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COGNITIVE BIAS AND ANXIETY IN TEENAGERS

DOCTORAL THESIS ABSTRACT

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ABSTRACT CONTENTS

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CHAPTER I

THEORETICAL APPROACH OF COGNITIVE BIAS IN ANXIETY

All the theoretical approach relates cognitive bias with threatening information, starting with the early stages of informational processing (Williams and co., 1988, 1997; Wells and Mathews, 1996, Mogg and Bradley, 1998; Mathews and Mackintosh, 1998). In order that this type of differentiated stimuli processing to appear, two conditions are necessary – either the stimuli bare a high level of threat, which justifies an adaptive reaction of vigilance towards the stimuli (Öhman and Mineka, 2001), or the person confronts with a state or trait of anxiety (Williams and co., 1988, 1997; Mogg and Bradley, 1998; Bar-Haim and co., 2007; Eysenck and co., 2007; Ouimet and co., 2009).

Regarding the relationship between cognitive bias and anxiety, there are eight models which are different from each other in what manner these cognitive biases can represent vulnerability, a maintaining or even a causal factor in anxiety. Five models confer attention bias a causal role in anxiety: the model of the two informational processing stages (Williams and co. 1988, 1997), the cognitive – motivational model of anxiety (Mogg şi Bradley, 1998), and the model of threat assessment system (Mathews and Mackintosh, 1998), the integrative model of Bar-Haim and co. (2007) and the multi-stage model of Ouimet (2009). In the same time, Mogg and Bradley (1998), respectively Wells and Mathews (1996) confer a greater importance to anxiety vulnerability of some inferential processes in the evaluation of the threatening degree (Mogg, Bradley, 1998), respectively of some meta-cognitive processes (Wells, Mathews, 1996), attention bias being, in fact, the consequence of anxiety, especially of a lower capacity of attention control (Eysenck and co., 2007) which leads to an imbalance between the ascendant and descendent informational processes in the way of an increase of the influence of ascendant processes of stimuli traits, especially of the threatening ones.

Last but not least, by postulating the existence and the philo-genetic development of the "fear module" by Öhman and his collaborators (1996, 2001, 2009), biologically localized at the amygdale level, the cognitive biases lose their central position in the vulnerability towards anxiety, being rather the consequences of the fear response, which has the adaptive function of triggering as fast and as efficient possible an early processing of environment threats in order to avoid danger.

CHAPTER II

EMPIRICAL EVIDENCE OF DIFFERENTIATE PROCESSING OF THREATENING / ANXIETY. NEGATIVE BIASES

One of the most important conclusions regarding threatening stimuli processing is that bias towards the threatening stimuli is not specific to anxiety, but it is a general characteristic of any cognitive system which developed an efficient defense system against dangers. This defense means, in the first place, the development of a system which detects fast and efficient the threats coming from the environment. Thus, the threatening stimuli coming from the environment benefit from a preferential allocation of attention resources, a parallel distributed processing and the increase in the neuro-physiological arousal necessary to trigger the effective defense behaviors.

Attention bias is a robust phenomenon, experimentally proven (Hakmata şi co., 2010), but is not an homogenous phenomena, but a distinct one, according to the type of anxiety, the context in which the dangers appear, the intensity of the threat and other factors which can influence or even determine the way of the attention bias. Moreover, it was emphasized the existence of a pre-attention unspecific bias, which appears because all the factors with a negative valence are being processed and not only the ones with a clear threatening feature, for a better and more efficient defense against dangers.

On the other hand, the attention bias in people suffering from anxiety disorders is specific for each disorder separately, as people with an obsessive – compulsive disorder present a higher sensitivity to threatening stimuli specific to obsession and are less sensitive to other stimuli categories unspecific to this disorder, while people suffering from social phobias are more sensitive to stimuli which are threatening to their social image and less sensitive to other types of threatening stimuli and so on. Research in the field of attention selectivity showed the attention system is not a unitary one and attention focus is based on three distinct sub-systems: attention orientation, attention engagement and attention disengagement (Posner, Petersen, 1990). It is very likely that one of the dysfunctions involved in the vulnerability for anxiety to reside in the difficulty to disengage the attention from threatening stimuli (Fox and co, 2001; Amir and co., 2003).

Regarding the influence of the anxiety trait and state over the attention bias, there are a number of hypothesis: (1) the effects of the anxiety state and trait can add to each other, thus appearing a level beyond which it is manifested an enhanced vigilance towards threatening stimuli (2) there are different patterns of vigilance vs. avoidance in the anxiety level, as non-anxious people prefer to avoid the threatening stimuli, while anxious people become more vigilant no matter the threatening degree of the stimuli; (3) there is a curvilinear relationship between the stimulus threat degree and the attention response, as when the stimulus threat value is small or almost null, there is no attention bias in anxious or non-anxious people, at a medium threat degree there appears an avoidance tendency in non-anxious people and a preferential allocation of resources in anxious people, while when the threat intensity becomes large, a higher vigilance reaction is registered towards the threatening stimuli, no matter the anxiety level in people.

If at an attention level, robust evidence were gathered in the favor of preferential processing of threatening stimuli, we can't say the same thing about threatening stimuli storage and reactivation, where obtained results are inconsistent and sometimes even contradictory. The most studies involving **memory bias** of threatening stimuli focused on the clinical population, so we don't have available, according to our knowledge, any recent study regarding the way of storage and reactivation of threatening stimuli (specifically negative stimuli which have or don't have a personally relevant threatening degree) in normal, non-pathological conditions. We only have available indirect results in which researchers have observed some tendencies in the absence of anxiety of easier reactivation of threatening words, but also contradictory results which emphasized a positive bias in non-clinic subjects.

In what concerns the reactivation of threatening information in the anxiety clinic population, the results are mixed, some studies proving a bias in the explicit memory, but not in the implicit one (Neidhardt, Florin, 2002, Cloitre şi co., 1995), while others have shown a bias in the implicit memory and not in the explicit one (Lundh şi Öst, 1997; McNally şi co., 1990), while other research didn't manage to emphasize any type of memory bias whatsoever (Rinck, Becker, 2005**;** Coles, Heimberg, 2005**)**. It is very possible that this result inconsistency to be caused by an inadequate study methodology: the use of irrelevant subject samples for memory bias (people with generalized anxiety or social phobia), the use of low – threatening level stimuli or personally irrelevant stimuli, the use of trials which triggered more the surface, perceptual traits of stimuli

and not their semantic, significance characteristics. Moreover, all studies focused on reactivation as a means of bringing back in the working memory of information in their absence, while no study used recognition as a means of bringing back into the working memory of information in their presence, although this is done much easier than the reactivation in the absence of the object and it would have been probably much easier to emphasize the occurring of the memory bias. Last but not least, apart from the attention bias, the memory bias is more sensitive to an anxious emotional disposition than it is to anxious traits.

At an inferential level, this bias towards threatening stimuli is maintained only to those anxious people who continuously tend to associate ambiguous events with negative consequences, threatening ones, even in spite the ulterior experiencing of events associated with positive, non-threatening events (Amir, Beard şi Przeworski, 2005), while in non-anxious people, there were registered exactly the opposite result of negative bias, meaning that researchers observed a positive bias in the interpretation of ambiguous events (Hirsch şi Mathews, 1997, 2000; Constans, Penn, Ihen şi Hope, 1999). We notice, thus, a gradual process which moves from a negative bias – observed at an attention and pre-attention level – towards a positive bias at inferential level of interpreting environmental events.

The differences between anxious and non-anxious people regarding the processing of environment threatening information, as they were noted based on empirical results offered by the field literature, are as follows:

a. When the stimulus' level of threat is small or almost null, there is no attention bias in either anxious or non-anxious people, but at a medium threat level of stimuli, phobic people tend to allocate preferentially attention resources, while non-anxious people tend to avoid the prolonged stimuli processing. There is a preferential pre-attention processing of stimuli with a medium level of threat, but if these stimuli prove not to be a real danger, this preferential processing tends to diminish at the attention level. When the threat degree is intense, it appears a higher degree of vigilance towards the threatening stimuli independent of the anxiety level, in both anxious and non-anxious people.
b. Anxious subject can't differentiate between the weak and strong predictors of danger, they presenting a prolonged bias on all threat levels, while non-anxious people present a pre-attention initial bias on all threatening stimuli categories, only to activate a series strategies of cognitive avoidance of stimuli with a low or medium emotional valence, so

that at an attention level we observe only an attention bias towards the stimuli presenting a high level of threat. This prolonged negative and generalized bias on many categories of stimuli, no matter their level of threat, represents one of the main vulnerability factors for anxiety.

c. There is an a priori tendency in anxious people to interpret ambiguous events as being threatening, especially by associating these events with negative consequences (Stopa, L., Clark, D.M., 2000; Mathews, A., Mackintosh, B., 2000; Hermann, C., Ofer, J., şi Flor, H., 2004). Despite the usual theories, this association of events with negative consequences, respectively a negative interpretation of ambiguous situation is the one that generates the anxiety disposition and not the other way around.

d. Another essential difference between anxious and non-anxious people is that, at the level of interpreting ambiguous environmental events, the anxious subjects keep presenting a negative bias, while non-anxious subjects present a positive bias (Hirsch şi Mathews, 1997, 2000). Negative bias in anxious subjects seems to be directly proportional with the symptoms' severity, respectively with the level of stimuli threat. In other words, anxious subjects tend to interpret ambiguous situations as being threatening, and high threatening situations as being catastrophic (Stopa şi Clark, 2000).

e. Once the threatening interpretation is activated, the anxious subjects seem not to learn anything from ulterior exposures to situations associated with positive, non-threatening consequences. In other words, anxious subjects aren't more sensitive to safety signals that come from the environment and don't diminish the negative cognitive bias. This is one of the reasons for which the threatening interpretations are quite resistant to change.

CHAPTER III

POSITIVE BIASES

Positive bias (positive illusions, positive bias of self image, positive bias in the attribution of success or failure) represents a ubiquitous and experimentally validated phenomena (Taylor and Brown, 1988, 1994; Kwan and co., 2004; Mezelius and co, 2000). Positive bias (self-enhancement bias or self-serving bias) can constitute by itself a defensive mechanism, when the ego is threatened (Campbell and Sedikides, 1999), but also can represent a protective factor of the psychological system in stress or traumatic situations (Fredrickson, 2001). People who hold positive illusions themselves have a positive self-esteem, a lower incidence of depression, a positive emotional disposition towards happiness and contentment, a neuro-physiological and neuro-endocrine response which is lower in stress situations in comparison to other people, engage themselves in active coping strategies and are more problem-solving oriented.

Positive emotions proved to have an important role in the recovery process after life traumatic events (Bonanno, 2004; Folkman and Moskowitz, 2000) and have a protective role for the biological and psychological system after threatening situations or negative emotions experiencing (Tugade and Friedrickson, 2004). Thus, because they activate the parasympathetic functions, producing the lowering of some physiological parameters – cardiac rhythm and blood pressure among others – we can state that positive emotions lead to a significant recovery after an intense cardiovascular activation provoked most of the times by threatening situations or negative emotions experiencing (Fredrickson, 2001) . In other words, we can say that positive emotions represent “antidotes” against adverse effects of negative emotions consequent to those situations (real or perceived) of threat and danger, they having the role of correcting or annulling the unwanted effects of the negative emotions, preventing a possible generalization of a negative bias in the cognitive system, with pathological consequences.

CHAPTER IV

EMPIRICAL RESEARCH

THE DYNAMICS OF THREATENING INFORMATION PROCESSING AT AN ATTENTION, MEMORY AND INFERENTIAL LEVEL IN TEENAGERS

One of the main assumptions of the present research is that the preferential processing of threatening information is not specific to people suffering from some anxiety disorders or a vulnerability towards anxiety, just as some anxiety cognitive theories led us to believe (Beck, 1979), but it is a main characteristic of an efficient defense system. Consequently, the main novelty trait of this research is that we aim to shed light over the specifics and the dynamics of threatening information processing at an attention, memory and inference level, as a part of an efficient defense system, regardless of the anxiety level and using the same conceptual and methodological framework. Although there is some level of consensus regarding attention negative bias in anxious people, the studies concerned with the per se threatening information processing independent from the anxiety level are quite few and presenting mixed results, depending on the methods used (type of used stimuli, stimuli relevance, the intensity or degree of threat, different experimental tasks). Moreover, the threatening information processing at the memory and inference levels were never studied in the same framework as those at the attention level so it could correctly be observed the vertical dynamics of threatening information processing. In order to overcome these methodological drawbacks, we will study the specifics of threatening information processing on all three levels of processing in a unique framework, given by the use of same subjects, the same stimuli categories and the same experimental tasks.

