (two levels: oral or no-oral presentation) was the categorical predictor, and factor scores on rRSQ dimensions were continuous predictors. The following cognitive bias indexes were entered as dependent variables: two measures of judgmental biases (likely cost associated with the upcoming negative events, and probability that the event will happen); two indices of attention biases (attention biases for threatening and pleasant stimuli); and an index of negative memory bias. For the grouping variable (experimental condition), deviation coding was applied.

Bivariate correlations (Table 1) showed strong positive correlations between BIS and Freeze, Flight, and Freeze, as well as between two modalities of judgmental bias. BIS and BAS correlated moderately and negatively.

MANCOVA (Table 2) suggested that the set of independent variables explained a substantial amount of the variance of SPCQ – cost ($p < .05$) and SPCQ – probability ($p < .05$). BIS was the only factor to significantly (and positively) contributed to the prediction of SPCQ – cost. Experimental condition predicted the score on SPCQ – probability, whereby the experimental group scored significantly higher than the control group ($M_{exp} = 36.21$; $M_{cont} = 28.24$; $F_{(1)} = 4.20$, $p < .05$). Freeze contributed significantly and

Table 1. Experiment 1: Descriptive statistics and bivariate correlations (Pearson correlations; two-tailed)

Variable	BIS	BAS	Fight	Flight	Freeze	SPCQ – cost	SPCQ – probability	AB – th	AB – pl	NMBI
BAS	−.51***									
Fight	.07	.17								
Flight	.34**	−.14	−.10							
Freeze	.64***	−.23*	−.02	.52***						
SPCQ – cost	.41***	−.22*	.11	.18	.28*					
SPCQ – probability	.30**	−.13	.22	.03	.24*	.63***				
AB – th	−.11	.11	−.08	−.17	−.24*	−.01	.11			
AB – pl	.09	.07	.11	−.02	.26*	.10	.09	−.24*		
NMBI	−.23*	.06	−.05	−.03	−.11	−.18	−.14	−.13	−.05	
M	2.20	2.75	2.30	2.72	1.90	32.23	34.27	−0.65	0.31	−0.67
SD	0.61	0.55	0.59	0.55	0.63	16.26	15.89	25.44	24.42	2.31
α	.82	.78	.76	.61	.79	.94	.94			

Notes. *N* = 78. BAS = Behavioral Approach System; BIS = Behavioral Inhibition System; SPCQ – cost = judgmental bias – assessment of cost (negative impact) of events in near future; SPCQ – probability = judgmental bias – assessment of likelihood of negative events in near future; AB – th = attention bias toward threatening stimuli; AB – pl = attention bias toward pleasant stimuli; NMBI = Negative Memory Bias. *$p < .05$, **$p < .01$, ***$p < .001$ (all significance tests are two-tailed).

Table 2. Experiment 1: Results of MANCOVA

Variable	SPCQ – cost *B* (β)	SPCQ – probability *B* (β)	AB – th *B* (β)	AB – pl *B* (β)	NMBI *B* (β)
BIS	8.69 (.33)*	4.12 (.16)	7.87 (.19)	−3.97 (−.10)	−1.28 (−.34)
BAS	−1.10 (−.04)	−0.91 (−.03)	6.55 (.14)	3.17 (.07)	−0.27 (−.06)
Fight	2.54 (.09)	5.37 (.20)	−5.46 (−.13)	4.05 (.10)	−0.08 (−.02)
Flight	2.72 (.09)	−1.82 (−.06)	−3.78 (−.08)	−8.84 (−.20)	0.30 (.07)
Freeze	−0.14 (−.01)	3.62 (.14)	−11.34 (−.28)	17.28 (.45)*	0.09 (.02)
EC	3.04 (.19)	3.56 (.23)*	−1.47 (−.06)	−0.39 (−.02)	0.51 (.22)
R^2	.21	.19	.09	.13	.11
Adj. R^2	.15	.13	.01	.05	.03
$F_{(1,71)}$	3.22	2.84	1.19	1.72	1.41
ECexper.					
M	36.21	38.87	−2.71	1.19	−0.28
SD	15.63	15.83	26.28	29.39	2.23
SE	2.50	2.53	4.21	4.71	0.36
ECcontr.					
M	28.24	29.67	1.41	−0.58	−1.05
SD	16.08	14.76	24.75	18.52	2.34
SE	2.57	2.36	3.96	2.97	0.37
Total					
M	32.23	34.27	0.65	0.31	−0.67
SD	16.25	15.89	25.44	24.42	2.31
SE	1.84	1.80	2.88	2.76	0.26

