REDUCING PROBABILITY OVERESTIMATION OF THREATENING EVENTS: AN ITALIAN STUDY ON THE EFFICACY OF COGNITIVE TECHNIQUES IN NON-CLINICAL SUBJECTS

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Abstract

Objectives: Our study was aimed at evaluating the efficacy and stability of the "Pie Technique", "Cumulative Probability" and "Inverted Pyramid", cognitive techniques applied in a clinical context to reduce overestimation of the probability of threatening events.

Method: 319 healthy participants were randomly assigned to one of 8 groups. Groups differed on the level of trait anxiety (high vs. low), and on the cognitive techniques they were to receive (Pie Technique, Cumulative Probability, Inverted Pyramid, Control task). All groups were exposed to an intervention aimed at reassigning the initial probability estimate.

Results: In both high and low trait anxiety individuals, all the techniques successfully produced a statistically significant reduction in the estimation of the perceived probability, while no significant outcome was found in the control task group. This effect was significantly maintained at a 4 week follow up.

Conclusions: Our study shows that the Pie Technique, the Cumulative Probability and the Inverted Pyramid reduce the estimation of the perceived probability of negative events occurring in both high and low trait anxiety individuals. This effect was considerably maintained at a 4 week follow up. The reduction should mainly be attributed to the technique's power in contrasting the cognitive mechanism of hyper-focalization. The present study takes into account only general threatening events, and not threats specifically related to the different disorders. Moreover, it demonstrates that all the techniques are useful to reduce danger overestimation but in a group of non-clinical individuals. We can't thus generalize our results to anxious patients.

Key words: cognitive therapy, cognitive techniques, anxiety disorder, probability, trait anxiety

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1. Introduction

In patients affected by anxiety disorder has been observed a particular cognitive bias related to the overestimation of the probability of threatening events (e.g., Bögels and Zigterman, 2000; Hofmann, 2007; Mavromoustakos et al., 2016; Peschard and Philippot, 2017). Grupe and Nitschke (2013) state for example that the bias of anticipation for possible threats has a key role in the maintenance of anxiety disorders.

It is not clear yet whether this overestimation is due to a basic cognitive error (may be regarding to the capacity to estimate the probability of negative events occurring in general), or whether this kind of overestimation is something specific. In general, judgements of threat-relevant outcomes are believed to be biased because of the use of heuristic rules (Gilboa-Schechtman et al., 2000). Furthermore, numerous studies carried out on patients suffering from various anxiety disorders such as Panic Disorders, Social Anxiety or Phobias, have shown

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that patients actually tend to overestimate probability compared to controls (cf. Bögels and Zigterman, 2000; Öst and Csatlos, 2000; Hofmann, 2007; Mavromoustakos et al., 2016; Peschard and Philippot, 2017). However, this happens only when patients must make predictions concerning events falling within their specific pathological domain. For example, individuals with Social Anxiety Disorder (SAD) overestimate the cost of negative outcomes or evaluations by others for social events, but not for negative non-social events (Hofmann, 2007). Thus, patients affected by different anxiety disorders tend to overestimate the likelihood of the negative events most relevant to their specific disorder, that is the increased negative expectancies tend to be specific to the particular concerns of each disorder (Harvey et al., 2004; Mavromoustakos et al., 2016). Patients' concerns determine what they see as important and this will influence, for instance, what information is most salient and accessible. For several authors (e.g. Gilboa-Schechtman at al., 2000; Mavromoustako et al., 2016; Peschard and Philippot, 2017), this event-specific cognitive bias of probability judgment, together with other distortions, plays a significant role in the etiology and maintenance of the pathogenic beliefs underlying anxiety disorders.