Regarding the memory biasing, researchers didn't agree even upon the anxious people, some studies proving a bias in the explicit memory, but not in the implicit memory, others an implicit memory bias and not in the explicit memory bias, while others didn't find biases at all in respect to memory. According to our knowledge, we don't have available any empiric recent study regarding the means of storage and reactivation of negative emotional stimuli different from the stimuli with an emotional negative value, with or without a relevant personal threat for the subject, in normal, non-pathological contexts. We only have indirect results because some tendencies have been observed in people without an anxiety history of reactivating easier

threatening words, but also contrary results, where a positive bias was observed in subjects with lower levels of anxiety. All these studies used explicit and implicit memory tests.

Another novelty trait of this research is given by the fact that besides the implicit and explicit memory tests of reactivating information in the absence of the object, we will use a test to evaluate recognition as a form of reactivation in the presence of the object. We selected this form of reactivation because we consider it has a greater ecological value, as in the natural environment we frequently confront ourselves with potential anxiety-inducing situations without being necessary to reactivate in the working memory situations we confronted in the past, in their absence.

Research regarding anxiety stimuli processing at an inferential level caught much more attention in the last years, with a renewed accent on anxious people or on those vulnerable at anxiety, the majority of such studies following the interpretation of social ambiguous situations with or without a previous exposure to anxiety-inducing stimuli. We know, however, too little about the way other threatening or anxiety-potential information are inferentially processed than those relevant to social anxiety.

Studies conducted by now reached a series of important conclusions regarding the anxiety-potential information inferential processing:

(1) There is an a priori tendency in anxious people to interpret ambiguous events as being threatening and especially to associate these events with negative consequences (Stopa, L., Clark, D.M., 2000; Mathews, A., Mackintosh, B., 2000; Hermann, C., Ofer, J., and Flor, H., 2004).

(2) This negative bias is, however, more diminished in non-anxious people, or even replaced with a positive bias, meaning with a tendency of positively interpreting the ambiguous environmental information (Hirsch and Mathews, 1997, 2000).

(3) This bias of interpretation is determined by stable cognitive structures and personality traits more than it is determined by contextual emotional states (Mathews, A., Mackintosh, B., 2000; Constants and co., 1999).

Because the vast majority of scientific literature in this field assumes the existence of a difference in the processing of anxiety stimuli in anxious persons, by this present paper, we aim to emphasize the differences in processing between anxious and non-anxious subjects on all three levels: attention, memory and inference, by using the same conceptual and experimental framework. In order to obtain this, from our initial sample, we will select only the subjects

presenting a high level of nonclinical anxiety and a low level of anxiety, respectively. We will follow anxiety as both state and trait for social threatening and physical threatening situations.

4.1. Study 1A. Threatening information processing at the attention level

4.1.1. Goals and hypotheses

At this stage, we aim to put into evidence the means of threatening information processing at an attention level. The main assumption we start from is that even if there are differences in threatening information processing between anxious and non-anxious subjects, all people, no matter their anxiety level, preferential process the threatening information, because this strategy has a powerful adaptive value.

In order to see what are the processing differences between anxious and non-anxious subjects, we will take into account anxiety as both a state and a trait. Most recent studies show that a state of anxiety can lead to some modifications in the processing of threatening information, in the way of an increased vigilance not only for the stimuli presenting a higher level of threat, but also for the stimuli with a lower level of threat. As anxiety as trait, it appears that this doesn't decisively influence the differentiate processing of anxiety inducing stimuli. The only consensus in this direction is the specificity of the negative bias at the attention level, meaning that subjects presenting an obsessive-compulsive disorder have a higher sensitivity to stimuli specific to obsessions and are less sensitive to other categories of stimuli, non-specific to the disorder, people suffering from social phobia present a higher sensitivity to specific threatening stimuli over their social image and less sensitive to other types of stimuli and so on. We will study also in the present paper if this specificity is present also at a sub-clinic level, and we will use thus two forms of sub-clinic anxiety – the anxiety in social threatening situations and the anxiety in physical threatening situations, with an emphasis on two types of threatening stimuli: social and physical.

Synthetically, the hypotheses of this study are:

I1: There is a preferential processing of threatening stimuli (social and physical), no matter the subjects' levels of anxiety.

I2. There are differences in the processing of threatening stimuli depending on the anxiety levels as follows: a preferential processing of threatening stimuli with high level of danger by non-

anxious subjects and a preferential processing of all threatening stimuli no matter their level of danger by the anxious subjects.

I3. Attention bias is specific for the anxiety type. In the present experimental design, the support of this hypothesis would imply that:

i) Social anxious subjects present a differentiate attention processing of threatening stimuli which are relevant to social anxiety, but not of the stimuli relevant to physical anxiety.

ii) Subjects presenting anxiety to physical dangerous situations present a differentiate attention processing of threatening stimuli relevant to physical danger anxiety, but not of stimuli relevant to social anxiety.

4.1.2. Method

4.1.2.1. Participants

In the first stage of the study were included 149 participants, students at the National College "Emil Racoviță" in Cluj-Napoca, having an age between 16 and 19 years. Studies conducted to compare the teenage and adult samples didn't show any significant difference in their levels of attention bias. Participation to the study was achieved with the explicit agreement of the students. The age average of the sample is 17,01, with a standard deviation of 0,775**.** The gender report fell in the favor of the feminine one: 94 female subjects and 55 male subjects.

In order to the most accurate evaluation of the specific of anxiety information processing, we eliminated from the working sample the subjects presenting a high tendency of giving social desirable answers. For this purpose we used the Marlow-Crown Scale and because the scores at the social desirability scale proved to be symmetrical distributed, we used as a delimitation level the value given by the sample average plus one standard deviation, in this present case $m+1\sigma$ = 21,66 (m=17,16; σ=4,5). Consequently, the subjects obtaining at the social desirability scale a higher score that the critical level of 21,66 were eliminated from the study.

In a second phase, after the dot test was administered, we eliminated the subjects who gave wrong answers or who presented a very long latency in answering (over 2000 ms) in over 51% of the items total and also the ones who following the screening, declared they didn't read the stimuli included in the dot test and they mechanically answered when the dots appeared.

Following all these selections, from the initial sample of 149 subjects, there were left only **118,** among who 46 are male and 72 are female, with an age average of 17,05 years.

4.1.2.2. Instruments and materials

In order to conduct this study, we used four distinct categories of instruments and materials: psychological evaluation scales, experimental verbal stimuli set (words), a special computer program to run the experimental tasks and a pen and paper test to evaluate the perceived threatening level of the used verbal stimuli. We will present them in a sequence:

1) The Marlow-Crown Social Desirability Scale was developed by Crown and Marlow in 1960 and it is one of the most used evaluation instruments of the felt need of approval or avoidance of disapproval from the others. The scale consists of 33 items which contain descriptions of very desirable but very rare life situations and descriptions of very undesirable but very common life situations. The answers variants are "true" or "false", the respondent being asked to answer according to his personal attitudes and traits. The score varies between 0 and 33, a high score indicating a high level of social approval need.

2) The Endler Multidimentional Anxiety Scale represent a three scales set which measure three types of anxiety: EMAS-S measures anxiety as a state, EMAS-T measures anxiety as a trait, and EMAS-P evaluates the subject' perception on the type and threat level perceived in an immediate situation. EMAS-S consists of 20 items, among which 10 measure the emotional-physiological component of anxiety as a state, and the other 10 measure the cognitive component of the state of anxiety. Each item is assessed on a scale from 1 (at all) to 5 (very much). The respondents are asked to evaluate for each of the items the way they feel in that precise moments. The EMAS-T includes four situational dimensions of anxiety as a trait. The scale represents an inventory of 60 items, composed of 15 answer items for each of the four general situations. The items are evaluated on a scale from 1 (at all) to 5 (very much). EMAS-T emphasizes four separate anxiety scores of anxiety as a trait for each individual: social evaluation, physical danger, ambiguity and daily routines. Among these four situations, in the present research we used the scores concerning the social evaluation and the physical danger scores.

3) *Stimuli*

In order to verify the hypotheses, in the experimental stage were used 64 verbal stimuli (words) from the next categories: 8 anxiety stimuli relevant to social threat, 8 positive relevant

stimuli for social threat, 8 anxiety relevant stimuli for physical threat, 8 positive relevant anxiety stimuli for physical threat and 32 neutral stimuli.

These were grouped in 32 word pairs as follows:

- anxiety stimulus relevant for social threat + neutral stimulus (8)
- anxiety stimulus relevant for physical threat + neutral stimulus (8)
- positive relevant stimulus for social threat + neutral stimulus (8)
- positive relevant stimulus for physical threat + neutral stimulus (8)

This set of stimuli was gathered by using a three-stage procedure: the stimuli generation (1), the stimuli selection (2) and the stimuli pairing in word pairs (3).

We chose two different sources of *stimuli generation (1).* The first source we used to obtain verbal stimuli was the anterior studies concerning attention biases which offered the list of used word-pairs and social anxiety scales, health anxiety and traumatic events.

The second source consisted of five specialized psychologists who were asked to generate a series of words with anxiety potential and positive, respectively, relevant to social situations and physical dangerous situations. 349 verbal stimuli in all categories were generated and then united in a single list and subjected to an evaluation and selection process.

In the selection of the *64 verbal stimuli (2)* used in this experimental study we took into account the following criteria: the stimuli relevance for the category they belong to, their emotional valence, the frequency they are used in the Romanian language and their abstract level.

Finally, *the match of stimuli in pairs (3)* was conducted taking into account the next prescriptions: the two stimuli to have the same length (number of letters), the same abstract level and approximately the same frequency use in the Romanian language but to be different as relevance and emotional valence

4) *Experimental software*

In order to run the research, we used a computer program developed by Mircea Miclea and Paul Cotârlea, which allows the exposure of verbal stimuli with a controlled duration in the Dot Probe paradigm, respecting the specific rigors of this experimental task. The program is developed so it allows the following of several exposure cycles, every cycle consisting in several stages:

(1) FIX (fixation point) – in the screen center is exposed the sign (+) which has the role of warning and sight focus

(2) SOA (stimulus onset asynchrony) – asynchrony interval of stimuli, empty screen

(3) S (stimuli) – a pair of words is symmetrical exposed in the upper and the down side of the screen, respectively

(4) POA (probe onset asynchrony) – asynchrony interval of the target stimulus, empty screen

(5) P (probe) – in the center of the location previously occupied by one of the two words, a visual stimulus is exposed and the subject must answer by pressing a pre-established key

(6) SRT (supplementary response time) – supplementary interval for answer registration; in this phase, the screen is empty in order to record the subject's answer if the afferent key is pressed

(7) IIT (inter-items time) – this is the demarcation phase between two consecutive items; the screen is empty but the computer doesn't register any answer from the subject

5) ***The evaluation scale of the stimuli threatening level***

The evaluation scale of the stimuli threatening level gathers all the stimuli which are threatening from a social and physical point of view and used in the experimental phase, the subjects having the task of evaluating them on a Likert scale from 0 (at all anxiety-inducing) to 10 (very anxiety inducing) and assess thus how threatening is for each of them every single item. In this way, we obtain a personalized situation describing the level of threat of every anxiety inducing stimulus, so we could undergo statistical processing depending on the personal relevance of the threatening stimuli.

4.1.2.3. Procedure

All the subjects in the initial lot (N=149) were asked to answer on two battery tests: the Marlow-Crown Social Desirability Scale and EMAS (EMAS-S and EMAS-T). These instruments were used in groups gathering around 25 subjects, every one answering individually and without a time frame. Each scale was accompanies by the specific instructions for the task and answer variants.

The task of evaluation attention biases in the Dot Probe paradigm was administered in an interval of few days after the administration of the two batteries, time used in completing the screening (score calculation and subjects selection). The task of evaluation attention biases in the Dot Probe paradigm was administered to all the subjects registering a lower score of 21,66 at the Marlow-Crown Social Desirability Scale, in heterogeneous groups of up to 4 people. Entering the lab, each subject was invited to sit in front of a computer, at a distance of approximately 80 cm by the screen, so that the horizontally sustained sight of any subject to be focused in the

center of the screen, while the subject, the keyboard and the screen to be in a collinear position. After each subject individually received the task, all the subjects underwent a training session similar to the working task, after which they proceeded in completing the experimental task.