Notes. *N* = 78. BIS = Behavioral Inhibition System; BAS = Behavioral Approach System; EC = experimental condition as a independent variable (potential danger); *F* = *F* test: Model significance; ECexper. = Experimental Condition: Experimental group; ECcontr. = Experimental Condition: Control group; SPCQ – cost = judgmental bias – assessment of cost (negative impact) of events in near future; SPCQ – probability = judgmental bias – assessment of likelihood of negative events in near future; AB – th = attention bias toward threatening stimuli; AB – pl = attention bias toward pleasant stimuli; NMBI = Negative Memory Bias; SPCQ – cost, SPCQ – probability, AB – th, AB – pl, NMBI as dependent variables; B = unstandardized regression coefficients; **β** = standardized regression coefficients. *$p < .05$ (all two-tailed).

positively to the prediction of attention bias toward pleasant stimuli.

Behavioral parameters for attentional bias (response times – RT) are showed in Tables 3 and 4.

Discussion

The results provide support for both the assumption that situational features affect cognitive biases, and for Gray's

Table 3. Experiment 1: Behavioral parameters for attentional bias (response times – RT)

Attentional bias		Min	Max	*M*	*SD*	Sk	Ku
RT	RTC_anger	289.83	558.45	392.19	58.29	0.331	−0.232
	RTI_anger	275.28	577.36	391.54	61.89	0.586	0.268
	RTC_joy	272.19	555.91	392.39	59.26	0.387	−0.197
	RTI_joy	278.44	528.72	392.70	62.08	0.309	−0.589
	RT_neutral	352.91	640.91	484.79	74.56	0.215	−0.696
Bias indexes	BI_anger	−52.80	58.15	−0.65	25.44	0.013	−0.197
	BI_joy	−67.29	69.39	0.31	24.42	−0.282	1.194

Notes. N = 78. RT = Response Times; RTC_anger = congruent trials for threatening stimuli; RTI_anger = incongruent trials for threatening stimuli; RTC_joy = congruent trials for pleasant stimuli; RTI_joy = incongruent trials for pleasant stimuli; RT_neutral = responses times for neutral stimuli; BI_anger = bias indexes for threatening stimuli; BI_joy = bias indexes for pleasant stimuli; Sk = Skewness; Ku = Kurtosis.

Table 4. Experiment 1: Behavioral parameters for attentional bias (response times – RT)

Attentional bias		Group	Min	Max	*M*	*SD*	Sk	Ku
RT	RTC_anger	Experimental	293.01	507.28	396.27	53.65	0.236	−0.308
		Control	289.83	558.45	388.10	63.02	0.455	−0.120
	RTI_anger	Experimental	275.28	545.92	393.56	61.51	0.552	0.237
		Control	292.76	577.36	389.52	63.01	0.648	0.509
	RTC_joy	Experimental	272.19	527.68	398.14	59.14	0.228	−0.259
		Control	290.54	555.91	386.64	59.59	0.573	0.142
	RTI_joy	Experimental	305.83	528.72	399.33	59.75	0.470	−0.327
		Control	278.44	525.94	386.06	64.40	0.246	−0.820
	RT_neutral	Experimental	357.86	633.36	491.07	71.60	0.142	−0.616
		Control	352.91	640.91	478.50	77.83	0.323	−0.667
Bias indexes	BI_anger	Experimental	−52.80	58.15	−2.71	26.28	0.334	0.058
		Control	−47.83	52.44	1.41	24.75	−0.336	−0.122
	BI_joy	Experimental	−67.29	69.39	1.19	29.39	−0.430	0.584
		Control	−44.09	55.33	−0.58	18.52	0.140	1.395

