Psychological Topics 22 (2013), 2, 221-236

Original scientific paper – UDC – 159.942.5.072

Disentangling Fear and Anxiety in Self–reported Responses to Situational Scripts

Meike Pappens, Laurence Claes, Tine Versleegers, Debora Vansteenwegen, Omer Van den Bergh, Ilse Van Diest

Department of Psychology, University of Leuven, Leuven, Belgium

Abstract

With decreasing threat ambiguity and increasing threat imminence, human psychophysiological responses can be mapped onto a defensive continuum that distinguishes between the states of general anxiety, cued anxiety, and fear. The present study aimed to investigate whether self–reported physiological, cognitive, behavioral and attentional responses can also distinguish between cued anxiety and fear. Healthy participants (*N*=141) received 9 situational scripts (3 prototypical scripts per phase of the defensive continuum) each followed by 22 responses. They indicated how likely they would display each response in the described situation. The results of an INDCLAS–analysis indicated that the distinction between "cued anxiety" and "fear" can be made on the basis of self–reported responses. Responses typical for fear situations were "fear of dying", "breathing faster", and "feeling of choking". Cued anxiety situations evoked "accelerated heart rate", "to startle", "sharpened senses", "tense muscles" and "sweating". This finding may contribute to constructing an easy tool to distinguish cued anxiety and fear in both clinical and experimental contexts.

Keywords: human defensive behavior, anxiety, fear, self–report, psychophysiological responses

Introduction

From an evolutionary perspective emotional organization has developed to accommodate to adaptive challenges serving survival and reproduction. To deal with particular features of recurring situations relatively specific emotional states evolved out of less specified states (Nesse, 1998) resulting in an emotion topography containing states that partly differ but also partly overlap. To define an emotion from a natural selection theory perspective thus requires insight in how specific features of an emotion offer a selective advantage in a particular situation.

The pattern of emotional responding comprises an aggregated set of responses in relatively independent response systems (e.g. physiological, behavioral,

✉ Pappens Meike, Research Group Health Psychology, Department of Psychology, Tiensestraat 102, B-3000 Leuven, Belgium. E-mail: *meike.pappens@psy.kuleuven.be*.

cognitive/attentional) to serve a common adaptive function and that – as a result – can be conceived as one functional entity (McNaughton & Zangrossi, 2008). Because of their evolutionary basis an important phylogenetic continuity in emotions is plausible, promoting the use of animal models for the study of human emotions.

Well established in psychology is the difference between the emotional states "anxiety" and "fear" (Estes & Skinner, 1941; Freud, 1948), the description of which is typically linked to the different situations that elicit them: anxiety is defined as "the emotion in situations of ambiguous, signaled or potential threat" and fear as "the emotion that occurs when encountering clearly threatening stimuli" (Blanchard, Blanchard, Griebel, & Nutt, 2008). McNaughton and Corr (2004) propose a "behavioral response-based" differentiation with "approach" behaviors linked to anxiety and "avoidance" behaviors to fear. In their theory, an independent "defensive distance" dimension superimposes the categorical anxiety/fear (approach/avoidance) dimension resulting in specific anxiety/fear behaviors depending on the "psychological distance" of the threat. At close distance anxiety would lead to "defensive quiescence" (attentive immobility) and fear to "attack"; intermediate distance would evoke "risk assessment" when anxious and freezing (tonic immobility) or "flight behavior" when fearful. Long distances would result in non-defensive or pre-threat behavior. However, the independence of the defensive distance continuum from defensive direction has been contested, because findings suggest that proximal threats are more likely to trigger fear than anxiety responses (Perkins, Cooper, Abdelall, Smillie, & Corr, 2010).

Several studies have suggested that fear and anxiety are controlled by different brain systems (Corr, 2008; Gray & McNaughton, 2000; McNaughton & Corr, 2004) and that they are associated with different neuropharmacological effects. For example, drugs known to reduce anxiety in patients with general anxiety disorder (GAD) alter risk assessment and defense threat/attack behaviors (i.e. approach behaviors) in animals, whereas anti-panic (fear) medication influences flight responses (i.e. avoidance behavior; Blanchard et al., 2008). This finding prompted the assumption that the risk assessment component of animal behavior in situations of ambiguous threat might be seen as the animal counterpart of e.g. the "rumination" and "worry" components of GAD (Robichaud, Dugas, & Conway, 2003) and that animal "flight" behavior associated with clear and imminent threat is the equivalent of escape mechanisms in panic disorder (PD) patients.