Each item began with the exposure for 1000 ms of a white fixation point shaped like this (+), having the dimensions of 5mm/5mm; the subjects were instructed to focus their sight on this sign until words showed up. In the next step, on the screen appear the two verbal stimuli, aligned centrally and vertically symmetric towards the focus point. The words were written in white caps and a size of 9 cm in Times New Roman, with a distance between them of 38 mm. The exposure time for the words was 50 ms for the condition of subliminal perception and 500 ms for the condition of supraliminal perception. Between the time of words apparition and the probe apparition it was set a time interval of 700 ms (MOA), during which the screen was left empty. After this interval expired, the target stimulus, represented by two dots, arranged either (:), or horizontally (. .) appears in the location previously occupied by one of the two words,. These remained on the screen for 1000 ms, while subjects had to answer to these target stimuli in a timeframe of another 1000 ms. The subjects' task was to read the words on the screen and to differentiate their responses to the apparition of target-stimuli by pressing different keys (Alt Left for vertical points and Alt Right for horizontal points). The computer registers the subjects' reaction time if the response shows up in the interval of points display (1000 ms) or right after that (in the next sequence of 1000 ms). Between each consecutive two items (fixation point + word pair + target stimulus + answer registration interval) we set an interval IIT of 500 ms during which the screen remains empty.

The actual test included a total of 256 items. There were formed 32 distinct word pairs consisting in an emotional stimulus (positive or anxiety-inducing) and a neutral stimulus, both similar as letter numbers, abstract level and frequency of use in the Romanian language as follows:

- anxiety stimulus relevant for social threat + neutral stimulus (8)
- anxiety stimulus relevant for physical threat + neutral stimulus (8)
- positive relevant stimulus for social threat + neutral stimulus (8)
- positive relevant stimulus for physical threat + neutral stimulus (8)

Each pair of words was exposed four times, based on some permutations between the words position and the target stimulus position, in order to eliminate all the possible confounded variables caused by the words and target stimuli's positions.

After the end of the attention bias test, the subjects took a five minutes break, after which they completed a set of questionnaires, as follows: EMAS-S, one of the three memory tests (necessary in the second stage of the study), The Ambiguous Scenarios Interpretation Questionnaire (necessary in the third stage of the study), and the evaluation scale of the stimuli threatening level.

4.1.2.4. Experimental design

In order to check the first research hypothesis, we will use a 2 x 2 experimental design:

- Independent variable 1: Items congruency – with two modalities: congruent items (the target replaces the threatening stimulus) versus incongruent items (the target replaces the neutral stimulus) – intra-subject variable
- Independent variable 2: The type of threat – with two modalities: social threat and physical threat – intra-subject variable
- Dependent variable: Response latency: operationalized by the interval measured in ms between the apparition of target on screen and the subject's response (pressing the afferent key).

In order to check the second research hypothesis, we will use a 2 x 2 x 3 x 2 experimental design:

- Independent variable 1: Item congruency – with two modalities: congruent items versus incongruent items - intra-subject variable
- Independent variable 2: The type of threat – with two modalities: social threat and physical threat – intra-subject variable
- Independent variable 3: The intensity of threat – with three modalities: high level of threat, medium and low level of threat – intra-subject variable
- Independent variable 4: Subjects samples – with two modalities: subjects with a high level of anxiety and subjects with low level of anxiety – inter-subjects variable
- Dependent variable: Response latency: operationalized by the interval measured in ms between the apparition of target on screen and the subject's response (pressing the afferent key).

In order to check the third research hypothesis, we will use a 2 x 2 x 3 experimental design:

- Independent variable 1: Item congruency – with two modalities: congruent items versus incongruent items - intra-subject variable
- Independent variable 2: The type of threat – with two modalities: social threat and physical threat – intra-subject variable
- Independent variable 3: Subjects samples – with three modalities: subjects with high levels of social anxiety, subjects with high levels of physical anxiety and non-anxious subjects – inter-subjects variable
- Dependent variable: Response latency: operationalized by the interval measured in ms between the apparition of target on screen and the subject's response (pressing the afferent key).

4.1.3. Results

The preferential processing of threatening stimuli hypothesis verification

Experimental hypothesis 1: There is a preferential processing of threatening stimuli (social and physical), no matter the subjects' levels of anxiety.

The 2x2 variance analysis with repeated measurements showed a main significant effect of the *congruency variable* on the *latency response variable* and a significant effect of the *valence variable* on the *latency response variable* and also a statistically significant interaction effect of the two above mentioned variables on the *latency response* one.

The analysis of simple effects ran through t tests and also through syntaxes show that there is a significant difference only in the case of anxiety-inducing stimuli for physical threat [t(118)= 5,63, p=.000, d=0,51; F(1,118)=31,78, p=.000, r=0,46], which indicates that when confronting with anxiety-inducing stimuli which are relevant for physical danger, the subjects don't preferentially process these stimuli, but, on the contrary, they present a higher reaction time, which denies the research hypothesis in this stage.

Considering the obtained results, we continued to analyze the data taking into account the personal relevance of stimuli, or, in other words, how threatening is perceived each anxiety stimulus by each subject. Because there is a very high variance between the subjects regarding the number of stimuli baring a high, medium or low level of danger, while the latency timeframes for each experimental condition are not normally distributed, the K-S test being statistically significant for all stimuli categories, we used non-parametric methods in order to verify the differences between the experimental conditions (the Friedman test for more pair samples and the

Wilcoxon test for comparing experimental groups two by two, with a corrected significance level through the Bonferroni method, all the results being reported at a significance adjusted level of α=0,006).

The results show that in the case of the anxiety stimuli relevant for social threat, the latency time is significantly lower for the congruent items than for the incongruent items, both for the stimuli with a high level of threat (z=-3,11505, p=.002, r =0,28) and the ones with a low level of threat (z=-8.8504, p=.000, r =0,81), while in the case of anxiety stimuli relevant to physical threat, the latency time is significantly higher for congruent items versus incongruent items, for both high threatening stimuli (z=-3,55564, p=.000, r =0,32) and low threatening ones (z=-18,9876, p=.000, r =1,74). In other words, in the case of anxiety stimuli relevant to social threat, there is a preferential processing of information for both the threatening stimuli with high and low levels of presented danger. On the other hand, for the anxiety stimuli relevant to physical threat, the latency time is significantly higher, which indicates the avoidance or the delayed processing of these stimuli. This delayed processing of stimuli relevant to physical threat can be explained due to the experimental context, this one being particularly social but very well secured from a physical point of view. In conclusion, in the context given by our experimental conditions, the hypothesis of preferential processing of anxiety stimuli regardless the subjects' level of anxiety is confirmed only in the case of anxiety stimuli relevant to social threat.

The verification of the threatening stimuli differentiate processing depending on the anxiety state level and the threat intensity hypothesis

Experimental hypothesis 2: There are differences in the processing of threatening stimuli depending on the anxiety levels as follows: a preferential processing of threatening stimuli with high level of danger by non-anxious subjects and a preferential processing of all threatening stimuli no matter their level of danger by the anxious subjects.

In order to see in what degree there are significant differences in the way anxious subjects process threatening information in comparison with non-anxious subjects, out of the final sample 118 study participants, we extracted two subject lots who presented extreme scores at the EMAS-S (measuring the level of the anxiety state): a lot consisting of 12 subjects who registered the highest scores at the EMAS-S subscale, representing 10,17% out of the total sample and another lot consisting in also 12 subjects who registered the lowest scores at the EMAS-S (representing

10,17% out of the total sample) and whose scores at the EMAS-T for social and physical threatening situations are under the average of raw scores obtained on the sample of 118 subjects.

In order to verify the hypothesis of differentiate processing of threatening scores depending on the level of the anxiety state and the intensity of the threat, we will undergo two types of non-parametric methods processing: *inter-group comparisons* between the latency times registered on the congruent and incongruent items depending on the threat levels in the non-anxious subjects (1) and intra-group comparisons for each subject category (anxious and non-anxious) between the congruent and incongruent items, depending on the threat level, in order to observe in which experimental conditions the lower latency time was (2).

Although the same tendency was observed in the relevant stimuli for both social and physical anxiety, that anxious subjects registered higher latency times than the non-anxious subjects in congruent items with higher levels of threat and lower latency times than the non-anxious subjects in the congruent items with lower threatening levels, only the differences regarding the stimuli relevant to physical anxiety are statistically significant: U=5271, Z=-2,616, p=.009, r=0,75 for congruent items with high level of threat and U=335, Z=-4,126, p=.000, r=1,19 for congruent items with low level of threat (The Mann-Whitney U test for independent samples). Intra-group, the statistical results (Friedeman and Wilcoxon tests for pair – samples) show that there is one significant difference, in anxious people, for anxiety stimuli relevant to physical threat, in the sense of a delayed processing of highly threatening stimuli (Z=-2,602, p=.008, r=0,75). Taking into account the fact that in the case of this experiment, the stimuli representing a physical danger are perceived as more anxiety- inducing than the stimuli representing a social danger, we can say that these results show that people who live a state of anxiety (but who do not present anxiety personality traits) have a higher latency time in processing highly threatening stimuli, in comparison to incongruent items and non-anxious subjects.

Under these circumstances, the second research hypothesis is only partially confirmed, in the sense that there is a processing difference between anxious and non-anxious people of threatening stimuli, differences which manifest themselves in particular and depending on the perceived danger of the threat. These differences in processing in anxious subjects are not in the direction of hyper-vigilance, but in the direction of a delayed processing at an attention level of threatening information which are personally relevant.

The verification of the specificity of attention resources allocation depending on the type of anxiety as a trait hypothesis.

Experimental hypothesis 3: Attention bias is specific for the anxiety type. In the present experimental design, the support of this hypothesis would imply that:

i) Social anxious subjects present a differentiate attention processing of threatening stimuli which are relevant to social anxiety, but not of the stimuli relevant to physical anxiety.

ii) Subjects presenting anxiety to physical dangerous situations present a differentiate attention processing of threatening stimuli relevant to physical danger anxiety, but not of stimuli relevant to social anxiety.

In order to verify this hypothesis, out of the initial lot of 118 subjects, we extracted three subject samples as follows: participants who obtained an above average score at the EMAS-T scale for situations of social evaluation and an below average score for physical dangerous situations (the sample HighSA&LowPA), participants who obtained an above average score at the EMAS-T scale for physically dangerous situations and a below average score for social evaluation situations (the sample HighPA&LowSA) and participants who obtained below average scores at both scales.

In order to eliminate the situation in which anxiety as a state to intervene in our results, we followed the samples so not one of them to contain subjects who also registered above average scores at the EMAS-S scale, in the same time.

We underwent two types of non-parametric processing: inter-group comparisons between the latency times in the congruent and incongruent items with high, medium and low levels of threat intensity and the latency times registered by the non-anxious subjects (1) and intra-group comparisons for each subject category (HighSA&LowPA, HighPA&LowSA and non-anxious) between the congruent and the incongruent items, depending on the threat levels (2).

Intra-group, we obtained two statistically significant differences (the Friedeman and Wilcoxon test for paired samples): in the participants with social anxiety, the latency times in congruent items with high level of social anxiety is significantly higher in comparison to the incongruent (Z=-2,730, p=.006, r=0,79), and in the participants with higher physical anxiety, the latency times in congruent items with high levels of physical anxiety is significantly higher in comparison to the incongruent items (Z=-3,338, p=.001, r=0,96). Inter-group, we identified two significant differences (the Mann-Whitney U test for independent samples) in the processing of

threatening congruent items as follows: the subjects with social anxiety process significantly faster than the non anxious subjects the information baring a medium level of social threat (U=1212, Z=-3,198, p=0,001, r=0,92), while the subjects with physical anxiety process significantly faster than the non-anxious the information with a high degree of physical threat (U=5833, Z=-2,092, p=.038, r=0,60).

Subsequently, the hypothesis regarding the specificity of attention resources allocation depending on the type of anxiety trait is confirmed: the subjects with social anxiety register a reaction time significantly higher in congruent items versus incongruent ones for the threatening stimuli relevant to social anxiety with a high degree of threat, but not relevant items to physical threat, while the subjects with physical anxiety register a significantly higher reaction time for threatening stimuli relevant to physical anxiety with a high level of threat, but not for the threatening stimuli relevant to social anxiety. On the other hand, although the anxious subjects present a delayed incongruent-item processing with a higher degree of threat versus incongruent ones, in comparison to non-anxious subjects, these persons present an attention latency time lower to congruent items with a high level of threat. In other words, although the subjects characterized by anxiety traits process with delay the threatening stimuli than the neutral ones, they still are characterized by a state of vigilance in comparison to non-anxious people..

4.1.4. Conclusions

The research data lead us to the conclusion that, depending on the social and physical context an individual is placed, the high-threatening stimuli are preferentially processed, no matter the anxiety levels. These results concur with the evolutionist theories regarding dangerous data processing (Öhman and Mineka, 2001), but also with some theoretical models (Williams and co., 1997; Mogg and Bradley, 1998) who presume this selective attention orientation towards the threatening environmental information in order to prepare the most efficient defense reactions. The presence of an intense anxiety state or of some anxious traits leads, however, to a delay in the processing of threatening information at the attention level in comparison to the neutral ones. This delayed processing may have several explanations, either linked to the presence of avoidance mechanisms of anxiety-inducing situations (Amir, Foa and Coles., 1998; Chen and co., 2002), or linked to the attention mechanisms themselves, and we talk here about the possible difficulties of attention disengagement which can occur in anxious people (Fox and co., 2001,

2002; Amir, Klumpp and Przeworski, 2003; Buckner, Maner and Schimdt, 2010). It is also possible that an intense emotional state to have the same effects over the information computing processes as a cognitive load and thus to slow down the anxious information computing processes including at an attention level. Whatever the explanation would be, all these data can indicate the fact that, in certain contexts, the presence of an anxiety state or trait may reduce, at least partially, the efficiency in the threatening information processes at the attention level, a fact which can have as consequences the delay of the adaptive reactions.