Notes. N_E = 39; N_K = 39. RT = Response Times; RTC_anger = congruent trials for threatening stimuli; RTI_anger = incongruent trials for threatening stimuli; RTC_joy = congruent trials for pleasant stimuli; RTI_joy = incongruent trials for pleasant stimuli; RT_neutral = responses times for neutral stimuli; BI_anger = bias indexes for threatening stimuli; BI_joy = bias indexes for pleasant stimuli; Sk = Skewness; Ku = Kurtosis.

hypothesis that BIS contributes to the perception of potential dangers. The results indicate that the assessment of probability of occurrence of negative events and distress is higher in the group who faced potential social threat. This result is consistent with the assumptions, supported by both the rRST (Gray & McNaughton, 2003) and Kimbrel's model (2008) that the situational feature triggers the perception of social threats. The activating event (the anticipation of public exposure), launches the "cognitive scheme of danger," which is the basis for increased alertness.

Regardless of the experimental manipulation, BIS is responsible for the anticipation of negative outcomes in new and ambiguous situations (Corr, 2011; Gray & McNaughton, 2003). The results indicate that BIS as a dispositional factor, shapes the estimation of occurrence of negative outcomes in new situations. With regard to the characteristics of the experimental manipulation, it may be important to point out that the situation did significantly differ from the usual circumstances that the participants were accustomed to during course practical. Namely, it is possible that the work on a new task itself (preparation of speech) did contribute to the overall perception of tension among participants.

Experimentally induced potential social threat did not affect either attention or memory biases. This result is in line with recent studies, which report that different quality of induced affects (e.g., happiness and sadness) has no effect on the various aspects of attention (alertness, orientation, and selectivity; Finucane et al., 2010). The only effect that is registered in the domain of attention bias is the effect of Freeze on attention bias toward positive stimuli. Although there is a possibility that this effect is an artifact, this result may point to the tendency of people scoring high on Freeze to focus their attention on pleasant stimuli. Namely, a person can revert to the mechanisms that would enable a "getaway" from a new and potentially demanding situation. In the light of these results, this mechanism may point to positive information as the distraction in potentially threatening situations.

Experiment 2

Participants

At the end of Phase 1 of the study, during which demographic and questionnaire data were gathered, the sample comprised 169 first and second year students from the Faculty of Philosophy in Niš. A total of 150 participants took part in the experimental phase of the study. Four participants withdrew during the write-up of draft speeches, while additional four withdrew in the later stages of the study. The data of 21 (31.5%) participants were excluded from the analyses: 14 (21%) failed to complete the entire set of measures administered in the study, 3 (4.5%) claimed that they "saw through" the experimental manipulation, 3 (4.5%) were univariate outliers ($z > \pm 2.50$), and 1 (1.5%) multivariate outlier (Tabachnick & Fidell, 2007). Therefore, the final sample comprised 121 participants (103 [85.1%] female), aged 19–23 years (M = 19.80, SD = 0.78). Experimental and control groups are equal with respect to gender ($\chi^2_{(2)} = 1.44$, $p = .49$) and year of study ($\chi^2_{(2)} = 0.90$, $p = .64$). The participants were randomly assigned to groups. The groups did not differ with regard to personality traits – BIS: $F_{(2,118)} = .07$; $p = .93$; BAS: $F_{(2,118)} = -.14$; $p = .87$; Fight: $F_{(2,118)} = .05$; $p = .95$; Flight: $F_{(2,118)} = -.82$; $p = .44$; Freeze: $F_{(2,118)} = .03$; $p = .98$). The participants provided written consent to participate in the study. The study was approved by the Ethical Committee at the Department of Psychology, Faculty of Philosophy, University of Novi Sad.

A priori power analysis was conducted in G*Power 3.1.9.2 (Faul et al., 2007) in order to determine the optimal sample size. Tests for MANOVA global effects (F tests), adjusted for MANCOVA, were performed. The results showed that, with three groups, five covariates, and five response variables, assuming $\alpha = .05$, in order to detect an effect of medium size ($f^2(U) = .15$) with 80% power, total sample size of $N = 56$ participants would be needed, with f_c (35, 187.52) = 1.49, $\lambda = 35.34$, Wilks $U = .56$.