Peripheral physiological correlates of defensive behaviors have also been studied in different species, including humans (Fanselow, 1994; Lang, Bradley, & Cuthbert, 1997). Most often these responses are modeled according to a defensive continuum originating in animal predator research (Fanselow, 1994) but adapted by

Lang et al. (1997) for human defensive responding. The defensive cascade model (Lang et al., 1997) describes how the patterning of physiological indices (e.g. skin conductance responses, fear-potentiated startle, and cardiac responses) displays a unique image of the defensive state of individuals. The model describes three subsequent stages of defensive responding characterized by differential peripheral physiological and central activations (Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; Lang et al., 1997; Lang, Davis, & Öhman, 2000; Pappens et al., 2010). Progress from one defensive phase to another is accompanied by increasing levels of arousal triggered by situation- and threat-related factors. The first two stages of this defensive continuum (pre- and post-encounter) can be labeled as "anxiety" stages since they describe physiological reactions to ambiguous, anticipated or distant threat. Fear is related to the circa-strike phase, because this phase models responses to clear and imminent threat (Davis, Walker, Miles, & Grillon, 2010).

The continuum starts at a "pre-encounter" stage (i.e., before a possible threat has been observed) with the individual in a relatively calm but vigilant state because although no danger has yet been noticed, the situation could possibly become dangerous. We define this as a "general anxiety" phase because it is characterized by sustained "low anxiety" aimed at an unfocused potential future danger. DSM IV criteria (APA, 1994) for general anxiety indeed describe low arousal negative emotions (e.g., irritability) and symptoms of vigilance (e.g. "tense muscles") to be part of the disorder. Although little research has investigated psychophysiological responses during this phase, basal levels of heart rate and skin conductance (Lissek et al., 2005) have been measured indicating very low levels of arousal. The progress from the pre-encounter to the post-encounter stage (i.e., after a potential threat has been noticed) is marked by an orienting response after the detection of a "possible" danger. At the beginning of this "cued anxiety" phase the perceptual processing of the possible threat is facilitated. The organism is in an anxious, relatively aroused, alert, attentive immobile (Cantor, 2009) and hyper-vigilant state and is primed to undertake action if necessary. During this attentive orientation phase increased electrodermal activity, a decrease in heart rate (Lang et al., 1997) and in respiratory rate (Van Diest, Bradley, Geurra, Van den Bergh, & Lang, 2009) can be observed. A relative inhibition of the startle reflex is followed by a fear-potentiated startle once the probability of an overt defensive action increases (Bradley, Codispoti, & Lang, 2006; Lang et al., 1997). Anxiety changes into "fear" during the last stage of the continuum, the circa-strike phase (Davis et al., 2010): it has become clear that a dangerous encounter with the threat is inevitable and imminent. Depending on the distance to the threat one prepares to engage in an active fight or flight reaction or when no escape is possible and at very

close distance tonic immobility can be observed (Cantor, 2009). The circa-strike phase is characterized by massive bursts of sympathetic arousal, visible in an accelerated heartbeat, a dramatic increase of respiratory rate (Van Diest et al., 2009), a pronounced rise in electrodermal activity (Lang et al., 2000), and an inhibition of the startle reflex (Löw, Lang, Smith, & Bradley, 2008). Some authors (Bouton, Mineka, & Barlow, 2001; McNaughton & Corr, 2004) refer to the action-oriented, "circa-strike"side of the defensive continuum as "panic".

By virtue of carefully studying a range of physiological defensive response patterns in the laboratory, the defensive cascade model of Lang and colleagues (1997) has importantly contributed to our current understanding of the differentiation between human "anxiety", especially "cued" anxiety, and "fear" responses. However, it is currently unknown whether healthy people can subjectively differentiate between the individual physiological components of these specific states. It has already been demonstrated that people are capable of reporting on defensive anxiety and fear behaviors (e.g. flight/fight, attack, risk assessment) when confronted with scripted threat situations (Blanchard et al., 2001; Perkins et al., 2010; Perkins & Corr, 2006; Shuhama, Del-Ben, Loureiro, & Graeff, 2008). In addition to self–report of behavioral specifics of anxiety and fear (Blanchard et al., 2001) we are interested in self–reports of physiological, but also attentional and cognitive constituents of fear and especially "cued" anxiety.

With the present study, we thus wanted to investigate whether and which self–reported responses can differentiate between "cued anxiety" and "fear". To this aim, we created a number of prototypical "cued anxiety" and "fear" situational scripts. Because the defense cascade model describes 3 phases of human defensive responding, we also included "general anxiety" scripts. However, mainly "cued anxiety" and "fear" physiological, attentional, behavioral and cognitive responses were selected. Healthy participants imagined themselves in each of the scripts and rated to which extent they thought they would display the responses in the situation (see Blanchard et al., 2001).

We predicted that participants will report responses of cued anxiety (e.g., to startle, keep still) and fear (e.g., act without thinking, faster breathing) when presented cued anxiety and fear scripts, respectively.