In cognitive therapy these overestimations of danger may be addressed by various techniques. The most used and quoted are the "Inverted Pyramid" (IP, Wells et al., 1997; Salkovskis et al., 2003), the "Pie Technique" (PT, Van Oppen and Arntz, 1994; Salkovskis et al., 2003), and the "Cumulative Probability" (CP, Van Oppen and Arntz, 1994). The "Inverted Pyramid" (e.g. Wells ,1997; Salkovskis et al., 2003) and the "Pie Technique" (e.g. Van Oppen and Arntz, 1994; Wells, 1997; Salkovskis et al., 2003) are designed to help the subject to consider the negative event in relation to other possible scenarios. Their goal is to shift the attention away from the negative focal hypothesis towards alternative hypotheses to favor the production of a more complete model of the test situation. Specifically, the Inverted Pyramid encourages the patient to defocus. Thinking of the negative outcome as an event that concerns only a limited number of people leads the subjects to distribute the attention on a more extensive examination of real facts. For example, for those suffering from hypochondria a simple headache is equal to a brain cancer. With this technique, the patient is asked to estimate the current number of individuals they know with that particular symptom and to make a list of the number of healthy individuals with a passing head pain, those with a persistent pain, those who decide to visit a doctor, those who may undergo to medical tests etc. At the last step of the pyramid there are those who may be suffering from brain cancer. The "Pie Technique" is similar, yet the reduction of the probability estimate takes place through the listing of a series of possible alternative events, explicitly expressed, at the occurrence of the negative event (e.g. each event is made into a slice of a pie chart. The catastrophic interpretation is usually a very small slice of the pie). In both cases, the result will be a reduction of the estimated probability of the threat. Additionally, the "Pie Technique" was originally developed to challenge the overestimation of the amount of responsibility for an aversive event, and later adapted by Wells and colleagues (1997) to test the chance that one particular negative event will happen. Finally, the "Cumulative Probability" technique (Van Oppen and Arntz, 1994) aims to reduce the initial probability estimation of a catastrophe by comparing it with the chance estimation based on an analysis of sequence of events that lead to the catastrophe. Thus, this type of technique does not counter the tendency of the subject to focus his/her attention on the catastrophic event.

So far, no empirical study has demonstrated neither the efficacy of the three techniques described (IP, CP and PT) in producing a reduction in the estimated probability of threatening events, nor the stability over time of this estimation reduction. Indeed, studies regarding these techniques were mainly addressed to evaluate their effectiveness within an intervention protocol, together with other techniques.

The aim of this study is thus to verify whether the cognitive techniques "Pie-Technique", "Cumulative Probability" (Van Oppen and Arntz, 1994) and "Inverted Pyramid" (Wells, 1997; Salkovskis et al., 2003) are all equally effective in reducing overestimation of probabilities of negative events and whether this effect is stable over time. In an earlier study (Gragnani et al., 2003), the team already demonstrated that all three techniques were actually able to produce an efficient reduction of the perceived probability of a negative event, but this study presented two limitations. First, there was no control condition. Moreover, the stability of the threat overestimation reduction due to the application of the techniques was not evaluated. In the present paper, we thus included a control condition, in order to be certain that the potential reduction of the estimation is actually attributable to the cognitive intervention performed. In this circumstance, participants performed a control task, in which they had to underline the words with double consonants in an Italian text. Moreover, to evaluate the stability over time of the danger overestimation reduction, participants were asked to give a new estimation of the probability of the negative event occurring after 4 weeks, at follow up.

In line with the idea that there are no qualitative differences between anxious individuals and normal subjects with regard to probabilistic reasoning (Nesse and Klaas 1994), in the present paper we assessed the trait anxiety in a normal group in order to test more specifically the hypothesis about the effectiveness of the current technique for anxious people. For this reason, the group was divided into high and low trait anxiety.

2. Materials and Methods

2.1 Participants and design

A total of 319 normal subjects (170 women, 149 men) aged between 19 and 57 years (mean: 33.6 years) with 8 to 19 years schooling were involved in the study. They were recruited from several sites (university students, working population) via advertising, as well as announcements on the public boards of Roma La Sapienza University. The study was carried out in Roma, Italy at the Centre for Cognitive Psychotherapy in Rome. All the participants were thus volunteers. They were screened by an abbreviated interview. They were randomly assigned to one of 8 groups in a 2 X 4 between subject design. Groups differed on the level of trait anxiety (high n= 166 vs. low n= 153; median split), and on the cognitive techniques they were to receive (Pie Technique, Cumulative Probability, Inverted Pyramid, Control task, see **table 1**).