4.2. Study 1B. Threatening information processing at the memory level

4.2.1. Goals and hypotheses

In this stage, we aim to underline the means of storage and reactivation of threatening information in comparison to the storage and reactivation means of positive or neutral information. Due to the fact that previous research led to contradictory results regarding both explicit and implicit memory, we will try to replicate the existent research on a teenagers' sample having as focus both types of memory, and concerning the explicit memory, we will also use an explicit reactivation test (mostly used by researchers until now) and explicit recognition test, which we consider it has a higher ecological value. Therefore, in this study phase, we will verify the next *experimental hypotheses:*

I1: The threatening stimuli are implicitly reactivated in a higher degree than neutral or positive stimuli.

I2: Threatening stimuli are explicitly reactivated in a higher degree than neutral or positive stimuli.

I3: Threatening stimuli are recognized in a higher degree that neutral or positive stimuli.

4.2.2. Method

4.2.2.1. Participants

In this stage, the study participants are the same 118 students who took part in the first phase of the research.

4.2.2.2. Instruments and materials

For this research phase, there were necessary three distinct categories of instruments and materials: the verbal set of stimuli (words) used in the first stage of the research, the computer program in the Dot Probe paradigm used in the first part of the research and a pen and paper set of tests which assessed the way these stimuli are processed at the memory level. The verbal stimuli set and the computer program were described in the first part of the research. The reactivation test sets for verbal stimuli are as follows:

1) The implicit reactivation questionnaire is a test requiring the completion of word roots. The subject receives a list of word roots (corresponding to all positive, negative and neutral stimuli used in the Dot Probe task) and is asked to fill them as fast as they can with the first words that come to their minds.

2) The explicit reactivation questionnaire consists in the free reactivation of verbal stimuli used in the first experimental phase. The subjects are invited to reactivate from their memory as many words possible from the previous experimental session, no matter their order or their pairings.

3) The recognition questionnaire consists in the task of recognizing the presence or the absence of some words in the experimental phase. In order to complete this task, we put up a list of words which comprises all the stimuli presented in the experimental phase, to which we added an equal number of threatening words/stimuli relevant to social and physical threat, positively relevant for social and physical threat and some neutral stimuli which were not presented in the experimental phase of the Dot Probe test. These words were taken from the initial words list used to select the experimental stimuli. Thus, this list contains 164 words, the double of the words used in the first stage of the experiment.

4.2.2.3. Procedure

After the first experimental stage was completed, the subjects randomly received one of the three word reactivation questionnaires involving the words presented in the first part of the research. Thus, the tests were completed individually, without deadline, after the Dot Probe program was run and after they completed the EMAS-S scale, so the reactivation task took place in an interval of approximately five minutes after the exposure to the threatening, positive and neutral words, the break and the completion of the EMAS-S. In order to avoid the learning effect, the reactivation questionnaires were given before the *evaluation scale of the stimuli threatening*

level necessary in the first stage of the research. In the case of procedure following failure or the unfinished completion of questionnaires, we annulled the explicit or implicit memory protocols. After eliminating the annulled protocols (15), out of the 118 participants, 42 subjects followed correctly the procedure of completing the implicit reactivation questionnaire, 38 followed correctly the procedure of completing the explicit reactivation questionnaire and 43 subjects followed correctly the procedure of completing the recognition questionnaire.

4.2.2.4. Experimental design

In order to verify the research hypotheses, we will use a 3 x 2 design:

- Independent variable 1: The emotional valence of stimuli (words) with three modalities: threatening words, positive words and neutral words – intra-subject variable.
- Independent variable 2: The type of anxious relevance with two modalities: threatening/positive words relevant for social anxiety and threatening/positive words relevant for physical anxiety – intra-subject variable.
- Dependent variable: the number of threatening, positive and neutral words reactivated by the subjects.

4.2.3. Results

In order to verify the research hypotheses, we will make comparisons between the numbers of threatening, positive and neutral words implicitly and explicitly reactivated and recognized according to their relevance to social and physical anxiety. In the first phase of the statistical processing, we checked to see if the implicitly and explicitly reactivated words and the words recognized had a normal distribution, by using the Kolmogorov-Smirnov test for each sample. The results to the Kolmogorov-Smirnov test indicate a normal distributed variable in the recognition case and an asymmetrical distributed variable in the case of implicit and explicit reactivation. Thus we will use parametric instruments (ANOVA with repeated measurements) for the recognition and non-parametric instruments (the Friedeman and Wilcoxon tests for paired samples) in the case of explicit and implicit reactivation.

Regarding the *implicit reactivation,* we obtained only one significant difference, between the threatening words relevant to social anxiety and neutral words (Z=-2,993, p=.003, r=0,49).

Regarding *explicit reactivation* we obtained a significant statistical difference between all the emotional-loaded words (threatening and positive) and neutral words (Z=-4,840, p=.000,

r=0,75), between all the threatening words (social and physical) and neutral words (Z=-5,043, p=.000, r=0,77), between all the positive words (social and physical) and neutral words (Z=-2,817, p=.005, r=0,44) and between all the threatening words (social and physical) and all the positive words (social and physical), Z=-4,046 p=.000, r=0,75. In other words, after being exposed to the dot probe task, the subjects reactivated more threatening words than neutral words, more threatening words than positive words and more positive words than neutral words.

However, when analyzing the results taking into account the relevance for one of the two types of anxiety, we notice that in the case of *social anxiety*, the difference between the threatening words and the neutral ones is statistically insignificant, (Z=-1,098, p=.272) while the difference between positive and neutral stimuli is statistically significant (Z=-3,875, p=.000, r=0,6). In the case of *physical anxiety*, the situation is quite the opposite, the difference between the threatening and the neutral words being statistically significant (Z=-5,333, p=.000, r=0,82) and the difference between positive and neutral words being insignificant (Z=-,762, p=.446). Moreover, the difference between the threatening stimuli and the positive ones is also significant (Z=-5,015, p=.000, r=0,77). We observe a different processing at the memory level of the threatening and the positive information depending on the anxiety type: in the case of social anxiety subjects explicitly retained and reactivated significantly more positive words than neutral ones and in the case of physical anxiety, subjects reactivated explicitly more threatening words than neutral ones and positive ones respectively.

Regarding *recognition*, the results gathered through variance analysis indicate a principal significant effect of the variable *emotional valence* over the variable *number of recognized words* [F(2,84)=31,780, p=.000] but not a principal significant effect of the variable *type of anxiety* over the variable *number of recognized words*. We could notice, however, an interaction effect which is statistically significant between the variables *type of anxiety* and *emotional valence* over the variable *number of recognized words* [F(2,84)=15,989, p=.000].

The analysis of simple effects, done with the help of t tests, show a statistically significant difference (significance level adjusted to .005) between all the emotional words (threatening and positive) and neutral words [t(42)=7,161, p=.000, d=1,09], and also between all the threatening words (social and physical) and neutral words [t(42)=8,216, p=.000, d=1,25], between all the positive words (social and physical) and neutral words [t(42)=4,676, p=.000, d=0,71], without,

however, being observed a statistically significant difference between all the threatening words ((social and physical) and all the positive words (social and physical).

If we analyze the results depending on the relevance to one of the two anxiety types, we observe that in the case of *social anxiety*, in comparison with the neutral words, there were recognized more threatening words [t(42)=5,365, p=.000, d=0,81] and significantly more positive words [t(42)=5,430, p=.000, d=0,83], but without any significant difference between the threatening words and the positive ones. Regarding *physical anxiety*, we observed the existence of a significant difference between threatening words and neutral ones [t(42)=9,531, p=.000, d=1,45], between threatening words and positive ones [t(42)=5,385, p=.000, d=0,82], but no significant difference between the positive and neutral ones. In conclusion, in the case of words relevant to physical anxiety, the threatening words are recognized in a significantly higher degree.

4.2.4. Conclusions

In respect to the stimuli processing at the memory level, we started by hypothesizing that threatening stimuli are implicitly reactivated (1), are explicitly reactivated (2) and are recognized (3) in a higher degree than neutral or positive stimuli.

According to the obtained results, all three hypotheses are partially accepted because in the case of physical anxiety there is a preferential processing of threatening stimuli at the explicit memory level, but not at the implicit memory's level and in the case of social anxiety, there is a preferential processing of threatening stimuli at the implicit memory's level, while at the explicit memory's level emotional words are preferentially recognized (threatening and positive words in comparison to the neutral ones) while only positive words are preferentially reactivated.

We notice that in the case of social anxiety, if at the attention level we confronted ourselves with a bias towards threat, at the memory level we faced a positive bias of the explicit memory. We can't say the same thing about physical anxiety, where the bias towards threat is kept also at the memory level, the threatening stimuli being explicitly reactivated in a higher degree than the positive and the neutral ones.

4.3. Study 1C. Threatening information processing at the inferential level

4.3.1. Goals and hypotheses

During this stage, we aim to observe how the potentially threatening information both social and physical is processed at an inferential level. We already saw that at the attention level, the social threatening information is preferentially processed, the physical ones being processed with a delay, while the positive information don't benefit from a differentiated processing in comparison to the neutral one; at the memory level, regarding social information, we face a preference processing of positive information, while physically threatening stimuli are then preferentially processed. Thus, we expect that at an inferential level, this tendency of positive bias regarding social information and negative bias regarding physical threat information to be kept too.

Also, we will follow the differences in information processing in anxious and non-anxious subjects at the inferential level, taking into account anxiety as both a state and as a trait. According to the results mentioned in the specialized literature, we expect also in this present research to find no difference between the interpretations given by participants who experienced a state of anxiety and those who didn't during the experiment, but we expect to register some difference between the interpretations given by the subjects who present or don't present social/physical anxiety traits.

The hypotheses are as follows:

I1: No matter the level of anxiety, ambiguous social information is inferentially interpreted in a dominant positive way.

I2: No matter the anxiety level, the ambiguous physical potentially threatening information is inferentially interpreted in a dominant negative (dangerous) way.

I3. There is no difference in the interpretation of the potentially threatening social or physical ambiguous situations between the subjects with high levels of anxiety and the ones with low levels of anxiety (as a trait).

I4: Subjects with high levels of social and physical anxiety will interpret ambiguous situations as being more threatening than people with lower levels state of social and physical anxiety, respectively.

4.3.2. Method

4.3.2.1. Participants

In this stage we used the same 118 subject who took part to the previous experimental sessions.

4.3.2.2. Instruments and materials

For this research phase there were necessary three categories of instruments and materials: the verbal set of stimuli (words) used in the first stage of the research, the computer program in the Dot Probe paradigm used in the first stage of the study and an ambiguous scenarios interpretation questionnaire. The verbal stimuli set and the computer program were presented in the first stage of the research.

The ambiguous scenarios interpretation questionnaire consists of a list of 28 ambiguous scenarios used with the agreement granted by the author in the study of Colin MacLeod* and Ilan Cohen (Anxiety and the Interpretation of Ambiguity: A Text Comprehension Study, *Journal of Abnormal Psychology, vol., 102, 1993*), translated and adapted to the present research needs. The questionnaire contains 28 ambiguous scenarios, 14 of them relevant to social threat and 14 relevant for physical threat, alternately presented, so that after each relevant social scenario follows a relevant physical scenario and vice versa.

4.3.2.3. Procedure

After following the procedure for the first two research stages, the subjects were requested to fill in the *ambiguous scenarios interpretation questionnaire*. They were filled in individually, without deadline. In order to avoid the learning effect, this questionnaire was administered before the *evaluation scale of the stimuli threatening level from the first stage of the study*.