Method

Participants

In return for course credit 141 psychology students (55% women, age range 18-24, *M*=22.4) volunteered to participate in our study. The study protocol was

approved by the Medical Ethical Committee and all subjects signed an informed consent form stating that participation was voluntary and that they could withdraw from the study at any moment without losing their credit.

Measures

Situation-Response Questionnaire

Research has shown that mental imagery can provoke physiological reactions associated with the imagined content (e.g., Van Diest et al., 2005) and following Lang's bio-informational theory of emotional imagery (1979) propositional knowledge of these sensations can be present. Therefore, we constructed a Situation-Response Questionnaire to assess people's capacity to report on physiological, attentional, behavioral and cognitive constituents of anxiety and fear.

Threat scenarios/situations. Nine scripts were selected to vary along the defensive cascade model of Lang et al. (2000) with 3 situations of vague, future, non-specific threat representing the pre-encounter stage of this continuum ("general anxiety"scripts), 3 situations of distant, ambiguous, "cued" threat ("cued anxiety" scripts) and 3 situations of clear and imminent threat ("fear" scripts). Eight very brief scenarios were newly constructed and one scenario (number 2) was adopted from Blanchard et al. (2001). For the creation of these scripts we followed the classical definition of fear and anxiety, differentiating these two states on the basis of threat ambiguity (Blanchard et al., 2008).

The following 9 scripts were administered in a randomized order:

(1) You're walking home alone at night. It is dark and you are in an isolated alley. All of a sudden, you hear a loud scream from a side-street. Fast, heavy footsteps are coming in your direction. (scream – cued anxiety)

(2) You are sleeping in bed at night, but suddenly wake up thinking you have heard a suspicious noise. It is dark and you are alone. (noise – cued anxiety)

(3) You're enjoying a hot bath when a vague smell of fire is entering the bathroom. You know your mother is preparing dinner in the kitchen. You call her but she does not respond. Maybe she can't hear you because her radio is playing loudly … (smell – cued anxiety)

(4) 10000 feet above the Atlantic, the Captain of the airplane suddenly announces that all the engines have broken down. Oxygen masks fall down. The Captain advises passengers to bend over and protect their heads. (airplane – fear)

(5) Your alarm clock wakes you up. You want to turn around, but you cannot. You're paralyzed … (paralyzed – fear)

(6) You and your friend are doing the descent of a wild river by kayak. In a rapid your boat flips over and both of you fall into the water. Your friend is a few meters ahead of you and all of a sudden you see how he's drawn to the bottom of the river in a whirlpool. You're floating in the same direction. (whirlpool – fear)

(7) Both your parents lose their job. How to progress from here? You feel insecure about your own and your family's future. (job loss – general anxiety)

(8) You're a second year bachelor student in Psychology, and worried about whether you'll ever find a job as a psychologist. There are some problems in the labor market. There are many psychologists out there unemployed. (unemployment – general anxiety)

(9) You had to redo your first bachelor year. You finally made it to the second bachelor year but you hear stories of how this year is even harder than the first bachelor year. You feel insecure about your future. Despite the fact that you're studying hard, you don't have the feeling that you ever really master your courses. (studies – general anxiety)

Self–reported Responses. Twenty cued anxiety and fear responses were selected based on (1) psychophysiological and behavioral responses described by Bradley, Codispoti, Cuthbert, & Lang (2001), Lang et al. (1997), Van Diest et al. (2009), and Vlemincx, Taelman, De Peuter, Van Diest, & Van den Bergh (2011) and (2) symptoms of panic disorder (DSM IV; American Psychiatric Association - APA, 1994). Selected "fear" responses based on DSM IV criteria for panic disorder are: feeling of choking, feeling faint, sweating, feelings of unreality, fear of losing control, fear of dying and accelerated heart rate. Van Diest et al. (2009) found a higher respiratory rate during a state of fear, resulting in the item "breathing faster". We also included "deeper breathing" as a fear response since it has been associated with high arousal negative mental states (Vlemincx et al., 2011). Acting without thinking was included as a cognitive "circa-strike" fear response. Especially "breathing deeper, breathing faster, accelerated heart rate and sweating" can be seen as indications of "energy mobilization" in the context of imminent threat. "Being terrified" is selected as the "tonic immobility" component of a very close inescapable threat (Cantor, 2009). "Cued anxiety" responses are mainly recruited from the defensive cascade model of Lang et al. (1997). "Heightened alertness", "you can think clear and sharp", and "sharpened senses" are included as responses aimed at information intake in function of risk assessment. "Holding your breath"

and "keeping still" were chosen because they reduce the chance of being noticed by a predator in a post-encounter phase. "Tense muscles" and "to startle" are included as indications of the post-encounter "primed to undertake action" state. General anxiety responses were "irritability", "tense muscles" out of DSM IV criteria for GAD (APA, 1994) and "sadness" as a low arousal negative emotion (Bradley et al., 2001), (see Table 1).