Procedure

The experimental procedure took place two weeks after the demographic and questionnaire data had been gathered. A *Social threat induction procedure* (STIP) was applied, also known as "The public speech task" (e.g., Bielak & Moscovitch, 2012; Kimbrel, 2008, 2009; Kimbrel et al., 2012; Mansell, Clark, Ehlers, & Chen, 1999). Participants' task was to give a presentation on a chosen topic (using a written draft) before a committee who assessed their presentation skills by giving nonverbal feedback to presenters. Participants were randomly assigned to three experimental conditions, which differed by the valence of the feedback (nonverbal signals expressed by the committee). The conditions were chosen according to previous studies (Chaikin, Sigler, & Derlega, 1974; Perowne & Mansell, 2002; Veljaca & Rapee, 1998), and were named Negative Feedback (NF), Positive Feedback (PF), and Neutral Feedback (NF). The first two conditions included three nonverbal signals each (NF: frowning, shaking head left to right as a sign of disagreement, leaning back as a sign of rejection; PF: smile as a sign of recognition, nodding head as a sign of agreement, leaning forward as a sign of interest and liking), while neutral feedback implied the lack of facial expression and bodily motions.

During the experimental procedure, sheets of paper with three topics (1. Violence, 2. Corruption, 3. Proneness to risky behaviors) printed out were administered to participants, with the instruction to pick only one topic and write a draft speech in 10 min. After that, the experimenter randomly took the drafts from the participants, in order for the examiners to randomly call out the students to give speeches. Each of the participants had 1 min to present the topic to the committee, while the examiners "rated public speech skills" by giving nonverbal feedback. The experimenter controlled the timing using a stopwatch. The whole procedure lasted approximately 35 min. After the presentations were completed, participants from the same group went to the computer classroom, where cognitive biases were assessed. This phase lasted 40 min. The last phase of the experiment was the debriefing.

Measures

The same measures as in Experiment 1 were applied. The only difference was that the instructions were in the past tense, since it was important to know how the participants felt in the current situation of social threat.

Results

Bivariate correlations (Table 5) suggested that the independent variables correlated moderately, except for BIS and Freeze, which show somewhat stronger positive correlation, as well as two SPCQ variables, which correlated strongly and positively. BIS, Flight, and Freeze correlated moderately and positively with the two SPCQ variables. Two indexes of attention bias correlated modestly and negatively.

MANCOVA (Table 6) showed that the set of independent variables explained a substantial amount of variance of SPCQ – cost ($p < .001$) and SPCQ – probability ($p < .001$).

Table 5. Experiment 2: Descriptive statistics and bivariate correlations (Pearson correlations; two-tailed)

Variable	BIS	BAS	Fight	Flight	Freeze	SPCQ – cost	SPCQ – probability	AB – th	AB – pl	NMBI
BAS	−.35***									
Fight	−.03	.18								
Flight	.48***	−.11	.05							
Freeze	.58***	−.29**	−.15	.46***						
SPCQ – cost	.48***	−.08	.03	.35***	.47***					
SPCQ – probability	.41***	−.07	−.10	.30**	.38***	.73***				
AB – th	.08	−.12	.07	−.04	−.03	−.10	−.11			
AB – pl	.16	−.12	−.02	.01	−.05	.05	.09	−.31**		
NMBI	.03	.01	−.01	−.06	.06	.01	.00	.00	.06	
M	2.29	2.94	2.42	2.60	1.91	36.04	37.16	−4.01	1.12	−0.21
SD	0.58	0.49	0.62	0.49	0.62	2.58	19.77	23.12	27.96	2.05
α	.78	.72	.82	.50	.77	.96	.95			

Notes. *N* = 121. BAS = Behavioral Approach System; BIS = Behavioral Inhibition System; SPCQ – cost = judgmental bias – assessment of cost (negative impact) of events in near future; SPCQ – probability = judgmental bias – assessment of likelihood of negative events in near future; AB – th = attention bias toward threatening stimuli; AB – pl = attention bias toward pleasant stimuli; NMBI = Negative Memory Bias. $^{**}p < .01$, $^{***}p < .001$ (all two-tailed).