2.2 Materials and procedures

Participants were tested in 8 groups of about 40 people. Two hours before the experimental session they were given the Trait Anxiety Inventory (STAI-Y; Spielberger et al., 1983) (see below). They were then assigned to the group of high or low trait anxiety

according their score to the Trait Anxiety Scale (see above). The participants of each group were then randomly assigned to one of the four experimental conditions (see **table 2**). At the beginning of the experimental session, an experimenter told them that the study was about personality differences in evaluating events. Participants were then given a 7-part protocol. They were asked: 1) to fill in the State Anxiety Inventory (STAI-S), 2) to read a short story related to a negative event (see below); 3) to estimate the probability of this event happening (Initial probability); 4) to complete the STAI-S again; 5) to read the story again; 6) to be exposed to an intervention aimed at reassigning the probability estimate (4 different conditions, see below) and 7) to make a new estimate of the probability of the negative event occurring (Final probability). The whole procedure takes about 25 minutes.

In order to test the stability of the potential reduction in probability estimation, participants were asked to read the story again and to make a new estimate of the probability of the negative event occurring after four weeks, at follow-up (Follow-up probability).

Three trained students performed the experimental procedure and each of them administered all the three techniques. In order to be sure that the three experimenters did not affect the results, we personally trained each student and controlled their training sessions. The training sessions consisted of the individual student performing the therapy techniques under observation of the specialist, so that we could be confident of the individual student's competency.

Informed consent was obtained.

2.3 High and low trait-anxiety group.

The Trait Anxiety Inventory STAI (STAI-Y; Spielberger et al. 1983) consists of 20 items assessing *trait anxiety.* This scale asks participants to rate how they feel "generally" using a 4-point scale (1= *almost never*, 4 = *almost always*) in response to a series of self-descriptive statements. The internal consistency for the trait scale is high; median alpha coefficient is .90 and validity correlations with other anxiety questionnaires range from .73 to .75 (from Spielberger et al., 1983). In the present study, the internal consistency for the trait scale is high as well: median alpha coefficient is .88. Total score can range from 20 to 80, with greater scores reflecting higher levels of trait anxiety. Participants were classified as either low or high in trait anxiety on the basis of a median split (see above).

2.4 Baseline State Anxiety

The baseline differences in state anxiety was assessed by asking participants to fill in State Anxiety Inventory (STAI-S) at the beginning of the experiment. The total score (range 20-80) was calculated by adding scores on the 20 items. Items were coded such that higher numbers reflect greater state anxiety. The internal consistency for the state scale is high; median alpha coefficient is .93 and validity correlations with other anxiety questionnaires range from .73 to .85 (from Spielberger et al., 1983).

2.5 Scenario: the probability of negative event

All participants read then one of three scenarios like the following one (translated from Italian):

It is Friday evening and you are waiting for your partner to come home. You have planned to go out to dinner together. At eight o'clock s/he calls you on your mobile from her/ his work phone to say s/he is unable to pass by home as s/he has had an emergency. You decide to meet directly at the restaurant; s/he is on her/his motor bike. While you are driving to the meeting place, you turn on the radio and hear that a serious accident has occurred on the ring road also involving some motor bikes. You know that the ring road is a short cut to get to the restaurant and that when s/he is in a hurry s/he drives fast and weaves in and out of the traffic. You are worried…you have always considered motor bikes dangerous! You get to the restaurant, park the car and rush inside; but s/he is not there. You are worried, because s/he has never been late before; so, you wait there, holding your mobile phone, undecided whether to call her/him or not for fear of distracting him while s/he is driving. You wait a little longer but s/he does not turn up; you cannot wait any longer and call her/him – but her/his mobile is switched off… it's now half past nine and s/he still has not arrived.

Initial probability. After reading the scenario, all participants completed a questionnaire containing the dependent measure for this experiment, together with two filler items. As regards the dependent measure, participants were asked to estimate the probability of the negative event happening, by answering the following question, for the story reported above:

What chances are there that one of the motor bikes involved in the accident described on the news is hers/ his? _____ *%* [Fill in the blank]

The two additional items asked for ratings of severity of the negative event and the satisfaction with preventive performance, as in the questions reported below, again for the story reported above:

1. *How severe is the accident described on the news?* _____ [Fill in the blank]
2. *How differently should I have behaved, i.e. staying home and waiting for her/him?* _____ [Fill in the blank]

Ratings of severity and satisfaction were made within the range of 0–100, with anchors at 0 (not at severe/ differently) and 100 (totally severe/differently). These filler items were added in order to reduce the possibility that participants would remember their ratings, and to reduce possible demand effects.