Table 1. *Overview of Responses and their Emotion Category*

Response	Emotion	Source
Heightened alertness	cued anxiety	Lang et al. (1997)
Feeling of choking	fear	DSM IV
Irritation	general anxiety	DSM IV
You can think clear and sharp	cued anxiety	Lang et al. (1997)
Sharpened senses	cued anxiety	Lang et al. (1997)
Sadness	general anxiety	Bradley et al. (2001)
Fear	cued anxiety	Lang et al. (1997)
Paresthesias	fear	DSM IV
Panic	fear	DSM IV
To startle	cued anxiety	Lang et al. (1997)
Sweating	fear	DSM IV
Breathing deeper	fear	Vlemincx et al. (2011)
Feeling of derealization	fear	DSM IV
You act without thinking	fear	DSM IV
You're afraid you'll lose control over yourself	fear	DSM IV
Tense muscles	cued anxiety/general anxiety	Lang et al. (1997)
You keep still	cued anxiety	Lang et al. (1997)
Fear of dying	fear	DSM IV
Accelerated heart rate	fear	DSM IV
You hold your breath	cued anxiety	Van Diest et al. (2009)
Breathing faster	fear	Van Diest et al. (2009)
Breathing faster	fear	Lang et al. (1997)

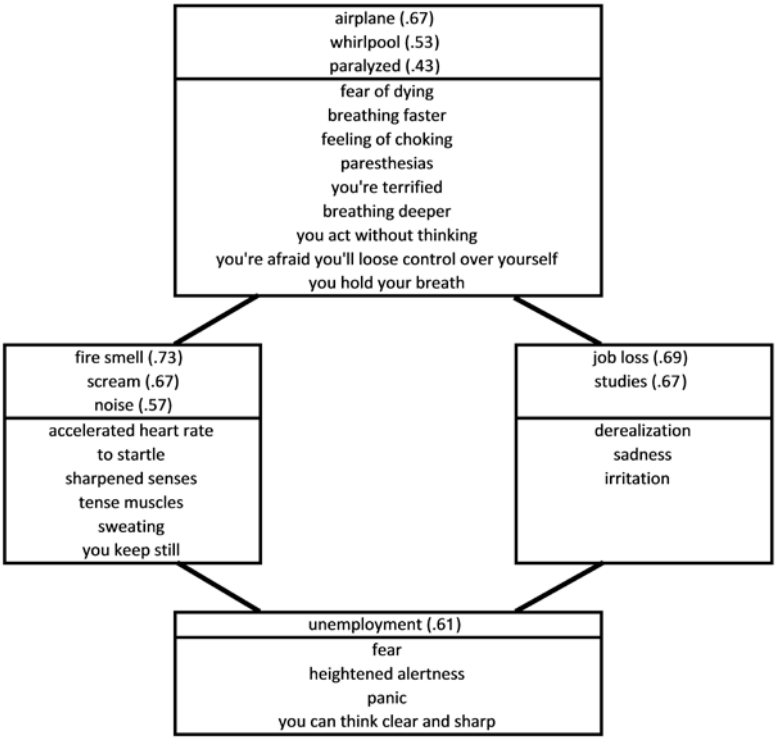
Procedure

Participants were asked to carefully read every script and to imagine themselves being in the pictured situation. They had to indicate on a 5-point Likert scale to what extent they would experience the described reaction in the given situation, from 1 *(not at all)* to 5 *(very strongly)* for the 22 responses. Scripts and responses were administered in a randomized order.

Statistical analysis

Persons x Situations x Response profiles were revealed performing an Individual Differences Hierarchical Classes Analysis (INDCLAS) on the dichotomized data (Claes, Van Mechelen, & Vertommen, 2004; De Boeck & Rosenberg, 1988; Leenen, Van Mechelen, & De Boeck, 1999; Van Mechelen, De Boeck, & Rosenberg, 1995; Vansteelandt & Van Mechelen, 1998). Given the nature of our research questions, we will solely focus on the Situations x Responses output. This type of analysis fits a hierarchical classes model to the data. Classes of situations evoking the same type of responses are formed just as response classes grouping responses elicited by the same type of situations. Bundles of situation and response classes are indicated in a graphical representation (Figure 1).

Figure 1. *Graphical Representation of the Rank 2 Solution with Situation- and Response Classes Organized in Hierarchical Order*



Note. Situation classes and response classes are organized in a hierarchical order with higher classes of situations and responses super-ordinate to lower classes of situations and responses. Goodness-of-fit statistics of situations in their situation class are also indicated.