Table 6. Experiment 2: Results of MANCOVA

	SPCQ – cost	SPCQ – probability	AB – th	AB – pl	NMBI
Variable	*B* (β)	*B* (β)	*B* (β)	*B* (β)	*B* (β)
BIS	11.06 (.31)**	10.62 (.31)*	5.38 (.14)	13.42 (.28)*	0.17 (.05)
BAS	4.4 (.11)	4.87 (.12)	−6.46 (−.14)	−4.9 (−.09)	0.17 (.04)
Fight	2.03 (.06)	−2.89 (−.09)	3.59 (.10)	−1.43 (−.03)	0.01 (.00)
Flight	2.44 (.06)	3.33 (.08)	−4.46 (−.10)	−1.11 (−.02)	−0.46 (−.11)
Freeze	9.86 (.30)**	5.63 (.18)	−3.57 (−.10)	−10.6 (−.24)*	0.32 (.10)
EC1	2.26 (.09)	1.08 (.04)	3.65 (.13)	−0.81 (−.02)	−0.19 (−.07)
EC2	−1.51 (−.06)	−2.15 (−.09)	−0.42 (−.01)	−4.16 (−.12)	0.00 (.00)
R^2	.31	.23	.05	.08	.02
Adj.R^2	.27	.18	.00	.03	−.04
$F_{(2,118)}$	7.24	4.77	0.94	1.50	0.33
EC1					
M	38.81	38.88	−1.07	0.05	−0.41
SD	20.99	19.54	24.24	28.33	2.37
SE	3.28	3.05	3.79	4.42	0.37
EC2					
M	34.54	35.10	−4.18	−2.47	−0.19
SD	18.97	18.31	21.42	26.86	1.85
SE	2.96	2.86	3.35	4.19	0.29
EC3					
M	34.71	37.53	−6.93	6.62	0.00
SD	21.97	21.71	23.85	28.71	1.92
SE	3.52	3.48	3.82	4.60	0.31
Total					
M	36.04	37.16	−4.01	1.12	−0.21
SD	20.58	19.77	23.12	27.96	2.05
SE	1.87	1.78	2.10	2.54	0.19

Note. *N* = 121. BIS = Behavioral Inhibition System; BAS = Behavioral Approach System; EC1 – experimental condition 1 as a independent variable (negative feedback); EC2 – experimental condition 2 as a independent variable (positive feedback); EC3 – experimental condition 3 as a independent variable (neutral feedback); *F* = *F* test: Model significance; SPCQ – cost = judgmental bias – assessment of cost (negative impact) of events in near future; SPCQ – probability = judgmental bias – assessment of likelihood of negative events in near future; AB – th = attention bias toward threatening stimuli; AB – pl = attention bias toward pleasant stimuli; NMBI = Negative Memory Bias; SPCQ – cost, SPCQ – probability, AB – th, AB – pl, NMBI as dependent variables; B = unstandardized regression coefficients; β = standardized regression coefficients. $^{*}p < .05$, $^{**}p < .01$ (all two-tailed).

Table 7. Experiment 2: Behavioral parameters for attentional bias (response times – RT)

Attentional bias		Min	Max	*M*	*SD*	Sk	Ku
RT	RTC_anger	331.41	627.19	432.92	55.92	0.767	0.799
	RTI_anger	323.48	609.48	428.91	57.65	0.724	0.562
	RTC_joy	338.06	597.86	432.61	53.95	0.750	0.713
	RTI_joy	338.61	677.83	433.72	63.51	1.201	2.376
	RT_neutral	408.14	726.32	532.10	69.10	0.583	0.316
Bias indexes	BI_anger	−62.11	58.52	−4.00	23.12	0.312	0.128
	BI_joy	−79.82	81.06	1.12	27.96	0.334	1.153

Note. *N* = 121. RT = Response Times; RTC_anger = congruent trials for threatening stimuli; RTI_anger = incongruent trials for threatening stimuli; RTC_joy = congruent trials for pleasant stimuli; RTI_joy = incongruent trials for pleasant stimuli; RT_neutral = responses times for neutral stimuli; BI_anger = bias indexes for threatening stimuli; BI_joy = bias indexes for pleasant stimuli; Sk = Skewness; Ku = Kurtosis.