Participants had then to complete the STAI-S (for quantifying the anxiety induction effect through the total State Anxiety Inventory score), and to read the negative story again.

2.6 Cognitive techniques.

Participants were thus exposed to an intervention aimed at reassigning the probability estimate. Three different types of probability reassignment procedures were used:

1) Pie technique (PT) (Van Oppen and Arntz, 1994; Wells, 1997; Salkovskis et al., 2003). Once the degree of probability of the negative event occurring has been decided, the subject is invited to take into consideration a range of possible alternatives, i.e. events that could occur instead of the negative event. For each event, the subjects are asked to write down their estimate of the probability of its occurrence. After each possible situation has been

assigned its relative probability of occurrence, the subjects are asked to fill in the pie chart by drawing a segment for each cause identified, where the size of each segment is proportional to the probability estimate provided by the subject.

2) Inverted pyramid technique (IP) (Wells et al., 1997; Salkovskis et al. 2003). It consists in asking the subject to indicate the number of persons directly involved in the various situations that can produce the negative event, ranging from the most generic situation (in which a large set of persons is involved) to the most specific one (in which only a small subset is involved).
3) Cumulative probability technique (CP) (Van Oppen and Arntz, 1994). The procedure involved in this cognitive technique consists in basing the estimation of the probability of the negative event occurring on an analysis of the sequence of events necessary for it to take place. Initially the subject assigns an estimate to each event and then assesses the cumulative probability of the combined events.

In the control condition participants were asked to underline the words with double consonants in an Italian text in order to avoid the potential effect of completing three consecutive probability estimates.

Final probability. Finally, the participants were given again the questionnaire containing the three items assessing their judgments about probability, severity and satisfaction, thus making a new estimate of the probability of the negative event occurring (our dependent variable)

Follow- up probability. The same participants were asked to read the story and the questionnaire, in order to have a new estimation of the probability of the negative event occurring, at a 4 week follow up.

Dependent variable. The dependent variable related to the probability estimation of the negative event was thus assessed at three different points:

(1) Initial probability: The number indicated immediately after having read the story related to the negative event occurring.
(2) Final probability: The number indicated after the interventions or the control task.
(3) Follow up probability: The number indicated after 4 weeks, at follow-up.

Finally, as an anxiety induction check we analyzed: (1) the baseline state anxiety total score, (2) the state anxiety total score after having read the story.

3. Results

Of the 371 subjects initially recruited for the study 319 (86 %) satisfied the admission criterion – i.e. an initial estimate of the negative event ≥ 5%. This procedure was necessary owing to the impossibility of assessing the efficacy of a technique for reassigning the probability estimate starting from too low a value (e.g. "1").

3.1 Descriptive variables

As the effect of the demographic variables Gender, Age and Schooling on participants' performance in the different experimental conditions, two repeated measures multivariate analysis of variance (MANOVA) were performed. The first MANOVA was made to evaluate the effect of Gender (2 levels), Age and Schooling on Probability (Initial vs. Final). Results show no significant effects, neither for Gender (F (1,191) = 1.9, n.s.), nor for Age (F (49,111) = 1, n.s.), nor for Schooling (F (2,191) = 1.6, n.s.). The second MANOVA was performed to evaluate the effect of the same demographic variables on Initial vs. Follow-up probability. As in the preceding analysis, demographic variables proved not to represent difference factors (Gender F (1,191) = 1.2, n.s.; Age F (49,191) = 1.2, n.s.; Schooling: F (2,191) = 0.6, n.s.). Overall, none of the descriptive variables seems to affect the way probability is assigned to an event. For this reason, they will be disregarded in the following analyses.