The dichotomization value was set at 2: scores 1 and 2 on the 5-point Likert scale were scored as "0"; 3, 4 and 5 as "1". The INDCLAS analysis yielded a series of hierarchical classes models of increasing complexity or rank (i.e., the number of classes at the bottom of the hierarchies). According to a goodness-of-fit criterion (Sneath & Sokal, 1973) as well as to its theoretical interpretability, the solution in rank 2 was selected (see Figure 1). A goodness-of-fit of at least .60 is required for the hierarchical model to fit the data. Goodness-of-fit statistics will also be reported for every situation (indicating its goodness of fit in its situation class) and for every response (indicating its fit in the response class it is put in). For the final interpretation of the selected model we will give more weight to situations and responses with higher goodness-of-fit values.

Results

Goodness-of-fit statistics for the solutions from rank 1 to rank 6 were respectively .59, .64, .65, .67, .67 and .68. We opted for the solution from rank 2, because the increase in goodness of fit from rank 2 was relatively small. The resulting model is pictured in Figure 1. Goodness-of-fit indices of situations and responses are also indicated in Figure 1 and Table 2, respectively.

The selected model shows that "fear" situations (airplane, whirlpool, paralyzed), "cued anxiety" situations (fire smell, scream, noise) and 2 out of 3 "general anxiety" situations (job loss, studies) cluster together in respectively a "fear", a "cued anxiety" and a "general anxiety" situation class. A response class is formed containing typical negative low arousal responses (irritation, sadness and derealization). We will label this response class as "general anxiety". Also, "accelerated heart rate", "to startle", "tense muscles", "sharpened senses", "sweating" and "you keep still" cluster together in a "cued anxiety" response class. "Fear of dying", "breathing faster", "feeling of choking", "paresthesias", "you're terrified", "breathing deeper", "you act without thinking", "you're afraid you'll lose control over yourself" and "you hold your breath" gather in a "fear" response class. One class of responses containing "fear", "heightened alertness", "panic" and "you can think clear and sharp" is consistently reported in all situations. We will label this response class as "non-specific anxiety/fear".

Situations that cluster together in a situation class trigger the same type of responses. One situation (unemployment) evokes only the "non-specific anxiety/fear" response class. Typical responses for the "general anxiety" situation class are responses in the "general anxiety" response class and the "non-specific anxiety/fear" response class. The "cued anxiety" situation class is associated with

the "cued anxiety" and the "non-specific anxiety/fear" response class. The super-ordinate "fear" situation class evokes all response classes: "fear", "cued anxiety", "general anxiety" and "non-specific anxiety/fear" response classes. Responses only evoked by "fear" situations are: "breathing faster", "feeling of choking, paresthesias", "breathing deeper", "you act without thinking", "you're afraid you'll lose control over yourself", "fear of dying", "you hold your breath", and, "you're terrified". Response/situation predictions are compared with response/situation outcomes in Table 2.

Table 2. *Predicted and Actual Situation Classes Responses were Reported In. Goodness of Fit Statiastics Showing the Fit of Responses in their Situation Class are also Depicted*

Response	Predicted Situation Class	Actual Situation Class	Goodness of Fit
Accelerated heart rate	fear	cued anxiety - fear	.83
To startle	cued anxiety	cued anxiety - fear	.72
Sharpened senses	cued anxiety	cued anxiety - fear	.70
Tense muscles	cued anxiety/general anxiety	cued anxiety - fear	.69
Sweating	fear	cued anxiety - fear	.66
You keep still	cued anxiety	cued anxiety - fear	.45
Fear of dying	fear	fear	.63
Breathing faster	fear	fear	.61
Feeling to choking	fear	fear	.59
Paresthesias	fear	fear	.55
Being terrified	fear	fear	.55
Breathing deeper	fear	fear	.53
You act without thinking	fear	fear	.49
You're afraid you'll lose control over yourself	fear	fear	.41
You hold your breath	cued anxiety	fear	.35
Feeling of derealization	fear	general anxiety - fear	.65
Sadness	general anxiety	general anxiety - fear	.61
Irritation	general anxiety	general anxiety - fear	.52
Fear	cued anxiety	non-specific anxiety/fear	.88
Heightened alertness	cued anxiety	non-specific anxiety/fear	.81
Panic	fear	non-specific anxiety/fear	.80
You can think clear and sharp	cued anxiety	non-specific anxiety/fear	.66

Discussion

The aim of this study was to investigate whether anxiety – especially cued anxiety – and fear responses could be measured by self–report in reaction to

prototypical cued anxiety and fear situational scripts. A prerequisite for the investigation of this research question was the successful construction of prototypical anxiety and fear situations. For the creation of these scripts we followed the classical definition of fear and anxiety, differentiating these two states on the basis of threat ambiguity (Blanchard et al., 2008). Furthermore, since studies investigating physiological correlates of these two emotional states model them according to three defensive stages (Lang et al., 1997) – two anxiety stages and one fear stage, we created three different types of situations. A categorical distinction was made between fear situations (airplane, paralyzed and whirlpool) and anxiety situations (fire smell, scream, noise, studies, unemployment and job loss) with the former category evoking clear, imminent (circa-strike) threat while the threat value of the latter was not clear or not imminent. Within anxiety situations we distinguished "pre-encounter" from "post-encounter" threat. Situations of the former were conceived as low arousal, unspecified, future-orientated threat situations ("general anxiety") while situations of the latter contained more specific objects of possible threat but with an unclear threat value and with higher levels of arousal ("cued anxiety").