Table 8. Experiment 2: Behavioral parameters for attentional bias (response times – RT)

Attentional bias	Group	Min	Max	*M*	*SD*	Sk	Ku
RTC_anger	NEGF	354.37	594.80	436.17	57.65	0.944	0.688
	POSF	349.09	552.63	429.81	52.23	0.168	−0.810
	NEUF	331.41	627.19	432.76	59.00	1.053	2.142
RTI_anger	NEGF	341.00	609.48	435.10	59.74	1.047	1.203
	POSF	334.24	556.36	425.63	55.93	0.396	−0.209
	NEUF	323.48	575.84	425.84	58.18	0.707	0.673
RTC_joy	NEGF	359.15	586.53	438.23	54.29	0.955	0.986
	POSF	342.10	552.65	428.48	52.92	0.382	−0.225
	NEUF	338.06	597.86	431.04	55.55	0.950	1.580
RTI_joy	NEGF	338.61	656.50	438.27	70.09	1.211	1.854
	POSF	340.06	554.22	426.01	51.47	0.239	−0.573
	NEUF	343.50	677.83	437.05	68.42	1.490	3.356
RT_neutral	NEGF	416.18	726.32	535.22	72.79	0.945	0.858
	POSF	408.14	650.23	526.50	66.15	0.058	−0.976
	NEUF	413.95	720.95	534.71	69.61	0.636	0.802
BI_anger	NEGF	−45.19	47.39	−1.07	24.24	0.334	−0.537
	POSF	−50.69	58.49	−4.16	21.42	0.351	0.881
	NEUF	−62.11	58.52	−6.93	23.85	0.274	0.538
BI_joy	NEGF	−37.04	81.06	0.05	28.33	1.077	0.892
	POSF	−79.82	45.56	−2.47	26.86	−0.870	1.680
	NEUF	−55.81	80.92	6.02	28.71	0.611	0.957

Notes. N_{NEGF} = 41; N_{POSF} = 41; N_{NEUF} = 39. RTC_anger = congruent trials for threatening stimuli; RTI_anger = incongruent trials for threatening stimuli; RTC_joy = congruent trials for pleasant stimuli; RTI_joy = incongruent trials for pleasant stimuli; RT_neutral = responses times for neutral stimuli; BI_anger = bias indexes for threatening stimuli; BI_joy = bias indexes for pleasant stimuli; NEGF = Negative Feedback; POSF = Positive Feedback; NEUF = Neutral Feedback.

BIS and Freeze contributed positively to prediction of SPCQ – cost. BIS positively affected attention biases toward pleasant stimuli, while Freeze was negatively related to attention bias toward pleasant stimuli. While bivariate correlations between attention bias toward pleasant stimuli and BIS, as well as FFFS were nonsignificant, the same relations were significant in the MANCOVA. Namely, in MANCOVA, statistical significance of standardized β coefficient for Freeze is 0.046. This is a marginally statistically significant result and should be treated with caution. Statistical significance of standardized β coefficient for BIS was 0.022. This result is theoretically implausible and most probably an artifact. This effect may be attributed to outliers. Experimental conditions did not affect any of the dependent variables.

Behavioral parameters for attentional bias (response times – RT) are shown in Tables 7 and 8.

Discussion

Experimentally induced circumstances of social threats, in their own regard, do not affect attentional, memory, or judgmental biases. The situation which was to provoke a real threat was apparently strong enough for the participants in all three groups, so that the effect of experimental manipulation did not occur. In other words, preparation of a speech and presentation before the professors is perceived as a consistent social distress regardless of the type of nonverbal feedback. BIS and Freeze have significant effects on judgmental and attention biases. BIS and Freeze are positively related to the assessment of cost of occurrence of undesirable social events, while BIS affects the assessment of distress. Such effects occur in groups of highly socially anxious individuals in experimental conditions similar to the conditions in this study (Pozo, Carver, Wellens, & Scheier, 1991; Winton, Clark, & Edelmann, 1995). However, although this study did not include a group of high-anxiety participants, it did include a highly provocative situation, which can be perceived as an intense social stressor (the presence of authority and the importance of their feedback). The emergence of BIS as the primary positive correlate of threat perception is in line with the expectations stemming from both MMSA and RST (Corr, 2011; Gray & McNaughton, 2003; Kimbrel, 2008). People who tend to perceive the environment as potentially threatening and harassing appear to show pronounced negative judgmental bias.