Moreover, to assess whether the three demographic variables (Age, Gender, and Schooling) differed among subjects in the experimental groups, they were simultaneously entered into a 4 X 2 multivariate analysis of variance model with Techniques (Pie Technique, Cumulative Probability and Inverted Pyramid) and Trait Anxiety (high and low) as independent variables. Wilks' Lambda coefficients revealed no significant main effects for neither Techniques (F (3,311) = 1.9, n.s.), nor Trait anxiety (F (1,311) = 1.84, n.s.). The descriptive data referring to the variables are shown in **table 1**.

3.2 Anxiety induction check

Table 2 shows the mean state anxiety ratings for participants high and low in trait anxiety and in all four experimental conditions (Techniques), both before and after having read the story. Each measure was subjected to a repeated measures ANOVA with Time (before vs. after) as a within group factor and Techniques (Pie Technique, Cumulative Probability and Inverted Pyramid) and Trait anxiety (low vs. high) as between group factors. A significant Time main effect was found (F (1, 311) = 5 , $p < .05$, η^2=.02), indicating a pre-to-post increase in state anxiety in all participants (before: M=38 , SD=10.4; after: M=40.1, SD=11.2). The Time X Techniques groups interaction was nonsignificant (F (3, 311) = .46, n.s.). The anxiety induction was thus effective in all techniques groups. Furthermore, also the Time X Tecniques X Trait anxiety groups interaction was nonsignificant (F (3, 311) = 1.94, n.s.), indicating that high trait-anxiety individuals were no more responsive to the affect induction than low-trait-anxiety

Table 1. *Demographic composition of the group of subjects for the various conditions*

Experimental condition	N	(N) Males	(N) Females	AGE Mean (SD)	Years of schooling Mean (SD)
PT	89	40	49	33 (13.7)	15.7 (1.5)
IP	93	55	38	35 (12.8)	14.9 (1)
CP	57	25	32	34 (10.3)	15.7 (1.7)
Control	80	47	33	32 (9.5)	15.5 (1.7)
Total	319	167	152	33 (11.9)	15.48 (1.62)

PT= Pie Technique, IP= Inverted Pyramid, CP= Cumulative Probability.

individuals. Overall these results suggest that it is unlikely that differences in probability estimation were due to individuals in one experimental group having a greater change in state anxiety than individuals in other experimental groups.

of trait anxiety.

In order to evaluate the stability of the effect of the techniques on probability estimation, a second repeated measure ANOVA was performed, with Probability (initial vs. follow-up) as a within group factor and Techniques (Pie Technique, Cumulative Probability and Inverted Pyramid) and Trait anxiety (low vs. high)

Table 2. *Means (standard deviations) state anxiety ratings, before and after having read the story, in the various conditions*

Variable and Condition	n	State Anxiety 1 M (SD)	State Anxiety 2 M (SD)
High-trait anxiety			
PT	45	44 (11.2)	44.2 (11)
IP	54	41.8 (11)	45 (11.6)
CP	38	45.4 (9.9)	45.8 (9.4)
Control	29	43.1 (11.6)	46 (12.2)
Low-trait anxiety			
PT	44	33 (6.1)	34 (5.5)
IP	39	33.1 (6.7)	33.2 (7.2)
CP	28	32.1 (5.1)	33.1 (9.1)
Control	42	33.2 (6.5)	33.5 (8)

PT= Pie Technique, IP =Inverted Pyramid, CP=Cumulative Probability

3.3 Estimate of probability

To evaluate the effect of the techniques in modifying the final estimate of probability, a first repeated measure ANOVA was performed, with Probability (initial vs. final) as a within group factor and Techniques (Pie Technique, Cumulative Probability and Inverted Pyramid) and Trait anxiety (low vs. high) as between group factors. A significant Probability X Techniques interaction was found, $F(3, 311)= 27.9$, $p<.001$, $\eta^2=.21$. The nature of the interaction was analysed by studying which groups displayed a significant pre-to-post decrease in probability estimation. As suggested by **table 3**, the decrease was significant in all the groups exposed to a cognitive technique (Pie Technique: t (88) = 9, $p<.001$, $d= 1.9$; Cumulative Probability: t (56) = 5.55 , $p<.001$, $d= 1.5$; Inverted Pyramid: t (92) = 11.15, $p<.001$, $d= 2.3$), but no significant effect was found in the control task group (t (79)= .1, *ns*).