Our data show that all situations conceptualized as prototypical for cued anxiety and fear, respectively, group together as equivalent situations in two separate situation classes "cued anxiety" and "fear". Two general anxiety situations also cluster together in a "general anxiety" situation class. One general anxiety situation (unemployment) evokes a different response pattern. It is possible that the content of this script, namely not finding a job after one finishes his studies, is too specific as a threat to represent a general anxiety situation. It is also not arousing enough to fit in the "cued anxiety" situation class or imminent and clear enough to cluster together with the fear situations. Except for "paralyzed", all the situations have acceptable to high goodness-of-fit indices, confirming their fit in the situation class they were assigned to, suggesting that we indeed succeeded in creating prototypical situations for each situation class. This indicates that a qualitative difference exists between responses to ambiguous versus responses to clear threat, corroborating the traditional distinction between "anxiety" and "fear" on the basis of threat ambiguity (Blanchard et al., 2008). The observation that different response patterns are associated with "general anxiety" situations compared to "cued anxiety" situations validates the distinction made in the defense cascade model between pre-encounter and post-encounter anxiety (Davis et al., 2010; Lang et al., 1997).

Our findings partially support our hypothesis that scripts of general anxiety, cued anxiety and fear are associated with self–reported responses that are specific for prototypical situations of general anxiety, cued anxiety and fear, respectively.

Except for two responses ("you hold your breath" and "tense muscles"), all mismatches between predicted and actual class membership result from responses that do not belong exclusively to the predicted situational class. For example, "sweating" is not only reported for fear situations, but also for cued anxiety situations. This is actually in line with the defensive cascade model (Lang et al., 1997), describing a gradual increase in sweating activity from the post-encounter to the circa-strike phase of the continuum. Another mismatch was derealization not only being mentioned in fear- but also in general anxiety situations. The apparent characteristic derealization holds in common with the other general anxiety responses is its low arousal. Four responses are associated with all types of fear and anxiety (the non-specific anxiety/fear class). All the other mismatches originate in the fact that apparently all responses were reported in fear situations. This could possibly be the result of a systematical bias to respond stronger to extremely threatening situations.

The only two real mismatches between predicted and actual response class are "you hold your breath" and "tense muscles". The rationale of adding "you hold your breath" as a cued anxiety response was that by making less noise oneself, noises of the environment could better be detected when assessing the risk of a situation (relevant for situations "noise" and "fire smell") and one would less likely be detected by a threatening person (relevant for "scream"). However, when considering the fear situation "whirlpool", holding your breath might also be very helpful when on the point of being dragged down in a whirlpool. More surprising is the finding that "tense muscles" is not part of cued anxiety and general anxiety classes but of cued anxiety and fear classes. Tense muscles are part of DSM IV–criteria for GAD so we predicted that sustained anxiety associated with future threat would evoke "tense muscles". A possible explanation is that this response is much more salient during tonic immobility and freezing than during cued anxiety and fear stages. In general, the identified situation clusters support the idea that situational scripts of general anxiety, cued anxiety and fear are associated with self–reported responses that are specific for prototypical situations of general anxiety, cued anxiety and fear, respectively.

Responses specifically linked to fear states are in descending order of goodness-of-fit: fear of dying, breathing faster, fear of choking, paresthesias, being terrified, breathing deeper, acting without thinking, and, you’re afraid you’ll lose control over yourself. These responses are all responses of extreme fear. Many of them are symptoms included in DSM IV–criteria for panic disorder (see Table 1). Some (breathing faster, breathing deeper) have been identified in the laboratory as circa-strike responses (Van Diest et al., 2009; Vlemincx et al., 2011). This suggests that response patterns evoked by fear scripts strongly resemble the response

patterns in natural fear situations thus confirming our hypothesis that persons can self–report on fear responses.

Again, in descending order of goodness-of-fit, cued anxiety responses "an accelerated heart rate", "to startle", "sharpened senses", "tense muscles", "sweating" and "you keep still" are connected with the cued anxiety situation class. Except for heart rate, which is thought to decelerate instead of accelerate, these responses have in common that they are typical for the post-encounter phase of the defensive continuum. Their mutual function is trying to absorb as much information as possible to assess the danger of a situation (sharpened senses, you keep still) while primed to undertake action (accelerated heart rate, to startle, tense muscles and sweating). Again, this confirms our hypothesis that cued anxiety can be assessed by self–report of responses constituting this emotion. Importantly however, it is also the absence of typical fear responses that can lead to the dissociation between fear and cued anxiety.