4.3.2.4. Experimental design

In order to verify the first two hypotheses, we will use a simple experimental design:

- Independent variable: The anxious relevance of ambiguous scenarios, with two modalities: ambiguous scenarios relevant to social anxiety and ambiguous scenarios relevant to physical anxiety – intra-subject variable.
- Dependent variable: the number of positive/threatening interpretations

In order to verify the third hypothesis, we will use a 2 x 2 design:

- Independent variable 1: The anxious relevance of ambiguous scenarios with two modalities: ambiguous scenarios relevant to social anxiety and ambiguous scenarios relevant to physical anxiety – intra-subject variable
- Independent variable 2: Subjects sample, with two modalities: subjects with high levels of anxiety and subjects with low levels of anxiety – inter-subjects variable

In order to verify the last hypothesis we will use a 2 x 3 experimental design:

- Independent variable 1: The anxious relevance of ambiguous scenarios with two modalities: ambiguous scenarios relevant to social anxiety and ambiguous scenarios relevant to physical anxiety – intra-subject variable
- Independent variable 2: Subjects sample, with three modalities: subject with high levels of social anxiety, subjects with high levels of physical anxiety and non-anxious subjects – inter – subjects variable
- Dependent variable: the number of positive/threatening interpretations

4.3.3. Results

In order to verify the first two hypotheses we will run comparisons between the number of positive interpretations and the number of threatening interpretations of ambiguous scenarios relevant to social anxiety and the number of positive interpretations and the number of threatening interpretations relevant to physical anxiety.

Because the Kolmogorov-Smirnov value indicates a normal distribution of results in the case of positive interpretations for social anxiety (Z_{KS}=1,292, p=.071) and threatening interpretations relevant to physical anxiety şi (Z_{KS}=1,159, p=.136), but not for the threatening interpretations relevant to social anxiety (Z_{KS}=1,541, p=.017), and also for the positive interpretations relevant to physical anxiety (Z_{KS}=1,679, p=.460), in order to see if these differences are also statistically significant, we will use the Wilcoxon test for paired samples as a non-parametric mean of statistical calculation. The results show that there is a significantly higher number of positive interpretations of ambiguous scenarios relevant to social anxiety (Z=-2,100, p=.036, r=0,2) and a significantly higher number of threatening interpretations of ambiguous scenarios relevant to physical anxiety (Z=-4,396, p=.000, r=0,4), independently of the subjects' levels of anxiety, results which fully confirm the first two research hypotheses.

The hypothesis verification of ambiguous scenarios interpretation according to the levels of the anxiety state

The results gathered after using the Mann-Whitney U test for independent samples show that there is no difference between the participants with a high level of anxiety and the ones with low level of anxiety in the case of the ambiguous scenarios relevant to physical anxiety, but in the case of the ambiguous scenarios relevant to social anxiety, the subjects presenting high levels of anxiety tend to make a significant higher number of threatening interpretations than those with lower levels of the anxiety state (U=24,00, Z=2,454, p=.016, r=0,74), which partially invalids the first research hypothesis. At the intra-group level, if in the subjects with low levels of anxiety we obtained no significant difference (Wilcoxon test for paired samples) between the threatening and the positive ones, however, the anxious subjects make significantly more threatening interpretations than positive ones, relevant to both social anxiety (Z=-2,203, p=.028, r=0,63) and physical anxiety (Z=-2,537, p=.011, r=0,73).

The hypothesis verification of ambiguous scenarios depending on the levels of social and physical anxiety traits

Both inter-group comparisons (Mann-Whitney U for independent samples), and the intra-group comparisons (Wilcoxon test for paired samples), don't underline any statistically significant difference between the experimental conditions aimed by this study. Although there is a certain tendency of anxious subjects to interpret social or physical ambiguous scenarios in a threatening way, this tendency doesn't pass the test of statistical relevance.

4.4. Final conclusions

As we expected, there is a vertical dynamic of threatening information processing. No matter the level of anxiety, *the social threatening information* are preferentially processed at the attention and implicit memory's levels, while at the explicit memory and inference's levels, we observe the apparition of a positive bias, in the way that positive information are preferentially reactivated and the ambiguous situations, potentially threatening, are interpreted predominantly in a positive manner.

Information which is threatening to our physical integrity is processed with delay in comparison to the neutral ones at the attention level, but preferentially at the memory level. In the

same way, the interpretations of ambiguous situations with physical threatening potential are preponderantly directed to a negative level. However, we ask ourselves why we didn't find the same preferential processing of physically threatening information at the attention level, especially since the verbal stimuli relevant to physical danger were perceived as implying higher levels of anxiety than the ones relevant to social anxiety. One of the possible explanations is that the context of research was eminently social, because the students were asked to take part to the study during their classes and their environment was saturated with social evaluation conditions, but very secured from a physical danger point of view.

Some very important differences between anxious and non-anxious subjects were observed:

1. In the situation of the presence of an anxiety state, but in the absence of anxiety traits, both physical and social threatening information, with an exposure interval of 500 ms, are processed at the attention level with a delay by the anxious subjects in comparison to the non-anxious subjects. At an inferential level, anxious subjects tend to make more negative interpretations than non-anxious subjects.
2. At the attention level, people who present within their personality structure stable anxiety traits are more vigilant towards environment threats than non-anxious subjects, registering lower reaction times to threatening stimuli, but they also process with delay the threatening information in comparison with the neutral ones, which leads us to believe that this hyper vigilance of the anxious people doesn't make them necessarily more efficient if real dangers happen to threaten them because the delay in the defense reactions.
3. This differentiated processing of threatening stimuli is specific to the anxiety type, meaning that subjects with social anxiety process slower the threatening information relevant to social anxiety in comparison to the neutral ones, but faster than non-anxious subjects, without differently processing the information representing a physical danger in comparison with non-anxious subjects or neutral information. Subjects with an anxiety of physically dangerous situations process slower the information relevant to physical danger in comparison to the neutral ones, but faster than non-anxious subjects, without differently processing of relevant information for social anxiety in comparison to non-anxious subjects or neutral information.
4. At an inferential level, the existence of an anxiety trait in the absence of an anxiety state doesn't produce any modification in the interpretation of ambiguous, potentially threatening

situations. To an extent, we can notice the absence of positive bias which was underlined when we made the statistical calculations for the whole sample of subjects, respectively to very non-anxious subjects from the emotional state or mood during the testing. However, the presence of an anxiety state influences the interpretation of potentially threatening situations (physical and social) in the direction of a negative interpretation. *In other words, our inferences are influenced more by the anxiety states than the stable anxiety traits*. It is highly probable that stable anxiety traits to influence the inferential processing in an indirect manner through the apparition of a strong anxiety state in the moment of confrontation with a dangerous situation.

CHAPTER V

THE ANALYSIS OF THE CAUSAL RELATIONSHIP BETWEEN ATTENTION BIASES AND ANXIETY

THE EFFECTS OF ATTENTION BIASES MODIFICATION PROGRAMS ON ANXIETY

In this chapter we tried to carry out an analysis regarding empirical evidence about a possible causal relationship between anxiety and attention biases, starting from the idea that any causal relationship should be studied from both directions. Attention bias can be both a cause and an effect of anxiety. From this point of view, researchers focused on two directions, the strongest one focusing on some programs of modifying the attention bias in order to lower the level of anxiety, while the second direction aims to study the effects of cognitive-behavioral therapies over attention bias.

5.1. Empirical evidence regarding the modification of attention bias as an effect of cognitive – behavioral therapies.

Using the Stroop method, researchers proved that the interference phenomenon presumably caused by attention bias was lowered or even eliminated after following CBT in the panic (Wiener and co., 2012), spider phobia (Watts and co., 1983), obsessive – compulsive disorder (Foa and McNelly, 1986), generalized anxiety (Mathews and co., 1995) and social phobia (Mattia and co., 1993) (see Chapter II for more details). These researches met the objection that the modification of the reaction times measured in the Stroop paradigm might be due to the modification of the emotional significance of threatening stimuli after following psychotherapy, and not necessarily due to a modification in attention resources allocation (Pishyar and co., 2008).

There are few studies trying to prove the lowering of post-therapy attention bias by using the Dot Probe method. Pishyar, Harris and Menzeis (2008) were the first who, measuring the response to a Dot Probe before and after 8 CBT group sessions, the subjects registered a significant lowering of vigilance towards threatening stimuli and an increase in vigilance towards positive stimuli relevant to social anxiety. Waters and co. (2008) showed that in a group of children with an average age of 9,9 years old, there was a lowering of interpretative biases post-therapy – to a level comparable to that of non-anxious children – but regarding the attention

biases, although there was noted a post-therapy lowering, their level didn't reach the one of non-anxious children.

Explaining the individual differences in the response to anxieties psychotherapies, Price, Tone and Anderson (2011) and Calamaras, Tone and Anderson (2012) introduced the idea that the effects of post-therapy attention biases lowering depends on *the type of attention bias* (vigilance or threatening information avoidance) which the participants present before starting therapy, and Clarke and co. (2012) reorient the research from the presence or absence of biases favoring the threatening stimuli towards the plasticity of attention biases, proving, in fact, that attention biases' modifications depending on experimental contingencies can be an important predictive factor for therapy response.

The hypothesis of post-therapy attention biases measured with the Dot Probe is an in incipient phase of experimental verification, not being able yet to extract a valid scientific conclusion based on such small number of existent research until present time.

5.2. Empirical evidence of attention biases modification programs on the anxiety level

The attention negative biases modification programs effects seem to be quite promising in the treatment of anxiety disorders or even in the prevention of stress reactions (See et al., 2009). It is even surprising the fact that only one attention biases modification session in subjects with social anxiety traits (Eldar and Bar-Haim, 2009), public speech anxiety (Amir and co., 2008) and contamination fear (Najmi and Amir, 2010) is enough to determine changes in the attention processing and the vulnerability towards anxiety. All four studies published and concerning the reduction of the clinical anxiety through attention bias modification in patients diagnosed with generalized anxiety (Amir et al. 2009a) and social generalized anxiety (Schmidt et al., 2009; Amir et al. 2009b, 2011) lead to the idea of the emergence of a new type of intervention to psychological disorders as a viable alternative for subjects to whom classic CBT didn't prove to be effective.

A qualitative analysis of studies regarding attention biases modification programs need our attention, however, as we should carefully approach the way in which we interpret the efficiency of this new approach of intervention in psychological pathology and it also indicates some directions towards future research should focus their attention:

1. *The use of several control samples.* All the studies mentioned in this chapter either didn't use a control sample (there were two experimental conditions of manipulating the attention resource allocation mean), or used a placebo-type of control sample, in which the participants were involved in a training in which the target appeared with equal probability instead of the threatening or neutral stimuli. Or, there are studies in which the placebo control sample also registered changes in the attention bias (Koster, 2010) or a diminishing of the anxiety levels (Amir, 2009b, Eldar and Bar-Haim, 2009, Reese et al., 2010), which indicated that sometimes, even the simple repeated exposure to emotional stimuli can determine changes in the attention resources allocation system and in the level of anxiety. This is why future research should take into account other control sample variants in which they either carry out the attention training with emotionally neutral stimuli, or they don't carry out any type of attention training at all.
2. *The anxiety reduction is owed to attention training in the direction of threatening stimuli avoidance or because it reflects more general attention control processes?* An alternative theory to cognitive bias towards anxiety-inducing stimuli in the etiology of anxiety disorders is the Attention Control Theory, which tells us that cognitive biases in anxiety reflect in fact more general cognitive deficits which have more to do with attention processes and not specifically with the differentiate processing of environmental threatening information (Eysenck, Derakshan, Santos, & Calvo, 2007). Or, none of the empirical research regarding attention bias modification effects over the anxiety levels does directly test this concurrent hypothesis. We only have some indirect proof of this concurrent hypothesis from studies which also highlighted a lowering in the anxiety levels even in the control samples. (Amir, 2009b, Eldar and Bar-Haim, 2009, Reese et al., 2010, Klump and Amir, 2010).
3. *Who should use the intervention of changing attention biases? Is it indicated to intervene with attention biases modification programs in anxious people who don't present any attention negative bias of preferential processing of threat?* Several studies, including the one conducted and presented in this thesis, showed that the phenomenon of attention bias is not a general and uniform one, but dependent of several factors; not all the anxious people preferentially process the threatening information. If the attention biases modification programs determine an improvement in the general capacity of attentional

control with an anti-anxiety effect, then it is possible that attention training to avoid anxiety stimuli to be also efficient for the subject categories who don't manifest this attention negative bias; but in this case, however, we should take into account other means of attention training which might be more effective. Moreover, there are some studies which show that, in imminent danger situations of life threat occurs a suppression of the negative attention bias no matter the level of anxiety and that, as the attention bias suppressing increases, the possibility of posttraumatic stress disorders symptoms to occur also increases (Bar-Haim et al., 2010; Wald et al., 2011).