The Probability X Trait Anxiety X Technique interaction was also nonsignificant (F (3, 311) = .73, n.s.), indicating that all the three techniques were equally efficient in reducing probability, regardless of the level as between group factors. A significant Probability X Techniques interaction was found, $F(3, 311)= 13.81$, $p<.001$, $\eta^2=.12$. The nature of the interaction was analysed by studying which groups maintained a significant decrease in probability estimation. As suggested by **table 3**, the effect was significantly maintained in all the groups exposed to a cognitive technique (Pie Technique: t (88) = 6.6, $p<.001$, $d= 1.4$; Cumulative Probability: t (56) = 4.82 , $p<.001$, $d= 1.3$; Inverted Pyramid: t (92) = 7, $p<.001$, $d= 1.5$), but no significant effect was found in the control task group (t (79)= .8, *ns*).

The Probability X Trait Anxiety X Technique interaction was also nonsignificant (F (3, 311) = .94, n.s.), indicating that all three techniques were equally efficient in reducing probability, regardless of the level of trait anxiety.

As expected, no one of the ratings referred to the two variables used as filler items (severity and satisfaction) showed any significative changes from the first to the final estimation, indicating that no one of the three techniques were efficient in reducing neither severity nor satisfaction level, regardless of the level of trait anxiety.

Table 3. *Means (standard deviations) of the first and second probability estimates and follow up in the various conditions*

Variable and Condition	n	Estimate 1 M (SD)	Estimate 2 M (SD)	Four-week follow up M (SD)
High-trait anxiety				
PT	45	43.3 (27.6)	21.6 (18.6)	31.1 (32.9)
IP	54	46.6 (27.2)	16.7 (12.7)	26.9 (21.7)
CP	38	42.2 (26.8)	25.5 (16.23)	37.1 (23)
Control	29	47.2 (24.2)	47.8 (24)	49.5 (24.3)
Low-trait anxiety				
PT	44	33.1 (21.6)	18.6 (14.7)	22.3 (20.1)
IP	39	38.9 (24.1)	11 (8.5)	25.4 (23.6)
CP	28	39.2 (18.4)	23.3 (22.8)	25.5 (24.7)
Control	42	34.8 (25.8)	34.1 (25.6)	35 (25.2)

PT= Pie Technique, IP =Inverted Pyramid, CP=Cumulative Probability

4. Discussion

The aim of this study was to evaluate the efficacy of some techniques usually applied in a clinical context to reduce overestimation of the probabilities of threatening events. Our hypothesis was that these cognitive techniques, "Pie- Technique", "Cumulated Probability" (e.g., Van Oppen and Arntz, 1994; Salkovskis et al., 2003) and "Inverted Pyramid" (e.g., Wells, 1997; Salkovskis et al., 2003) would be able to produce an effective reduction of the perceived probability of a negative event. This reduction could mainly depend on the technique's power in contrasting the cognitive mechanism of focalization. Even though these techniques were designed and developed for anxious individuals, our study was carried out on nonclinical subjects. According to a wide literature, there are indeed no qualitative differences between the latter and the former with regard to probabilistic reasoning (e.g., Nesse and Klaas, 1994).

To our knowledge, this is the first peer-reviewed prospective study to evaluate the efficacy and the stability of the techniques to reduce overestimation of the probability of threatening events. While in an earlier study (Gragnani et al., 2003) the team demonstrated that the three techniques were able to produce an efficient reduction of the perceived probability of a negative event, this presented a number of limitations. In the current paper, therefore, we adopted a different methodology. We assessed the trait anxiety of the subjects and divided them up based on trait anxiety (high and low trait anxiety) and we included a control condition. Mainly, we planned a follow up.

The study's main findings show that the IP, CP and PT techniques were all found to be effective, as expected. A statistically significant reduction in the estimation of the perceived probability was observed. Furthermore, this effect was also considerably maintained at a 4 week follow up. The decrease was significant in all the groups exposed to a cognitive practice, while no significant outcome was found in the control task group.