Finally, general anxiety responses typically include low arousal negative sensations: derealization, sadness and irritation. However, further research including more general anxiety responses is needed to identify a typical response profile of general anxiety.

The fact that – in line with previous findings (Blanchard et al., 2001; Perkins et al., 2010; Perkins & Corr, 2006; Shuhama et al., 2008) – self–reported responses to situational threat scripts seem to measure actual defensive tendencies, so truly reflect reactions to "real" threat, could hold some important consequences for further fear/anxiety research. First, ethical and legal issues for exposing people to real threat can be avoided by working with scripted threat situations. Second, gathering fear/anxiety data can be done in a less time consuming way and without the need of specialized equipment. This could offer a solution for the lack of data on normative defensive responding (Blanchard et al., 2008; Davis et al., 2010). Finally, it is of clinical relevance that the effect of clinical therapy on defensive responding could be assessed much more easily. For example, when exposing a spider phobic to a spider, the influence of this intervention on his/her defensive responding along the defensive continuum could be assessed outside the laboratory by simply asking that person to imagine a spider and to fill in a response questionnaire.

Up until now no self–report operationalization exists that can easily distinguish between fear and anxiety (Davis et al., 2010). This study could be the first step in that direction. However, to this end more responses should be included in future questionnaires. Because this study mainly focused on self–reported physiological responses it lacks more typical human responses such as screaming, begging, crying for help, etc. Future choices concerning which responses to add

could be guided by studying goodness-of-fit indices of the responses. These show which types of responses are especially apt to distinguish between different defensive states. For instance, in the current study especially breathing related reactions (breathing deeper and faster, feeling of choking) were reported in situations of fear.

An important limitation of the current study is the lack of information on different aspects of the situational scripts. Assessing situation features such as perceived magnitude and distance of the threat, escapability of the situation, etc. (Blanchard et al., 2001) would have offered the possibility of making more refined predictions about responses associated with the situations. Furthermore, only two specific general anxiety responses were included in this study, limiting the interpretation of the general anxiety results.

In general, we conclude that situational scripts of general anxiety, cued anxiety and fear evoke self–reported responses associated with general anxiety, cued anxiety and fear, respectively. The possibility of using self–report to assess defensive states in humans would make the assessment of fear and anxiety in clinical and laboratory contexts much easier.

References

American Psychiatric Association – APA (1994). *Diagnostic and statistical manual of mental disorders: DSM-IV***.** American Psychiatric Association, Washington, DC, USA.

Blanchard, R.J., Blanchard, D.C., Griebel, G., & Nutt, D. (Eds.). (2008). *Handbook of anxiety and fear.* London: Academic Press.

Blanchard, D.C., Hynd, A.L., Minke, K.A., Minemoto, T., & Blanchard, R.J. (2001). Human defensive behaviors to threat scenarios show parallels to fear- and anxiety-related defense patterns of non-human mammals. *Neuroscience and Biobehavioral Reviews, 25*, 761-770.

Bouton, M.E., Mineka, S., & Barlow, D.H. (2001). A modern learning theory perspective on the etiology of panic disorder. *Psychological Bulletin, 108*, 4-32.

Bradley, M.M., Codispoti, M., Cuthbert, B.N., & Lang, P.J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion, 1*, 276-298.

Bradley, M.M., Codispoti, M., & Lang, P.J. (2006). A multi-process account of startle modulation during affective perception. *Psychophysiology, 43*, 486-497.

Cantor, C. (2009). Post-traumatic stress disorder: Evolutionary perspectives. *Australian and New Zealand Journal of Psychiatry, 43*, 1038-1048.

Claes, L., Van Mechelen, I., & Vertommen, H. (2004). Assessment of situation-behavior profiles and their guiding cognitive and affective processes: A case study from the domain of aggressive behaviors. *European Journal of Psychological Assessment*, *20*(4), 216-226.

Corr, P.J. (2008). *The reinforcement sensitivity theory of personality.* Cambridge, UK: Cambridge University Press.

Davis, M., Walker, D.L., Miles, L., & Grillon, C. (2010). Phasic vs sustained fear in rats and humans: Role of the extended amygdala in fear vs anxiety. *Neuropsychopharmacology Reviews, 35,* 105-135.

De Boeck, P., & Rosenberg, S. (1988). Hierarchical classes: Model and data analysis. *Psychometrica, 53,* 361-381.

Estes, W.K., & Skinner, B.F. (1941). Some quantitative properties of anxiety. *Journal of Experimental Psychology, 29,* 390-400.

Fanselow, M.S. (1994). Neural organization of the defensive behaviour system responsible for fear. *Psychonomic Bulletin & Review, 1,* 429-438.