4. *The type of stimuli used in attention training should be specific to the anxiety type or could they represent a larger category?* The results from gathered in previous research highlighted the attention biases specificity depending the type of anxiety manifested by the study participants, so the attention training should take into account this specificity. Indeed, all empirical research used in the attention training programs specific stimuli for each anxiety type. However, no research addressed specifically to this specificity of used stimuli in order to prove without a doubt that, for instance, in subjects with social anxiety, the programs containing specific stimuli to social anxiety determine an ulterior substantial modification in the level of social anxiety, in comparison to the programs containing unspecific stimuli to social anxiety. Secondly, how specific should be these stimuli? Should they be strongly personalized or a standard set of stimuli is enough to obtain therapeutic effects, based on the idea that these training programs have the role of producing balance to basic attention mechanisms? (Bar-Haim, 2010)?
5. A great lack in the empirical research conducted until now is represented by *not using the positive stimuli* in the programs of attention training. The majority of studies used in the attention biases modification programs only threatening-neutral pairs of stimuli. Although this approach proved itself as being very effective even in clinical subjects (Amir and co., 2009a, 2009b, 2011, Schimdt and co., 2009) we don't know, however, if this approach is the most prolific one. For instance, there are quite many evidence that anxious people lack a certain positive bias that is present in non-anxious people and have drawbacks in positive stimuli processing (Bradley and co., 1999, Hirsh and Mathews, 1997, 2000). The research presented in the anterior chapter of this paper highlighted a deficit in processing at the memory and inference level of positive information in anxious subjects. Moreover,

Bar-Haim, Wald and their colleagues highlighted the fact that in situations of real danger, outside lab conditions, the suppression of attention negative bias is also associated with the increase of post-traumatic stress disorder symptoms (Bar-Haim and co., 2010; Wald and co., 2011, 2013). Also, it is possible that anxious subjects who don't manifest this negative attention bias or who have major difficulties in attention disengagement, to better respond to attention orientation programs of focusing towards positive stimuli than attention training towards threat avoidance. These are just some arguments in the favor of attention training towards positive stimuli.

CHAPTER VI

EMPIRICAL RESEARCH REGARDING THE CAUSAL ROLE OF ATTENTION BIASES IN ANXIETY

6.1. Study 2. The experimental confrontation of the concurrent assumptions regarding the effects of attention training on the anxiety level.

6.1.1. Goals and hypotheses

A series of experiments performed on random individuals as well individuals selected specifically because of their clinical/subclinical anxiety levels highlighted the fact that attention training has positive effects on modifying the level of anxiety. The main hypothesis of this research states that the preferential nature of processing threats/danger stimuli has a causal role in developing and sustaining of anxiety and that specific attention training meant to prevent the processing of threat factors is an efficient way to modify attention biasing and reducing the anxiety level. However, no study has yet undoubtedly proven the causal relation between negative attention biasing and anxiety. Although certain correlated analysis has shown that there is a connection between the altering of attention biasing and reducing the anxiety level, there is a possibility that this attention biasing modification is not the directly responsible factor for reducing the level of anxiety, but developing the capacity to control one's focus by improving the executive functions of the individual's attention capacities regarding orientation and inhibition (Eysenck and co., 2007). Therefore, there are two concurrent assumptions regarding the effects of attention training on the emotional response competence:

1. The anxiety level may be reduced by modifying the attention biasing and the preferential processing of other types of stimuli (the attention biasing hypothesis).
2. Increasing attention control capacity may lower the anxiety level (the attention control hypothesis).

As it follows, this research's two main objectives are: the testing of the causal role of negative attention biasing (1) and the comparative testing of the two explicative assumptions regarding the effects of attention training on anxiety levels (2) on groups of teenagers.

In the first stage of the study, in order to see if there is a causal relationship between attention negative bias and anxiety, we will select the participants who fall in the middle third of

a anxiety-trait (STAI-X2, EMAS-T). A part of the subjects will go through a training session of attention avoidance bias induction, while others will go through a training concerning the attention avoidance of threatening stimuli and focusing on stimuli with a positive emotional valence. If the attention bias has a causal role in the etiology and maintaining anxiety symptoms, we expect that participants who had induced a negative attention bias to show an increased post-training level of anxiety when confronted with a threatening situation, while participants who had induced a positive bias or an avoidance reaction of threat to experience lower levels of anxiety in the post-training timeframe when confronted with a anxiety-inducing situation.

Secondary to the two study goals, because it was proven that anxious people present a deficit in processing positive information and on the other hand, not always the attention trainings of threat avoidance lead to the expected results, we intend to comparatively explore also the efficiency of a program meant to train the attention towards positive stimuli. Therefore, the modification of the negative bias will take place in a group of participants through a training involving threatening stimuli avoidance (suppression of the negative bias), while in another group, through a training of attention orienting towards positive stimuli (positive bias).

We will test the next two hypotheses:

I1: The modification in the attention bias influences the level of anxiety as following:

i) People who have been induced to a negative bias will present a higher level of anxiety in the post-training timeframe.

ii) People who have been induced to a modification of attention bias, either in the direction of bias suppressing, or in the direction of positive bias, will present a lower level of anxiety in the post-training timeframe.

iii) There will be no significant difference between the levels of anxiety in the pre and post-training stages in those people who didn't suffer from any attention bias modification in the stage of attention training.

I2: The increase in the attention control capacity influences the lowering of the anxiety level. In the terms of our experimental design, in all experimental conditions, the level of anxiety will diminish in the post-training stage.

6.1.1. Method

6.1.1.1. Participants

In the first study phase were included 200 participants, students of "Emil Racoviță" National College in Cluj-Napoca, with ages between 15 and 19 years old. The age average is 16, 44, and the standard deviation of 1,02**.** Gender report balances favorably to the female population: 105 females and 95 males.

In the second stage, in order to capture in the most accurate way the potential causal role of attention bias over the level of anxiety and according to MacLeod and his team's (1992) methodological norms and experimental design, we selected the participants who fell into the middle third of scores obtained with the STAI-X2 scale (anxiety - trait). Out of this sample presenting medium values of anxiety (non-clinic), we eliminated those presenting a high tendency of offering social desirable answers. In order to do so, we used the Marlow-Crown Scale and because scores to the desirability test were symmetrically distributed, (the Kolmogorov-Smirnov indices was .112), we used as delimitation level the value given by the sample's average plus one standard deviation, in this case $m+1\sigma = 23,06$ ($m=17,36$; $\sigma=5,7$). Consequently, participants who scored at the desirability scale a value higher or equal with the critical level of 23, 06 were excluded from the experiment.

In the last selection phase, after we administered the Dot Probe, we excluded from the experiment all the participants who gave wrong answers or registered a very long delay time (over 2000 ms) in over 51% of items' total, and also those who declared they didn't read the stimuli included in the Dot Probe and answered mechanically to the dots' apparition. After completing these selection procedures, out of 200 participants we were left with 59 subjects, 28 male and 31 female, with an average age of 16, 35 years.

6.1.1.2. Instruments and materials

In order to conduct this study, we used three distinct categories of instruments and materials: psychological evaluation scales, experimental verbal stimuli (words) and a computer program to run the experimental tasks:

1. ***Endler Multidimensional Anyiety Scales EMAS*** – presented in Study 1 (cap. IV)
2. ***Stait–Trait Anxiety Inventory*** (Spielberger, Gorusch and Lushene, 1970) presented in Study 1 (cap. IV)

1) Stimuli

In order to evaluate attention biases, we used the same stimuli as in the first study, meaning 64 verbal stimuli, grouped in 32 word – pairs as follows:

- anxiety stimulus relevant for social threat + neutral stimulus (8)
- anxiety stimulus relevant for physical threat + neutral stimulus (8)
- positive relevant stimulus for social threat + neutral stimulus (8)
- positive relevant stimulus for physical threat + neutral stimulus (8)

In order to induce a certain type of bias, we used a set of words different from the first one. Thus, for inducing an attention preferential processing of anxiety-inducing stimuli, and threatening stimuli attention avoidance, we used 100 verbal stimuli grouped in 50 pairs, as follows:

- anxiety stimulus relevant for social threat + neutral stimulus (25)
- anxiety stimulus relevant for physical threat + neutral stimulus (25).

In order to induce attention positive bias we used 100 verbal stimuli grouped in 50 word-pairs as follows:

- positive relevant stimulus for social threat + neutral stimulus (25)
- positive relevant stimulus for physical threat + neutral stimulus (25).

For the neutral attention training (control sample), we used also 100 verbal stimuli with emotional valence, grouped in 50 pairs of words. The selection and matching word procedure was identical to the one presented in Study 1.

2. Experimental Software

It was the same we used in Study 1(cap. IV).

6.1.1.3. Procedure

Screening phase (1)

All the participants from the initial lot (N=200) were asked to answer three tests: the Marlow-Crown Social Desirability Scale and the two scales of measuring anxiety as a trait - STAI-X2 and EMAS-T. These instruments were administered in groups of approximately 25 subjects, each answering individually and without a deadline. Each administered scale was accompanied by the specific instructions of the task and answer variants.

The attention bias evaluation stage before inducing attention processing modifications (pre-training) (2)

The pre-training evaluation of attention bias with the help of the Dot Probe was done by using the same computer program and the same stimuli used in Study 1, the test being administered at an interval of 1 – 2 weeks from the administration of the three questionnaires, a necessary time to conduct the screening procedure (score calculation and subject selection).

The pre – training anxiety level evaluation (3)

At an interval ranging from a few days to 1 – 2 weeks from the pre-training attention bias evaluation, the participants were invited again to the lab for continuing the research. Before inducing the attention processing modifications, all the subjects completed the two anxiety–state assessment scales - STAI-X1 and EMAS-S.

The attention training phase (4)

Depending on the intended attention bias modifications, the subjects were randomly split into four experimental groups: threatening stimuli preferential processing - 20 participants (1), threatening stimuli processing avoidance - 14 participants (2), positive stimuli preferential processing - 12 participants (3) and neutral attention training (control sample) -13 participants (4).

Right after the pre-training phase of the anxiety state, subjects were invited to sit in front of the computer and check their working position (distance to screen of 80 cm, screen position adjustment so that participants' sight to be horizontally sustained in the center of the screen, while keyboard, participant and screen to be collinear) and working instructions began to be processed.

The experimental software used was the same as the one used to evaluate attention biases, with the difference that *the actual task* of attention training included 50 pairs of stimuli different from those presented in the stage of attention biases assessment, matched between an emotional stimulus (positive or threatening) and a neutral one, and neutral stimuli also for the sample lot, similar in letters numbers, degree of abstractness and frequency of use in the Romanian language. The probe of attention biases modification consisted of 200 items in total and the items order within the probe was random.

In order to modify the attention biases, in the experimental condition of inducing a preferential processing of anxiety-inducing stimuli (PPSA condition) the target-stimulus always

replaced the threatening stimuli; in the experimental condition of inducing an avoidance of threatening stimuli processing (EPSA condition) the target-stimulus always replaced the neutral stimuli and in the experimental condition of inducing a preferential processing for positive stimuli (PPSP condition) the target-stimulus always replaced the positive stimuli. In the training condition for neutral attention training (AAN) all stimuli are neutral and the number of items is identical to the total number of items from the attention biases modifications experimental conditions.

The post-training anxiety state evaluation (5)

The post – training anxiety state evaluation was done through the completion of the two measuring scales of the anxiety state, STAI-X1 and EMAS-S, which the subjects filled in also in the pre-training phase. After one day, a follow-up was conducted, in order to see if the possible anxiety levels modifications subsequent to attention biases modifications are stable for at least 24 hours

Attention biases evaluation phase after attention biases modification (post – training) (6)

Right after the assessment of the post-training anxiety state, the subjects followed the same dot detection path from the second phase of attention biases evaluation.

6.1.1.4. Experimental design

The research design is a bi-factorial type 4 one (Experimental group: PPSA, EPSA, PPSP, AAN) X 3 (The time scheduling of measurements: pre-training, post-training, follow-up) with repeated measures.

6.1.3. Results

Before verifying the research hypotheses, we first checked if we indeed managed to induce a different attention pattern through the experimental manipulations using the Dot Probe. Because we noticed there is a high variability of the IB values within all four experimental groups and the hypothesis of normal distribution was rejected for each experimental group, we administered the Wilcoxon test for paired samples. The statistical results didn't confirm the success of the experimental manipulations; therefore, assuming the chance of further reducing the subjects' number, we proceeded to a second selection of participants, by excluding the cases in which we didn't manage to induce the intended attention pattern. After the second selection we were left with 12 participants in the PPSA sample, 8 participants in the EPSA sample, 8

participants in the PPSA sample, and the initial number of participants in the control, meaning 13 participants.

In order to verify the two concurring hypothesis we conducted two types of comparisons: *intra-group* comparisons of the anxiety state (measured by STAI-X1 and EMAS-S) before, right after and 24 hours after we induced the certain attention patterns and *inter-group* comparisons in order to see if there were significant differences of the anxiety state between the four experimental groups after we induced a certain attention pattern. Because the groups are unequal and small in numbers (12/8/8/13), we will run the comparisons through non-parametric tests.