Behavioral Inhibition System reactivity was a significant positive predictor of attention bias toward pleasant stimuli. It is possible that the positive stimuli in the case of real danger may represent an adequate distractor, which attracts the attention of people with high BIS. On the other hand, people with high Freeze may perceive pleasant stimuli as a disturbing factor that interferes with cognitive processes responsible for the processing of signals of danger.

Final Discussion

The overall goal of this study was to explore the differences in cognitive processes in two different situations, which provoke potential and real threat. Results are in line with the basic premises of rRST (Gray & McNaughton, 2003), pointing to the differences between the cognitive processes associated with anxiety and fear. In case of potential threats, the role of cognitive processes is to detect possible inconvenience and distress, whereby BIS plays a key role in shaping of cognitive biases related to the cost of future events. Besides, BIS has a crucial role in the processes of signals of real danger. People with high BIS experience each new situation as an opportunity to scan the environment in search of possible dangers and risks. Differences between potential and actual threats are reflected in different cognitive processes that are activated under the influence of BIS. In the case of potential threats, BIS contributes to the assessment of cost, while in the circumstances of real threat, it contributes to attention biases as well.

The role of pleasant stimuli is particularly important for the understanding of attention focus in provocative situations. In case of potential threats, pleasant stimuli serve as distractors for people with high Freeze, while in the case of real threats, pleasant stimuli are distractors for people with high BIS. Focusing on positive stimuli in people with high Freeze may point to specific cognitive strategies for coping with potential stress. Positive stimuli serve the same purpose for the people with high BIS in cases of real danger. The results point to the possibility that the type of threat may be a moderator of the effects of BIS and Freeze on attention biases to pleasant stimuli. An alternative explanation for this result is the finding that people with high BIS and Freeze pay greater attention to positive stimuli because they are incongruent with the threat that currently occupies their cognitive capacities. Certainly this is a intriguing result, which raises the question of cognitive processing of positive stimuli in stressful situations.

Importantly, differences between results which are related to effects of personality traits on cognitive biases can be explained by using different assessment methods. In line with this, the judgment biases were assessed by self-reports, whereas attention biases and memory biases were measured based on task performance. Therefore, the judgment biases and the personality measures probably share more method variance what could also explain why SPCQ was generally more strongly related to rRST constructs. Previous evidence suggests that correlations between personality dimensions and processing of emotional stimuli are small (e.g., Gomez & Gomez, 2002; Kerns, 2005; Vermeulen, Luminet, & Corneille, 2006). Therefore, future research should include multi-method assessment of BIS, BAS, and FFFS sensitivity (e.g., behavioral tasks) and measurement of judgmental biases based on task performance.

Experimental manipulation affects only the cognitive processes that can be easily modeled under the influence of the current circumstances, such as cognitive bias. The lack of any effect on memory processes indicates that short-term effects provoked by experimental conditions were not sufficient to cause changes in memory. In other words, it is possible that stressful situations trigger the activity of working memory, but not long-term memory.

It should be noted that cognitive biases were measured after the threatening situation. For instance, the attentional bias toward positive stimuli in high BIS individuals may also be mediated by feelings of relief that the stressing situation has been overcome. Thus, the two experiments mainly differ in the temporal relation between the social threat and cognitive bias assessments. In general, future replication studies may benefit from a full pretest-posttest design, which may help disentangle the effects of temporal factors on all relevant variables.

The results point to the complexity of the interplay among situational features, personality traits, and cognitive processes. Situations of potential threat seem to engage cognitive processes more than the situations of real threat, possibly due to their more pronounced ambiguity and openness to interpretation. In the situations of real threat, effects of personality traits emerge, probably triggered by the need to overcome present danger.

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