Freud, S. (1948). *Inhibitions, symptoms and anxiety.* London: Hogarth Press & Institute of Psycho-analysis.

Gray, J.A., & McNaughton, N. (2000). Fundamentals of the septo-hippocampal system. In J.A. Gray & N. McNaughton (Eds.), *The neuropsychology of anxiety: An enquiry into the functions of septo-hippocampal system* (2nd ed., pp. 204-232), Oxford: Oxford University Press.

Lang, P.J. (1979). A bio-informational theory of emotional imagery. *Psychophysiology, 16*(6), 495-512.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (1997). Motivated attention: Affect, activation, and action. In P.J. Lang, R.F. Simons, & M.T. Balaban (Eds.), *Attention and orienting: Sensory and motivational processes* (pp. 97-135). Hillsdale, NJ: Erlbaum.

Lang, P.J., Davis, M.D., & Öhman, A. (2000). Fear and anxiety: Animal models and human cognitive psychophysiology. *Journal of Affective Disorders, 61,* 137-159.

Leenen, I., Van Mechelen, I., & De Boeck, P. (1999). INDCLAS: A three-way hierarchical classes model. *Psychometrika, 64*(1), 9-24.

Lissek, S., Powers, A.S., McClure, E.B., Phelps, E.A., Woldehawariat, G., Grillon, C., & Pine, D.S. (2005). Classical fear conditioning in the anxiety disorders: A meta-analysis. *Behavior Research Therapy, 43,* 1391-1424.

Löw, A., Lang, P.J., Smith, J.C., & Bradley, M.M. (2008). Both predator and prey. Emotional arousal in threat and reward. *Psychological Science, 19,* 865-873.

McNaughton, N., & Corr, P.J. (2004). A two-dimensional neuropsychology of defense: Fear/anxiety and defensive distance. *Neuroscience and Biobehavioral Reviews, 28,* 285-305.

McNaughton, N., & Zangrossi, H. Jr. (2008). Theoretical approaches to the modeling of anxiety in animals. In R.J. Blanchard, D.C. Blanchard, G. Griebel, & D. Nutt (Eds.). *Handbook of anxiety and fear* (pp. 11-28). London: Academic Press.

Nesse, R. (1998). Emotional disorders in evolutionary perspective. *British Journal of Medical Psychology, 71*, 397-415.

Pappens, M., Van den Bergh, O., De Peuter, S., Bresseleers, J., Vansteenwegen, D., & Van Diest, I. (2010). Defensive reactions to interoceptive threats: A comparison between loaded breathing and aversive picture viewing. *Biological Psychology, 84*, 98-103.

Perkins, A.M., Cooper, A., Abdelall, M., Smillie, L.D., & Corr, P.J. (2010). Personality and defensive reactions: Fear, trait anxiety, and threat magnification. *Journal of Personality, 78*(3), 1071-1090.

Perkins, A.M., & Corr, P.J. (2006). Reactions to threat and personality: Psychometric differentiation of intensity and direction dimensions of human defensive behavior. *Behavioural Brain Research, 169*, 21-28.

Robichaud, M., Dugas, M., & Conway, M. (2003). Gender differences in worry and associated cognitive-behavioral variables. *Anxiety Disorders, 17*, 501-516.

Shuhama, R., Del-Ben, C.M., Loureiro, S.R., & Graeff, F.G. (2008). Defensive responses to threat scenarios in Brazilians reproduce the pattern of Hawaiian Americans and non-human mammals. *Brazilian Journal of Medical and Biological Research, 41*, 324-332.

Sneath, E.H., & Sokal, R.R. (1973). *Numerical taxonomy.* San Francisco: Freeman.

Van Diest, I., Bradley, M.M., Geurra, P., Van den Bergh, O., & Lang, P.J. (2009). Fear-conditioned respiration and its association to cardiac reactivity. *Biological Psychology, 80*(2), 212-217.

Van Diest, I., De Peuter, S., Devriese, S., Wellens, E., Van de Woestijne, K.P., & Van den Bergh, O. (2005). Imagined risk of suffocation as a trigger for hyperventilation. *Psychosomatic Medicine, 67*, 813-819.

Van Mechelen, I., De Boeck, P., & Rosenberg, S. (1995). The conjunctive model of hierarchical classes. *Psychometrika, 60*(4), 505-521.

Vansteelandt, K., & Van Mechelen, I. (1998). Individual differences in situation-behavior profiles: A triple typology model. *Journal of Personality and Social Psychology, 75*(3), 751-765.

Vlemincx, E., Taelman, J., De Peuter, S., Van Diest, I., & Van den Bergh, O. (2011). Sigh rate and respiratory variability during mental load and sustained attention. *Psychophysiology, 48*, 117-120.

Received: August 31, 2012