The results we gathered at the intra-group level indicate the fact that subjects in the PPSA sample who preferentially processed the threatening stimuli present a level of post-training anxiety (measured by EMAS) significantly higher than the level anterior to the attention training (Z=-2,393, p=.017, r=0,58), while the participants in the PPSP sample who preferentially processed the positive stimuli relevant to social and physical anxiety registered in the post-training phase a significant lowering of the anxiety level measured by STAI-X1 (Z=-2,032, p=.042, r=0,71). However, no significant difference was registered between the levels of anxiety in the pre and post training phases in the control sample AAN (Z=-1,653, p=.098 for composite score), but neither in the EPSA sample, in which the participants were induced with an attention pattern of avoiding threatening stimuli (Z=-1,378, p=.066 for the composite score).

The *inter-group* comparisons showed that the post-training anxiety state of the three experimental groups with the modified attention pattern is not significantly different from the control sample, but that the anxiety state of subjects whom were induced positive bias, of preferential processing of positive stimuli for social and physical anxiety (PPSP sample), is significantly lower than the levels observed in the participants who registered the modification of preferential processing of threatening stimuli (U=15, Z=-2,288, p=.022, r=0,51), and also the anxiety state of the participants who registered the modification of threatening stimuli avoidance (U=9,5, Z=-1,921, p=.053, r=0,48).

In conclusion, the obtained results allow us to accept the hypothesis of the causal role of attention biases in anxiety and to reject the hypothesis of the causal role of the attention control in anxiety. But this interpretation must be precautious developed considering the small number of participants we reached after several selection trials

6.2. Study 3. The experimental confrontation of concurring hypotheses to explain the effects of attention trainings over the anxiety level by using explicit instructions

6.2.1. Goals and hypotheses

Because one of the limitations of Study 2 is the small number of participants left after several stages of selection depending on the medium level of anxiety and the success of experimental manipulations of attention biases modifications, we will conduct Study 3 an experimental replica of Study 2. We saw that the screening conducted at the end of Study 2 showed us that only an approximate one third of participants noticed the implicit association between the target stimuli location and the verbal stimuli with a certain emotional value, while on the other hand, only in a percent of (60%) of participants the attention biases modification succeeded in the intended direction.

In order to eliminate the drawback linked to the small number of participants, due to the probable skipping of the implicit associations, we will conduct an experimental replication of the Study 2, the only modification in procedure being related with the instructions in the attention training phase, in the way that they will become explicit instructions of association between the target stimuli and the verbal stimuli baring emotional valence, *without any type of instructions regarding the way they should orient their attention*. Krebs, Hirsch and Mathews (2010) are the only authors who used comparatively the minimal instructions usually used in the attention biases modification sessions and explicit instructions of making associations between the emotional valence of stimuli and the probe location, without any other instructions regarding attention orientation. The results showed the explicit instructions are more efficient in modifying the way of attention resources allocations, and participants oriented towards preferential processing of threatening stimuli through this types of instructions registered lower levels of negative cognitive intrusions.

Therefore, we will again test the two concurrent hypotheses using explicit instructions of associating the probe location and the emotional valence of stimuli as follows:

I1: Attention biases modification influences the levels of anxiety as follows:

i) People who have been induced to a negative bias will present a higher level of anxiety in the post-training timeframe

ii) People who have been induced to a modification of attention bias, either in the direction of bias suppressing, or in the direction of positive bias, will present a lower level of anxiety in the post-training timeframe

iii) There will be no significant difference between the levels of anxiety in the pre and post-training stages in those people who didn't suffer from any attention bias modification in the stage of attention training

I2: The increase in the attention control capacity influences the lowering of the anxiety level. In the terms of our experimental design, in all experimental conditions, the level of anxiety will diminish in the post-training stage.

6.2.2. Method

6.2.2.1. Participants

In the first stage of the study – anxiety traits screening – were included 239 participants, students of the "Emil Racoviță" National College in Cluj-Napoca, with ages between15 and 18 years old. The study was conducted with the explicitly solicited students' agreement. The average of the sample is 16, 9 years, and the standard deviation is 1, 00. The gender report balances in the favor of the female population: females and 105 males.

Similarly to the precedent study, out of this initial 239 participants sample, we selected only the ones who fell in the middle third of scores at the STAI-X2 Scale (anxiety-trait). Out of the medium anxiety sample (non-clinic), we excluded the participants with high rates of social desirability, as measured by Marlow-Crown Scale. Therefore, the subjects registering at this scale a score higher or equal to the critical level of 22, 86 ($m+1\sigma$) were excluded from the study.

In the last selection stage, after administering the Dot Probe, we excluded the subjects registering wrong answers or very long latency responses (over 2000 ms) in over 51% out of the total items number and those who declared after the screening that didn't read the stimuli included in the Dot Probe and answered mechanically when the dots appeared. After all these selections, we were left with only **76** participants out of 239, among which 32 males and 44 females, with an age average of 16, 06 years.

6.2.2.2. Instruments and materials

In order to conduct this experimental replica, we used the same instruments and materials from the precedent study:

1) *Marlow-Crown Social Desirability Scale* – presented in Study 1 (cap. IV)
2) *State–Trait Anxiety Inventory* (Spielberger, Gorusch & Lushene, 1970) – presented in Study 2 (cap. VI)
3) *Verbal stimuli* – presented in Study 2 (cap. VI)
4) *Experimental software* - presented in Study 2 (cap. VI)

6.2.2.3. Procedure

The working procedure was the same as the one from the previous study, with the exception that in the phase of inducing attention biases, the participants received explicit instructions regarding the way of the target stimuli and the emotional stimuli are associated.

6.2.2.4. Experimental design

The research design is a bi-factorial type 4 one (Experimental groups: PPSA, EPSA, PPSP, AAN) X 2 (The time scheduling of measurements: pre-training, post-training) with repeated measures.

6.2.3. Results

Before testing the experimental hypotheses, we verified again if we indeed managed to induce a different attention pattern in the four experimental samples through explicit instructions of associating the probe location and the emotional valence of the stimuli. In order to do so, we calculated a Bias Indices (BI) for each of the participants, obtained by calculating the difference between the means of reaction times at the incongruent items and the means of reaction time at congruent items (formula 1, cap. VI).

Contrary to our expectations, although we used explicit instructions regarding the association of target stimuli with emotional stimuli, we didn't get any statistically significant difference between the BI pre and post training in none of the experimental samples where the inducement of a certain attention bias was intended. Therefore, we continued to make a second subject selection depending on the BI modification in the intended direction. Thus, out of each experimental lot we excluded the participants who weren't induced with the desired attention pattern and we kept only those who registered in the post training session an increase (no matter how small) in the negative Bias Indices in the PPSA sample, positive in the PPSP sample and a decrease (no matter how small) of the negative Bias Indices in the EPSA sample. In this way, we can replicate the anterior study's results testing if in reality the attention bias modification is

followed by the anxiety level change. After the second selection we were left with 12 participants in the PPSA sample, 14 participants in the EPSA sample, 10 participants in the PPSA, while the control sample keeps the initial number of 12 subjects.

We administered then the same statistical calculations as in Study 2. The results gathered are extremely similar to those obtained in the previous study in which we used implicit instructions. At the intra-group level, there are significant differences between the anxiety levels in the pre and post training sessions for the groups PPSP (Z=-2,460, p=.014, r=0,71, STAI-X1; Z=-1,961, p=.05, r=0,56, composite score) and PPSA (Z=-1,895, p=.063, r=0,64, EMAS-S; Z=-2,023, p=.043, r=0,67, STAI-X1; Z=-2,386, p=.017, r=0,79, composite score), but there are no significant differences between the pre and post training sessions between the groups PPSP (Z=-941, p=.347, EMAS-S; Z=-1,673, p=.094, STAI-X1) and AAN (Z=-1,802, p=.06, EMAS-S; Z=-1,637, p=.102, STAI-X1).

Inter-group, we didn't obtain any significant difference of the anxiety levels in the post training sessions between any of the three experimental samples and the control sample, but we did observed a significant difference between the post-training level of anxiety in PPSP group and the PPSA one (U=23, Z=-1,940, p=.057, r=0,42, EMAS-S; U=16, Z=-2,481, p=.012, r=0,54, STAI-X1; U=19,5, Z=-2,205, p=.025, r=0,48, composite score). In other words, the anxiety state of the participants who were induced with a positive bias of preferential processing of positive stimuli relevant for physical and social anxiety (PPSP sample), is significantly lower in comparison to the level registered in the participants who were induced with a preferential processing of threatening stimuli (PPSA sample).

6.3. Conclusions and discussions

In these two studies we tried to first test the hypothesis of the causal role of attention bias over the vulnerability towards anxiety. A series of theoretical models (William and co., 1997, Eysenck, 1997), but also experimental studies (MacLeod and co., 2002,; Amir and co., 2008, 2009a, 2011; Bar-Haim and co., 2007, 2010) postulate the existence of a causal relationship between the potentially anxiety-inducing information and the non-adaptive emotional reactions. Surprisingly, however, only one experimental study aimed to directly test this causal relationship (MacLeod and co., 2002), but the greatest drawback of this research is that is uses two experimental samples in which was induced only a modification of the attention means

allocation of resources (preferential processing of anxiety-inducing stimuli and avoidance of the anxiety-inducing stimuli) without using a control sample. This way, the causal role of the attention processing of threatening information in anxiety can't be undoubtedly established.

On the other hand, Eysenck and colab. (2007) offer us an alternative theory to the attention biasing towards threatening stimuli in the etiology of anxiety disorders, the Theory of Attention Control, whose assumption is that these cognitive biases are the result of more general cognitive deficiencies which have to do with the control of the attention processes and not specifically with the differentiated processing of environmental information. As a consequence, the effects of the programs aiming to modify the attention biases in order to lower the anxiety levels is due to an increase in the attention capacities and not to the changes of the subjective allocation of attention resources towards threatening stimuli. The results of some experimental studies seem to back up this explanation of the attention deficit role in anxiety (Klump and Amir, 2010).

Therefore, by these studies, we aimed to simultaneously test the two concurrent hypotheses regarding the effects of the attention biases modification programs over the anxiety levels, the first referring to the causal role of attention biases in the anxiety etiology, and second referring to the causal role of the attention capacities in the anxiety etiology.

Besides the simultaneous testing of the two concurrent hypotheses, by the present studies we bring other elements of novelty in the series of experiments regarding the attention modification programs:

- The use of an attention training program using only neutral stimuli for the control sample, so we could test simultaneously the two concurrent hypotheses, but also to avoid the repeated exposure to emotional stimuli, which can determine by itself certain changes in the system of attention resources allocation and the anxiety level (Amir, 2009b, Eldar and Bar-Haim, 2009, Reese et al., 2010; Koster, 2010).
- The use of an experimental group in which we followed the inducement of a preferential processing of specific positive stimuli by using pairs of positive – neutral words, and comparing the post-training anxiety level with the situation of inducing the avoidance of threatening stimuli processing.
- The age category of the experimental subjects – teenage. Until now, there was no study conducted on this age category. The majority of previous studies were conducted on the adult

population with ages between 20 and 50 years old, while the studies conducted by Eldar and co. (2008), focused on subjects aged between 7 and 15 years old.

In the same time, we respected all the scientific norms meant to raise the level of controllability of possible confounded variables:

(a) The use of a control sample, in parallel with the three groups where actual experimental manipulations were conducted

(b) In order to test the causality of the above-mentioned processes, we selected out of initial lots of 200 and 239 participants, respectively, only the ones with a medium level of anxiety, similarly to the research conducted by MacLeod and co. (1992).

(c) We measured attention bias before and after the training, in order to test if the experimental manipulation was a success and afterwards we selected only those subjects in whom we observed a modification in the attention bias in the direction expected according to the experimental design.

(d) The verbal stimuli used in the Dot Probe of biases evaluation were different from the ones used in the actual attention training.

(e) The verbal stimuli were selected so they could differ from an emotional valence point of view but not from other perspectives such as abstract levels, frequency of use in the Romanian language and the words' length.

(f) We carried on all the possible permutations between the words position (up/down) and the target stimulus position (up / down) in order to avoid a possible pavlovian association between the word location and the target position.

In these conditions, synthetically, we obtained the following results:

(1) Subjects who preferentially processed threatening stimuli registered a significant increase in the post-training level of anxiety in the conditions of confronting with a stress factor.
(2) Subjects who preferentially processed specific positive stimuli registered a significant decrease of the post-training anxiety level in the conditions of confronting a stress factor.
(3) Participants in the control sample and those who were implicitly induced with anxiety-inducing stimuli avoidance didn't register a significant modification in the anxiety levels.
(4) Subjects who were induced with a preferential processing of threatening stimuli registered a significant increase of the anxiety level in comparison to those who were implicitly induced with a preferential processing of positive stimuli.