All the techniques we examined specifically treat the overestimation of the occurrence of negative events. Our study demonstrated that they are indeed, and equally, effective in the reduction of this overestimation, although they seem to act on different cognitive processes. As regards the Pyramid Technique and the Pie-Technique, this decrease could depend on their power in contrasting the cognitive mechanism of focalization, stimulating a detailed analysis of the different probabilities to be attributed to events that are different from the feared one (e.g. Van Oppen and Arntz, 1994; Wells, 1997; Salkovskis et al., 2003). While the cumulated probability technique (Van Oppen and Arntz, 1994) reduces the initial probability overestimation of a negative event by comparing this probability with the chance estimation based on an analysis of a sequence of events that lead to the feared one. Thus, this type of technique does not counter the tendency of the subject to focus his/her attention on the catastrophic event.

5. Limitations and further directions

Although we tried to overcome the limitations of the earlier paper (Gragnani et al., 2003), our study also presents at least two limits. Firstly, in the current study, we took into account only general threatening events. However, we know that patients affected by different anxiety disorders tend to overestimate the likelihood of the negative events most relevant to their specific disorder. The increased negative expectancies tend to be specific to the particular concerns of each pathology (Harvey et al., 2004). Further studies should thus evaluate what happens with threats specifically related to the different disorders.

Moreover, we demonstrated that all the techniques are useful to reduce danger overestimation, but in a group of non-clinical individuals. In fact, even though we divided the group in high and low trait anxiety, we didn't assess subjects affected by anxiety disorders. However, there is some empirical evidence that the effects of anxiety in non-clinical populations is similar to those of clinical anxiety (e.g. Burns et al., 1995). In general, these studies show that most students with the highest score in a self-report measure of anxiety meet diagnostic criteria for anxiety disorders. These results, therefore, support the notion of a connection between clinical and nonclinical symptoms and suggest the possibility to study clinical phenomena in non-clinical subjects. Anyway, we plan to further validate the conclusions drawn from the present study through a new investigation using clinical subjects, although we expect that our data can only be stronger in the clinical field. This prediction is based on the knowledge that the restructuring techniques used with patients suffering from anxiety disorders are implemented several times and in multiple sessions, and, in general, this repetition means that their effect tends to increase and stabilize over time, thanks also to the use of homework (Kazantzis et al., 2017).

From a more theoretical point of view, we know that the therapeutic efficacy of these techniques is due to their ability to reduce the perception of the threat, fueled among other things by the overestimation of the probability of the feared damage (see equation of anxiety of Beck, Emery and Greenberg developed in 1985, and subsequently revised by Salkovskis in 1996). We can imagine that reducing the probability attributed to a catastrophe contributes to reducing the perception of the threat even indirectly, by reducing the relevance and availability of the most feared scenario and increasing the availability of alternative, positive scenarios, not initially contemplated. Each cognitive restructuring operation is aimed at helping the patient to defocus the threat and shift his gaze to something else (Powers and De Kleine, 2017). Indeed, if the patient perceives a threat, he will focalize his attention on the signals that confirm it and will exclude all signals that disconfirm it (Johnson-Laird et al., 2006). Helping the patient reduce the estimated probability that a catastrophe will occur increases the amount of positive information that disconfirms the catastrophe. In other words, if something I am afraid of is less likely to occur, then I will be more willing to consider positive alternatives. These techniques can also motivate and encourage the patient's willingness (adherence) to submit to behavioral techniques, those that actually imply exposure to threatening stimuli. A further implication of our data is therefore that the reduction of the estimated probability may favor a greater disposition by the patient to "run the risk" and, ultimately, to accept the possibility that what is most feared could happen (Steiner, 1972; Powers and De Kleine, 2017; Hayes and Hofmann, 2018).

5. Conclusions

Overall, our study shows that the "Pie Technique", the "Cumulative Probability" and the "Inverted Pyramid" techniques, that are usually utilized in

cognitive therapeutic sessions, actually reduce the estimation of the perceived probability of a negative event occurring in both high and low trait anxiety individuals. All the techniques successfully produced a statistically significant result, and this effect was significantly maintained at a 4 week follow up. Further studies should be carried out with individuals affected by anxiety disorders and also aimed at investigating what would happen with threats specifically related to the disorders.

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