Therefore, according to the obtained results, we can conclude that the hypothesis of the causal role of preferential allocation of attention resources towards different emotional stimuli categories in the anxiety etiology is confirmed, while the hypothesis regarding the causal role of attention capacity in the anxiety etiology is rejected. We admit, however, that these studies have a number of limitations: the low number of participants, the lack of a selection prior to the gathering of experimental groups depending on the registered Bias Indices, so we could eliminate the extremes and keep medium values and a clear non-discrimination between the effects of the attention biases modifications for the relevant stimuli to social anxiety and physical anxiety, all the attention biases changing programs equally containing relevant stimuli for both types of anxiety.

Regarding the practical implications of these studies involving the use of attention biases modification programs in lowering anxiety levels, some aspects are worth to be considered:

(1) An attention bias altering program containing only one attention training has only immediate, short-term effects; it is possible, such as former studies involving follow-up sessions showed (Amir and co., 2009; Schmidt and co., 2009) that these effects of diminishing the anxiety levels to extend on longer periods of time provided we use attention biases alteration programs consisting in several training sessions

(2) Only approximately one third of the participants to this study noticed (and learned) this implicit association between the emotional stimuli and the target stimuli, therefore we should consider using another type of instructions which explain in a certain way the association between emotionally loaded stimuli and the target ones, considering that there is at least one (Krebs and co., 2010) which proved a higher efficiency of explicit instructions than that obtained by implicit instructions in attention bias alteration.

(3) Not all the study participants in these attention biases modification programs respond to this type of intervention, in the way of an actual modification in the attention resources allocation and, as a consequence, it is recommended to select the potential patients who will be exposed to such program by individually testing the efficiency of the attention bias alteration; just as not all the individuals manifest an attention bias towards threatening stimuli, not all the individuals respond to such attention bias modification programs.

(4) Subjects in Study 2 who were induced with an attention avoidance of stimuli not only that they registered no lowering of the anxiety levels whatsoever, but on the contrary, registered

increased levels of anxiety, even if not on such a degree that the increase to pass over the statistical level; it is possible, however, that in certain conditions, this increase to become significant; this result contradicts other previous research results (MacLeod, 1992, 2002; Amir, 2008, 2009) which showed that the avoidance of the potential social threatening stimuli led to an anxiety decrease, but concurs the research conducted by Amir and his collaborators (2010) and also Wald's (2011, 2013), who highlighted the fact that in real situations (and not in laboratory contexts) involving imminent physical danger, the suppressing of attention biases leads to the occurrence of post-traumatic stress disorder symptoms. It is very probable that the effects of attention biases modification programs to be different in the case of social threat than those of the physical threat, as we already saw in the first study conducted within the present research, and that the allocation of attention resources in the case of potentially social threatening stimuli acts differently from the stimuli baring a potential physical threat. It is certain that in some situations, the negative bias suppressing may lead to unintended effects, of increasing the anxiety levels. It is the task of future research to find out if the avoidance of the anxiety-inducing stimuli has different effects depending on the type of threat (social vs. physical) or if, as Wegner and his collaborators (1994) proved, in those situation of cognitive overload, stress or time pressure, suppression leads to the apparition of counter-intended effects. This is a serious argument in favor of taking more into consideration the effects of inducing positive biases and not only to diminish negative biases.

CHAPTER VII
FINAL CONCLUSIONS. THEORETICAL AND PRACTICAL IMPLICATIONS

Cognitive biases: error or threat adaptation? In the first part of this thesis we tried to offer an answer to this question approaching cognitive biases from another perspective, that of an efficient defensive cognitive system. And because the dominant vision in this moment over cognitive biases is of an error or information processing distortion which can have a role into the vulnerability to anxiety, in the first chapter we presented the most known and influential theories regarding the role of cognitive biases in anxiety, while in the second chapter, we presented empirical evidence for preferential processing of threatening stimuli at all the information processing levels.

In chapter IV we presented our own empirical research regarding the dynamics of threatening and safety (positive) information processing at the levels of attention, memory and inference, as a general characteristic of any defense system in the face of danger, regardless of the state or level of anxiety, but also together with a distinct analysis of the differences in the threatening and positive information processing between non-anxious subjects and anxious people (state and trait). The main novelty character of this research resides in the vertical dynamic analysis of threatening information processing at an attention, memory and inference level, as part of an efficient defense system, using the same conceptual and methodological framework. Although there is some level of consensus regarding the negative attention bias in anxious subjects, the studies concerning the threatening information computation process regardless of the anxiety levels are few and presenting mixed results, dependent of the methods used. Moreover, the threatening information processing at the memory and inference levels were never studied in a common framework with threatening information processed at the attention level so it could be observed the vertical dynamics of threatening information processing. In order to overcome these methodological disadvantages, we studied the specifics of information processing at all levels of computation in a unique frame, given by the use of the same subjects, same stimuli categories and the same experimental task.

The results we obtained led us to some important conclusions: first of all, they showed us that preferential and differentiated processing of threatening information is not anxiety's privilege, but is one of the basic traits of any efficient cognitive defensive system. From this point

of view, cognitive biases, although they seem to be deviations from the norms of logic, they don't represent also functional errors, but rather the expression of a threat adaptation and represent rather the norm than the exception.

The second important conclusion of this thesis is that cognitive bias don't represent an unitary phenomenon, but are extremely contextual, depending on a series of variables, such as the type of used stimuli, the context in which potentially threatening stimuli occur, the danger exposure time, the intensity of the threat, the threat proximity interval and also other factors which can influence or determine the way of the attention bias.

In the third place, cognitive biases are dynamic, plastic, suffering time transformations but also from one processing level to the other. Thus, in a first stage, information with high levels of threat is preferentially processed at an attention level, so that at the memory and inference level to occur a positive bias. In the case of extremely physical dangerous situations for the organism's physical integrity, this preferential processing of threatening information is also maintained at the memory and inference levels, being extremely relevant to the organism's survival.

In the fourth place, some important differences in informational processing were highlighted in concern with anxious and non-anxious subjects, among which we mention the following:

(a) In the situation of a present anxiety state, but in the absence of stable anxiety traits, both physical and social threatening information, with an exposure interval of 500 ms, are processed at the attention level with a delay in comparison to non-anxious participants. At an inferential level, the presence of a generalized anxiety state generates more negative interpretations than the absence of an anxiety state

(b) At the attention level, the subjects who present in their personality structure stable anxiety traits register lower times of reaction than non-anxious subjects, meaning that they manifest a certain hyper-vigilance for environmental threatening stimuli, but they process with delay the threatening information in comparison to neutral ones, which doesn't make them more efficient in the case of real dangers occurring, because their delayed defense reactions.

(c) At the inferential level, the existence of an anxiety trait in the absence of an anxiety state doesn't produce any modification in the interpretation of ambiguous, potentially threatening situations. We could at most remark the absence of a positive bias, which was highlighted when

we made the statistical calculations for the entire lot of participants, specifically in those subjects strongly non-anxious from the state and trait point of view when tested. On the other hand, the presence of an anxiety state influences the interpretation of potentially threatening situations (physical and social) in the direction of negative interpretations.

Therefore, we consider that cognitive biases represent, in general, an adaptation phenomenon to threat but which under certain circumstances, may turn into vulnerability factors for anxiety. Thus, the amplification and the exaggerated length of preferential processing of threatening stimuli, the suppressing – in some contexts – of the preferential processing which can lead to counter-intended effects of anxiety increase, a low plasticity of cognitive biases and also the insensitivity of the cognitive system to positive and safety signals, all can turn into determinant factors for anxiety manifestations.

Following these conclusions, but also taking into account the vast literature affirming that there is a causal relationship between cognitive biases and anxiety, in chapter V we conducted a bi-directional analysis of the empirical evidence supporting this causal relationship: the effects of CBT over attention biases and the effects of attention biases modification programs over the anxiety levels. Especially the effects of the attention biases modification programs seem to be very promising for the treatment of anxiety disorders or even stress reactions prevention (See et al., 2009). It is quite remarkable the fact that a single session of attention bias modification in subjects with social anxiety traits (Eldar and Bar-Haim, 2009), public speaking anxiety (Amir et al., 2008) and contamination fear (Najmi and Amir, 2010) seems to be enough to produce changes in attention processing and vulnerability towards anxiety. However, we observed that, surprisingly, no study managed so far to test without a doubt the causal relationship between negative bias and anxiety. Practically, only one experimental study aimed to directly test this causal relationship, (MacLeod and colab., 2002), but a major lack of this study was the fact that it used two experimental groups without using a control group. As a matter of fact, the vast majority of researches involving anxiety reduction through attention biases modification programs didn't use a control sample, and those which used one used a placebo-type of control sample, meaning they didn't use the same set of stimuli as they did in the attention biases trainings and without manipulating the direction of attention resources allocation. Or, the simple repeated exposure to emotional stimuli can produce changes in the attention resources allocation system and the anxiety levels (Amir, 2009b, Eldar and Bar-Haim, 2009,

Reese et al., 2010; Koster, 2010). In this way, the causal role of the attention processing of threatening information in anxiety couldn't be established beyond a doubt.

Following this trail of thinking, in chapter VI we presented our own empirical research regarding the causal role of attention biases in anxiety by an experimental confrontation of two concurring hypotheses which explain the effects of attention trainings over the anxiety levels using explicit and implicit instructions: the hypothesis of attention bias and the hypothesis of attention control capacity. Besides the simultaneous testing of these two hypotheses (1), this research brings some novelty elements in the series of attention modification programs studies: (2) using an attention training program built only of neutral stimuli for the control sample, in order to avoid the repeated exposure to emotional stimuli – which can produce by itself some changes in the way of attention resources allocation and also in the anxiety levels, (3) the age category – specifically the teenage one – by now this research being the only study concerning attention biases in teenagers and (4) the use of an experimental group in which we followed the inducement of a preferential processing of specific positive stimuli. There are two more studies (Wadlinger, Isaacowitz, 2008 and Taylor, Bomyea and Amir, 2011) which used attention biasing towards positive stimuli but, apart from some drawbacks we already mentioned in chapter V, none of these studies aimed to compare the results of the attention bias modification towards positive stimuli with other types of attention biasing alterations (towards threatening stimuli or the avoidance of threatening stimuli).

The results gathered are in favor for the hypothesis implying the causal role of the way people preferentially allocate attention resources to different emotionally loaded stimuli over anxiety and lead us to rejecting the hypothesis of the causal role between the attention control capacity and anxiety vulnerability. However, although we tried to control all the confounded variables which could interfere with the obtained results, this data should be carefully interpreted due to the small number of experimental subjects.

This time there were also some practical implications that are worth considering with regard to the attention biases and lowering the anxiety levels:

(a) An attention bias altering program containing only one attention training has only immediate, short – term effects; it is possible, such as former studies involving follow-up sessions showed (Amir and co., 2009; Schmidt and co., 2009) that these effects of diminishing the anxiety levels

to extend on longer periods of time provided we use attention biases alteration programs consisting in several training sessions

(b) Only approximately one third of the participants to this study noticed (and learned) this implicit association between the emotional stimuli and the target stimuli, therefore we should consider using another type of instructions which explain in a certain way the association between emotionally loaded stimuli and the target ones, considering that there is at least one (Krebs and co., 2010) which proved a higher efficiency of explicit instructions than that obtained by implicit instructions in attention bias alteration;

(c) Not all the study participants in these attention biases modification programs respond to this type of intervention, in the way of an actual modification in the attention resources allocation and, as a consequence, it is recommended to select the potential patients who will be exposed to such program by individually testing the efficiency of the attention bias alteration; just as all the individuals manifest an attention bias towards threatening stimuli, not all the individuals respond to such attention bias modification programs.

(d) Subjects in Study 2 who were induced with an attention avoidance of stimuli not only that they registered no lowering of the anxiety levels whatsoever, but on the contrary, registered increased levels of anxiety, even if not on such a degree that the increase to pass over the statistical level; it is possible, however, that in certain conditions, this increase to become significant; this result contradicts other previous research results (MacLeod, 1992, 2002; Amir, 2008, 2009) which showed that the avoidance of the potential social threatening stimuli led to an anxiety decrease, but concurs the research conducted by Amir and his collaborators (2010) and also Wald's (2011, 2013), who highlighted the fact that in real situations (and not in laboratory contexts) involving imminent physical danger, the suppressing of attention biases leads to the occurrence of post – traumatic stress disorder symptoms;

(e) These contradictory results, sometimes counter-intended, obtained by using attention training programs in the direction of avoiding threatening stimuli, together with the positive results of reducing the anxiety levels subsequent to implementing an attention biases modification program of preferential processing of positive stimuli relevant to social and physical anxiety, constitute themselves into a serious argument of further taking into consideration the effects of anxiety decrease provided by some programs inducing positive biases, not only of reducing negative biases.

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